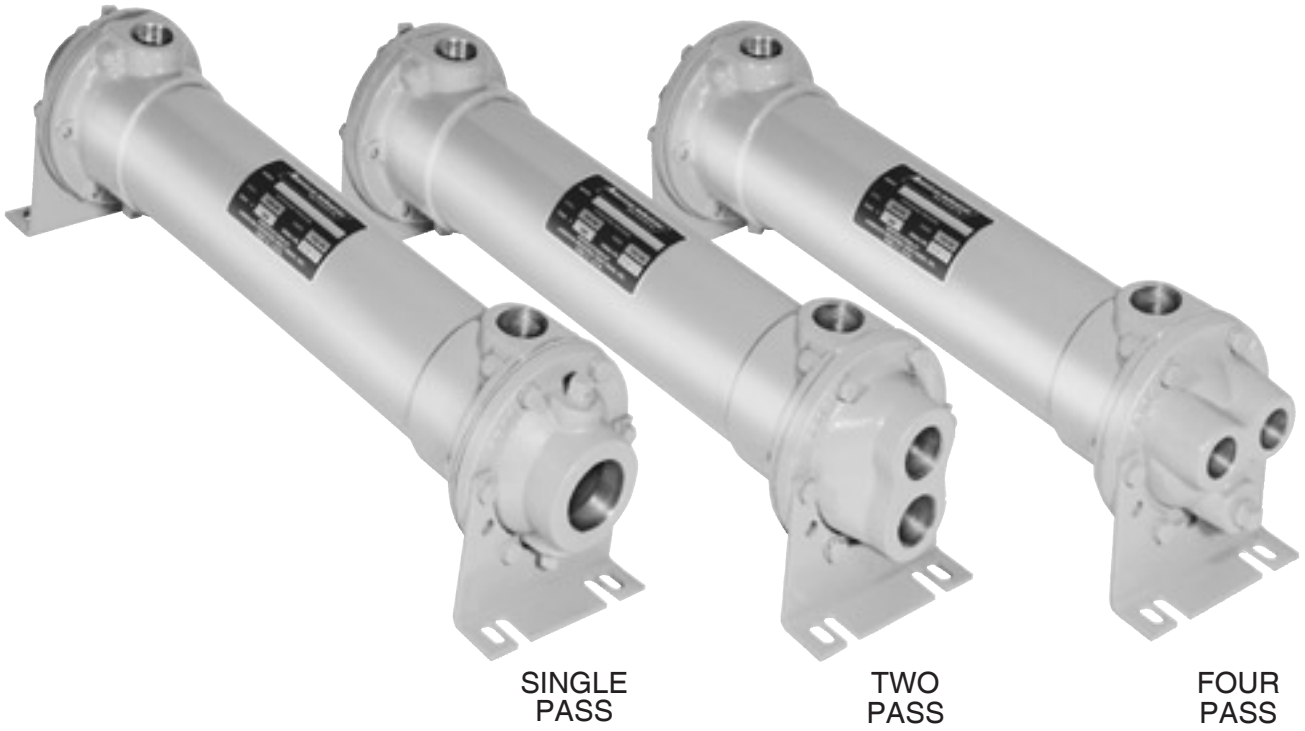
American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

AB - SAE - STS - EAB SERIES



Fixed Tube Bundle / Liquid Cooled

HEAT EXCHANGERS

- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 300 PSI.
- Operating temperature 300 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

3905 Route 173 Zion, IL 60099 tel: 1 (847) 731-1000 fax: 1 (847) 731-1010 www.aihti.com

AB, SAE, STS, & EAB Series *overview*

AB Series

Fixed tube construction heat exchangers with NPT connections. Made of brass with copper cooling tubes and cast iron end bonnets. Standard sizes from 2" through 8" diameters, and from 1.4 to 308 sq.ft. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tubes, bronze bonnets and zinc anodes. Can be customized to fit your requirements.

Optional 10" diameter units in brass are available upon request.

SAB Series

Similar to AB series with the exception of steel shell material. For use in applications where the shell fluid is non-corrosive with steel. Offered in 5" through 8" shell diameter.

SAE Series

Similar to AB series with the exception of the shell ports. SAE series from 2" through 6" diameter has SAE O-ring strait thread shell port connections. Size 8" diameter has SAE code 61 four bolt flange shell port connections.

SSAE Series

Similar to SAE series with the exception of steel shell material. For use in applications where the shell fluid is non-corrosive with steel. *Offered in 5" through 8" shell diameter.*

STS Series

Similar in design to AB series with fixed tube construction and NPT connections made of all 316 stainless steel. Standard sizes from 2" through 8" diameters, and from 1.4 to 308 sq.ft. Standard one, two and four pass models are available. Larger diameters available upon request. Can be customized to fit your requirements.

EAB Series

Expansion bellow minimizes the effects of differential expansion and contraction between the shell and cooling tubing, prolonging the overall life of the heat exchanger by reducing fatigue. Fixed tube construction heat exchangers with NPT connections. Made of brass with 90/10 copper nickel cooling tubes, stainless steel expansion bellows, and cast iron end bonnets. Standard sizes from 3.5" through 8" diameters, and from 3.6 to 308 sq.ft. Standard one, two and four pass models are available.

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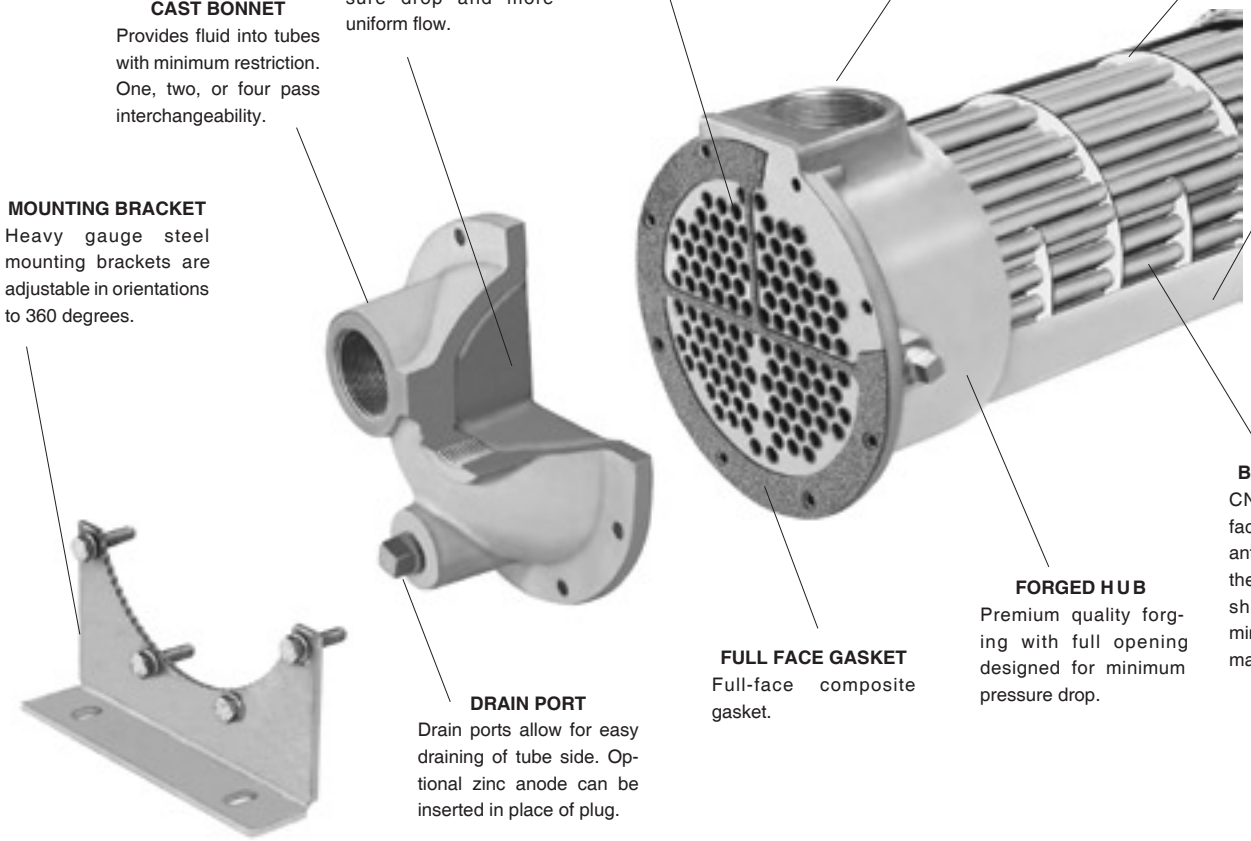
AB, SAE, STS, & EAB Series *construction*



TUBE JOINT
Roller expanded tube joint to integral forged hub.

THREAD
CNC precision threading to provide accurate leak-proof connections.

BAFFLES
CNC manufactured baffles to provide maximum turbulence and heat transfer with a minimum fluid pressure drop.

FLOW CAVITY
Generously sized to allow for minimum pressure drop and more uniform flow.

CAST BONNET
Provides fluid into tubes with minimum restriction. One, two, or four pass interchangeability.

FINISH
Gray semigloss enamel. Can be used as a base for additional coats.

MOUNTING BRACKET
Heavy gauge steel mounting brackets are adjustable in orientations to 360 degrees.

BUNDLE ASSEMBLY
CNC precision manufactured parts to guarantee a close fit between the baffles, tubes, and shell. Clearances are minimized to provide for maximum heat transfer.

FORGED HUB
Premium quality forging with full opening designed for minimum pressure drop.

FULL FACE GASKET
Full-face composite gasket.

DRAIN PORT
Drain ports allow for easy draining of tube side. Optional zinc anode can be inserted in place of plug.

UNIT CODING

Example Model

Options

AB - 1204 - C 4 - TP - CNT - B - Z

Model
AB
SAB
SAE
SSAE
STS
EAB

Shell Diameter
400 = 2.13"
700 = 3.65"
1000 = 5.13"
1200 = 6.13"
1600 = 8.00"

Effective Tube Length
(9" increments)

Baffle Spacing Code
A = 1 1/8"
B = 2 1/4"
C = 4 1/2"
D = 9 "
E = 18 "

Cooling Tube Diamenter
4 = 1/4"
6 = 3/8"
10 = 5/8"

Tube Side Passes
SP = 1 pass
TP = 2 pass
FP = 4 pass

Tubing
Blank = Copper
Options
CNT= 90/10 Cu Ni
STS = Stainless Steel
C = Carbon Steel

End Bonnets
Blank = Cast Iron
Options
B = Bronze

Zinc Anode
Z = 1 Zinc Anode
2Z = 2 Zinc Anode etc.

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	AB Series	SAB & SSAE Series*	SAE Series	STS Series	EAB Series	Standard Unit Ratings
Shell	Brass	Steel	Brass	316 Stainless Steel	Steel	Operating Pressure
Tubes	Copper	Copper	Copper	316 Stainless Steel	90/10 Copper Nickel	Tubes.....150 psig
Baffle	Brass	Steel	Brass	316 Stainless Steel	Brass	
Integral End Hub	Forged Brass	Forged Brass	Forged Brass	316 Stainless Steel	Forged Brass	Operating Pressure
End Bonnets	Cast Iron	Cast Iron	Cast Iron	316 Stainless Steel	Cast Iron	Shell.....300 psig
Mounting Brackets	Steel	Steel	Steel	Steel	Steel	
Gasket	Hypalon Composite	Hypalon Composite	Hypalon Composite	Hypalon Composite	High Temp Gasket	Operating Temperature
Expansion Bellows	–	–	–	–	Stainless Steel	300 °F

*Offered in 5" through 8" shell diameter.

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AB, SAE, STS, & EAB Series *selection*

STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other fluids that are commonly used with shell & tube heat exchangers.

Terms

GPM = Gallons Per Minute
CN = Constant Number for a given fluid
△T = Temperature differential across the potential
PSI = Pounds per Square Inch (pressure) of the operating side of the system
MHP = Horsepower of the electric motor driving the hydraulic pump
Kw = Kilowatt (watts x 1000)
T_{in} = Hot fluid entering temperature in °F
T_{out} = Hot fluid exiting temperature in °F
t_{in} = Cold fluid temperature entering in °F
t_{out} = Cold fluid temperature exiting in °F
Q = BTU / HR

For example purposes, a hydraulic system has a 125 HP (93Kw) electric motor installed coupled to a pump that produces a flow of 80 GPM @ 2500 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 5.3°F. Even though our return line pressure operates below 100 psi, we must calculate the system heat load potential (Q) based upon the prime movers (pump) capability. We can use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =80 x 210 x 5.3°F = 89,040 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(2500x80)/1714] x .30 x 2545 = 89,090 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =125 x .30 x 2545 = 95,347 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =28 x 3415 = 95,620 BTU/HR
E) Q = HP to be removed x 2545	E) Q =37.5 x 2545 = 95,437 BTU/HR

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid flow rate to derive the cold side △T. If your water flow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

Formula

$$\textbf{HOT FLUID Oil } \triangle T = \frac{Q}{CN \times GPM}$$

$$\textbf{COLD FLUID Water } \triangle t = \frac{BTU / hr}{CN \times GPM}$$

Example

$$\triangle T = \frac{89{,}090\ BTU/hr}{210\ CN \times 80GPM} \text{ (from step 1,example B)} = 5.3°F = \triangle T \text{ Rejected}$$

$$\triangle t = \frac{89{,}090\ BTU/hr}{500\ CN \times 40GPM \text{ (for a 2:1 ratio)}} = 4.5°F = \triangle t \text{ Absorbed}$$

T_{in} = Hot Fluid entering temperature in degrees F
T_{out} = Hot Fluid exiting temperature in degrees F
t_{in} = Cold Fluid entering temperature in degrees F
t_{out} = Cold Fluid exiting temperature in degrees F

$T_{in} = 125.3$ °F
$T_{out} = 120.0$ °F
$t_{in} = 70.0$ °F
$t_{out} = 74.5$ °F

$$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S\text{[smaller temperature difference]}}{L\text{ [larger temperature difference]}} = \left(\frac{S}{L}\right)$$

$$\frac{120.0°F - 70.0°F = 50.0°F}{125.3°F - 74.5°F = 50.8°F} = \frac{50.0°F}{50.8°F} = .984$$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;

L = Larger temperature difference from step 2.
M = S/L number (LOCATED IN TABLE A).

$LMTD_i = L \times M$

$LMTD_i = 50.8 \times .992$ (FROM TABLE A) $= 50.39$

To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula

$$R = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$$

$$K = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$$

Example

$$R = \frac{125.3°F - 120°F}{74.5°F - 70°F} = \frac{5.3°F}{4.5°F} = \textbf{\{1.17=R\}}$$

$$K = \frac{74.5°F - 70°F}{124.5°F - 70°F} = \frac{4.5°F}{55.4°F} = \textbf{\{0.081=K\}}$$

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c = 50.39 \times 1 =$ **50.39**

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STEP 4: Calculate the area required

Required Area sq.ft. = $\frac{\text{Q (BTU / HR)}}{\text{LMTD}_c \text{ x U (FROM TABLE C)}}$ $\frac{89{,}090}{50.39 \text{ x } 100}$ = **17.68 sq.ft.**

STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits your flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 80 GPM = Series Required from Table E = **1200 Series**
Baffle Spacing from Table E = **C baffle**
Water Flow Rate = 40 GPM = Passes required in 1200 series = **4 (FP)**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 17.68sq.ft Closest model required based upon sq.ft. & series= **AB-1202-C6-FP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

TABLE B- LMTD correction factor for Multipass Exchangers

R \ K	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

TABLE D- Surface Area

Model Number	Surface Area in Sq.ft. 1/4" O.D Tubing	3/8" O.D Tubing	5/8 O.D Tubing	Model Number	Surface Area in Sq.ft. 1/4" O.D Tubing	3/8" O.D Tubing	5/8 O.D Tubing
AB-401	1.4	–	–	AB-1602	44.4	30.3	17.6
AB-402	3.0	–	–	AB-1603	66.3	45.3	26.5
AB-403	4.6	–	–	AB-1604	88.3	60.3	35.3
				AB-1605	110.3	75.6	44.1
AB-701	3.6	2.6	–	AB-1606	132.3	90.4	53.0
AB-702	7.3	5.2	–	AB-1607	154.3	105.4	61.8
AB-703	11.1	7.9	–	AB-1608	176.3	120.4	70.6
AB-704	14.9	10.6	–	AB-1609	197.9	135.2	79.5
AB-705	18.7	13.3	–	AB-1610	219.9	150.2	88.3
				AB-1611	241.9	165.2	97.1
AB-1002	17.7	11.2	5.9	AB-1612	263.9	180.2	105.9
AB-1003	26.5	16.8	8.8	AB-1613	285.9	195.2	114.7
AB-1004	35.4	22.4	11.8				
AB-1005	44.3	28.0	14.7	AB-2004	155.1	110.7	60.8
AB-1006	53.2	33.6	17.6	AB-2005	193.8	138.4	76.1
				AB-2006	232.6	166.1	91.3
AB-1202	25.5	17.9	8.8	AB-2007	271.4	193.8	106.5
AB-1203	38.0	26.7	13.2	AB-2008	310.2	221.4	121.7
AB-1204	50.3	35.4	17.6	AB-2009	349.0	249.1	137.0
AB-1205	63.0	44.2	22.1	AB-2010	387.7	276.8	152.2
AB-1206	75.6	53.2	26.5	AB-2011	426.5	304.5	167.4
AB-1207	88.2	62.0	30.9	AB-2012	465.3	332.2	182.7
AB-1208	100.6	70.7	35.3	AB-2013	504.1	359.9	197.9
AB-1209	113.0	79.4	39.6	AB-2014	542.9	387.6	213.2
AB-1210	125.4	88.1	44.1	AB-2015	581.7	415.3	228.4

TABLE E- Flow Rate for Shell & Tube

Shell dia . Code	Max. Liquid Flow - Shell Side Baffle Spacing A	B	C	D	E	Liquid Flow - Tube Side SP Min.	SP Max.	TP Min.	TP Max.	FP Min.	FP Max.
400	10	15	20	–	–	3.5	21	–	–	–	–
700	17	29	30	35	–	9	61	4.5	30	2.2	15
1000	24	48	68	70	–	20	120	10	70	5.0	37
1200	29	56	105	115	120	30	250	15	112	7.5	56
1600	38	70	150	200	220	57	460	29	180	14	90
2000	–	–	190	370	550	90	650	45	320	25	160

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

note: AIHTI reserves the right to make reasonable design changes without notice.

AB, SAE, STS, & EAB Series *performance*

Instructions

The selection chart provided contains an array of popular sizes for quick sizing. It does not provide curves for all models available. Refer to page 4 & 5 for detailed calculation information.

Computer selection data sheets for standard or special models are available through the engineering department of American Industrial. To use the followings graphs correctly, refer to the instruction notes "1-5".

1) HP Curves are based upon a 40°F approach temperature; for example: oil leaving a cooler at 125°F, using 85°F cooling water (125°F – 85°F = 40°F).

2) The oil to water ratio of 1:1 or 2:1 means that for every 1 gallon of oil circulated, a minimum of 1 or 1/2 gallon (respectively) of 85°F water must be circulated to match the curve results.

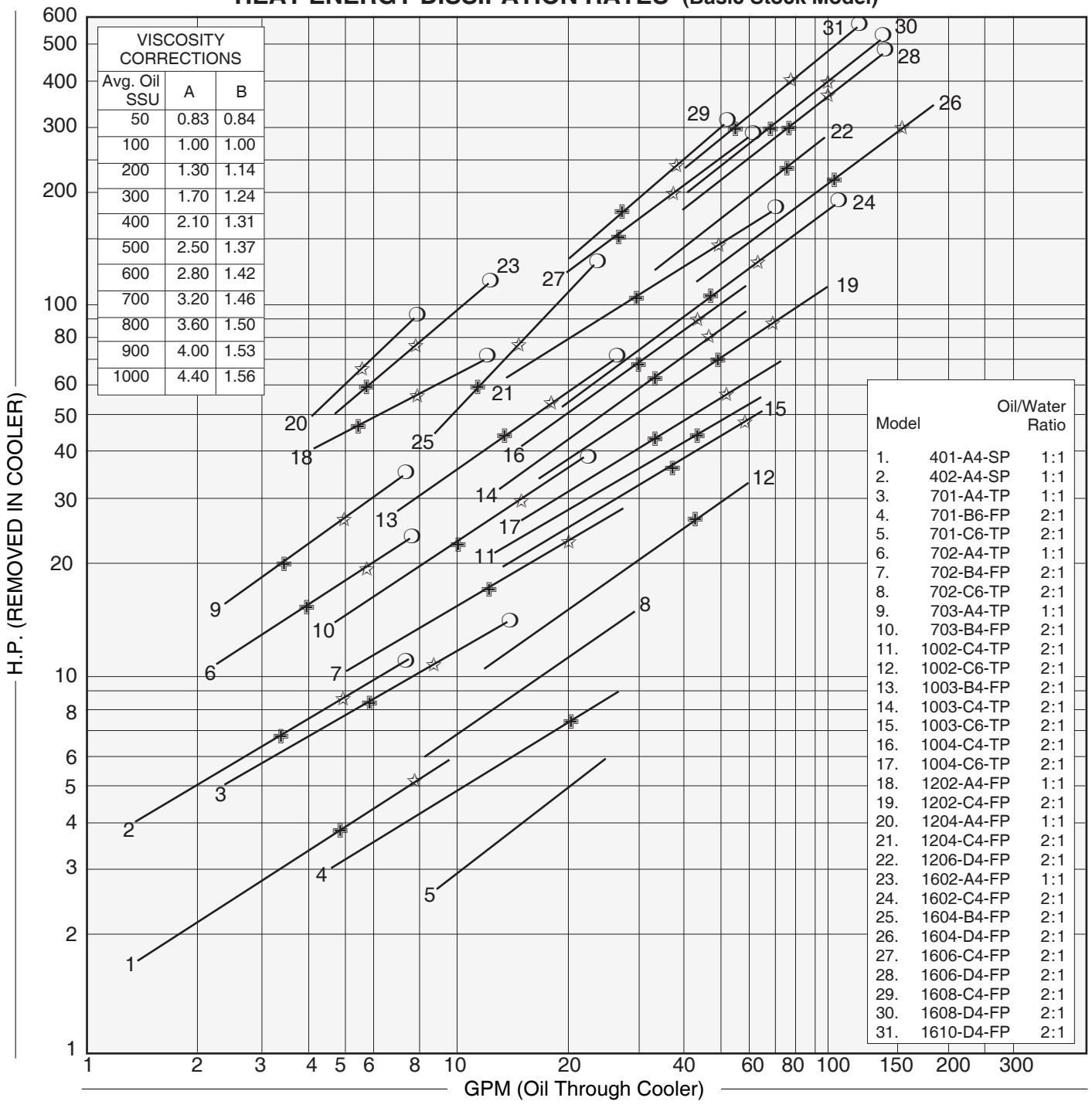
3) OIL PRESSURE DROP CODING: ✙ = 5 psi; ☆= 10 psi; ❍ = 20 psi; △ = 50psi. Curves that have no pressure drop code symbols indicate that the oil pressure drop is less than 5 psi for the flow rate shown.

4) Pressure Drop is based upon oil with an average viscosity of 100 SSU. If the average oil viscosity is other than 100 SSU, then multiply the indicated Pressure Drop by the corresponding value from corrections table A.

5) Corrections for approach temperature and oil viscosity are as follows:

$$H.P.\left(\tfrac{\text{Removed}}{\text{In Cooler}}\right) = H.P.\left(\tfrac{\text{Actual}}{\text{Heat Load}}\right) \times \left(\frac{40}{\text{Actual Approach}}\right) \times B.$$

HEAT ENERGY DISSIPATION RATES (Basic Stock Model)



VISCOSITY CORRECTIONS		
Avg. Oil SSU	A	B
50	0.83	0.84
100	1.00	1.00
200	1.30	1.14
300	1.70	1.24
400	2.10	1.31
500	2.50	1.37
600	2.80	1.42
700	3.20	1.46
800	3.60	1.50
900	4.00	1.53
1000	4.40	1.56

	Model	Oil/Water Ratio
1.	401-A4-SP	1:1
2.	402-A4-SP	1:1
3.	701-A4-TP	1:1
4.	701-B6-FP	2:1
5.	701-C6-TP	2:1
6.	702-A4-TP	1:1
7.	702-B4-FP	2:1
8.	702-C6-TP	2:1
9.	703-A4-TP	1:1
10.	703-B4-FP	2:1
11.	1002-C4-TP	2:1
12.	1002-C6-TP	2:1
13.	1003-B4-FP	2:1
14.	1003-C4-TP	2:1
15.	1003-C6-TP	2:1
16.	1004-C4-TP	2:1
17.	1004-C6-TP	2:1
18.	1202-A4-FP	1:1
19.	1202-C4-FP	2:1
20.	1204-A4-FP	1:1
21.	1204-C4-FP	2:1
22.	1206-D4-FP	2:1
23.	1602-A4-FP	1:1
24.	1602-C4-FP	2:1
25.	1604-B4-FP	2:1
26.	1604-D4-FP	2:1
27.	1606-C4-FP	2:1
28.	1606-D4-FP	2:1
29.	1608-C4-FP	2:1
30.	1608-D4-FP	2:1
31.	1610-D4-FP	2:1

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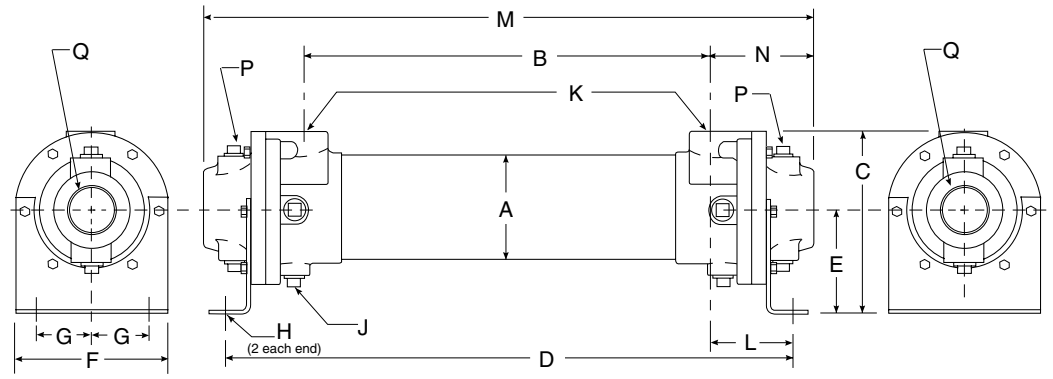
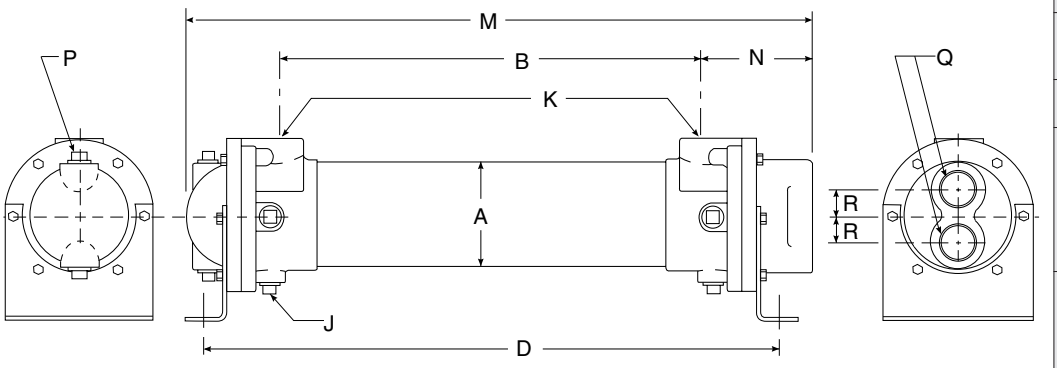


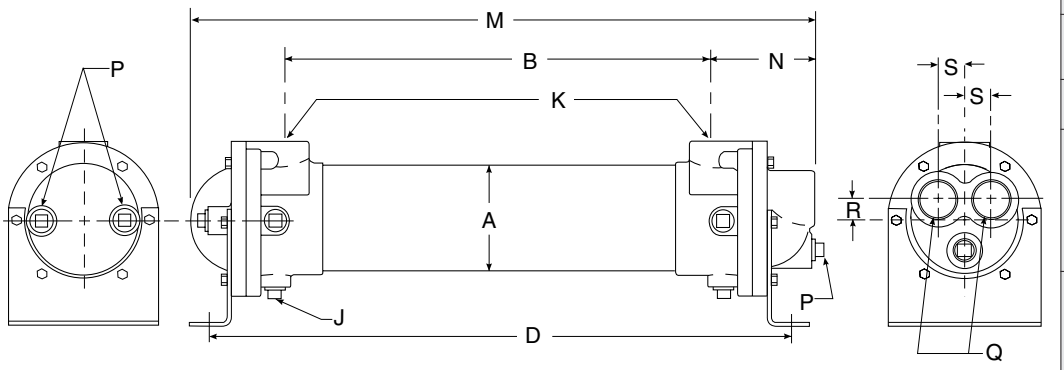
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT
AB-401	11.24	1.81	-	1.00
AB-402	20.24			
AB-701	13.47	3.24	(4) .38	1.50
AB-702	22.47			
AB-703	31.47			
AB-704	40.47			
AB-1002	23.60	4.05	(4) .38	2.00
AB-1003	32.60			
AB-1004	41.60			
AB-1202	24.38	4.88	(4) .50	3.00
AB-1203	33.25			
AB-1204	42.12			
AB-1205	51.12			
AB-1206	60.25			
AB-1207	69.25			
AB-1208	78.12			
AB-1209	87.12			
AB-1210	96.12			
AB-1602	26.62	6.52	(4) .50	4.00
AB-1603	35.62			
AB-1604	44.62			
AB-1605	53.62			
AB-1606	62.62			
AB-1607	71.62			
AB-1608	80.62			
AB-1609	89.62			
AB-1610	98.62			



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R
AB-701	13.28	3.30	(2) .38	1.00	.88
AB-702	22.28				
AB-703	31.28				
AB-704	40.28				
AB-1002	23.29	3.80	(2) .38	1.50	1.19
AB-1003	32.29				
AB-1004	41.29				
AB-1202	23.94	4.56	(2) .50	2.00	1.44
AB-1203	32.81				
AB-1204	41.69				
AB-1205	50.69				
AB-1206	59.81				
AB-1207	68.81				
AB-1208	77.69				
AB-1209	86.69				
AB-1210	95.69				
AB-1602	25.10	6.08	(2) .50	2.50	1.88
AB-1603	34.10				
AB-1604	43.10				
AB-1605	52.10				
AB-1606	61.10				
AB-1607	70.10				
AB-1608	79.10				
AB-1609	88.10				
AB-1610	97.10				



FOUR PASS (FP)

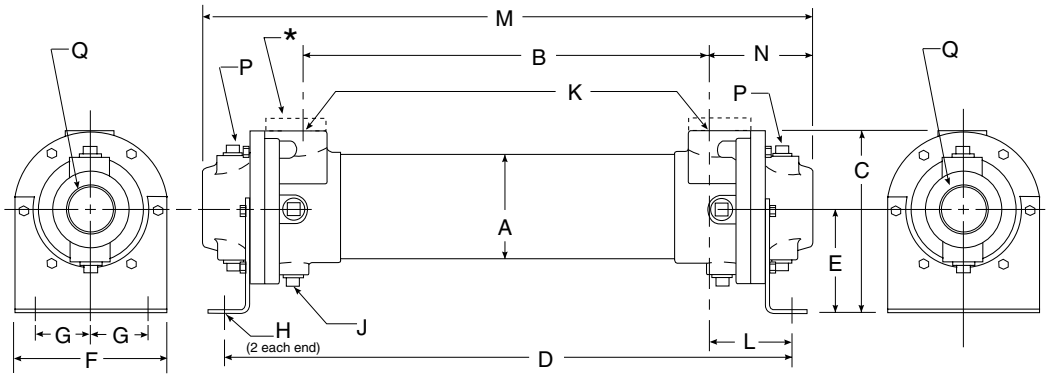
Model	M	N	P NPT	Q NPT	R	S
AB-701	13.42	3.24	(3) .38	.75	.62	.88
AB-702	22.42					
AB-703	31.42					
AB-704	40.42					
AB-1002	23.55	4.06	(3) .38	1.00	.75	1.19
AB-1003	32.55					
AB-1004	41.55					
AB-1202	24.44	4.90	(3) .50	1.50	1.06	1.44
AB-1203	33.31					
AB-1204	42.19					
AB-1205	51.19					
AB-1206	60.31					
AB-1207	69.31					
AB-1208	78.19					
AB-1209	87.19					
AB-1210	96.19					
AB-1602	25.05	6.48	(3) .50	2.00	1.38	1.88
AB-1603	34.05					
AB-1604	43.05					
AB-1605	52.05					
AB-1606	61.05					
AB-1607	70.05					
AB-1608	79.05					
AB-1609	88.05					
AB-1610	97.05					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J NPT	K NPT	L	Approx. Weight	Model
AB-401	2.13	7.62	3.50	11.12	1.94	2.75	.88	.41ϕ	-	.50	1.72	7	AB-401
AB-402		16.62		20.12								10	AB-402
AB-701	3.66	7.00	6.25	12.38	3.62	5.25	1.50	.44ϕ x 1.00	(2) .38	1.00	2.69	23	AB-701
AB-702		16.00		21.38								29	AB-702
AB-703		25.00		30.38								33	AB-703
AB-704		34.00		39.38								49	AB-704
AB-1002	5.13	15.50	7.38	21.62	4.00	6.75	2.00	.44ϕ x 1.00	(6) .38	1.50	3.06	54	AB-1002
AB-1003		24.50		30.62								76	AB-1003
AB-1004		33.50		39.62								82	AB-1004
AB-1202	6.13	14.62	8.81	21.50	4.75	7.50	2.50	.44ϕ x 1.00	(6) .38	2.00	3.44	79	AB-1202
AB-1203		23.50		30.38								98	AB-1203
AB-1204		32.38		39.25								115	AB-1204
AB-1205		41.38		48.25								130	AB-1205
AB-1206		50.50		57.38								150	AB-1206
AB-1207		59.50		66.38								170	AB-1207
AB-1208		68.38		75.25								190	AB-1208
AB-1209		77.38		84.25								210	AB-1209
AB-1210		86.38		93.25								230	AB-1210
AB-1602	8.00	13.60	12.13	22.38	6.50	10.00	3.50	.44ϕ x 1.00	(6) .38	3.00	4.39	145	AB-1602
AB-1603		22.60		31.38								170	AB-1603
AB-1604		31.60		40.38								200	AB-1604
AB-1605		40.60		49.38								225	AB-1605
AB-1606		49.60		58.38								250	AB-1606
AB-1607		58.60		67.38								275	AB-1607
AB-1608		67.60		76.38								315	AB-1608
AB-1609		76.60		85.38								350	AB-1609
AB-1610		85.60		94.38								390	AB-1610

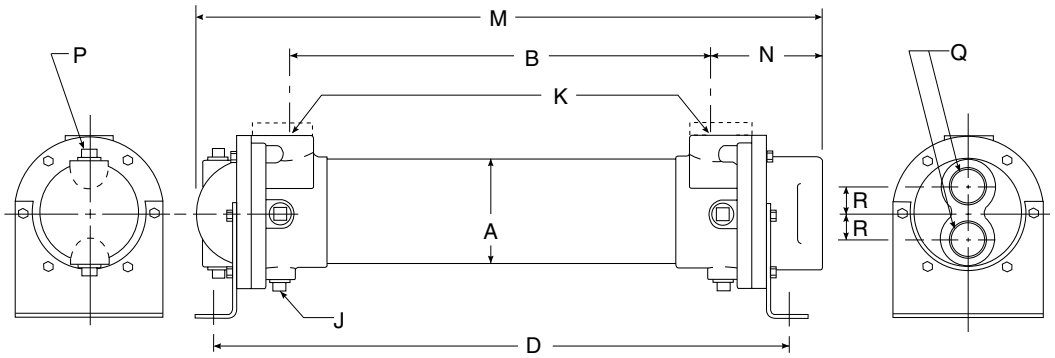
note: AIHTI reserves the right to make reasonable design changes without notice.

SAE Series *dimensions*



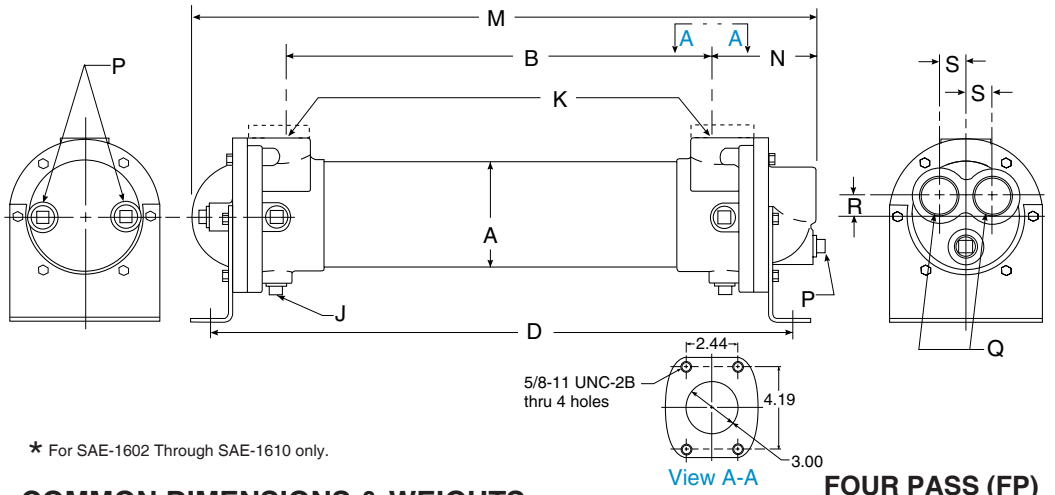
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT
SAE-401	11.24	1.81	-	1.00
SAE-402	20.24			
SAE-701	13.47	3.24	(4) .38	1.50
SAE-702	22.47			
SAE-703	31.47			
SAE-704	40.47			
SAE-1002	23.60	4.05	(4) .38	2.00
SAE-1003	32.60			
SAE-1004	41.60			
SAE-1202	24.38	4.88	(4) .50	3.00
SAE-1203	33.25			
SAE-1204	42.12			
SAE-1205	51.12			
SAE-1206	60.25			
SAE-1207	69.25			
SAE-1208	78.12			
SAE-1209	87.12			
SAE-1210	96.12			
SAE-1602	26.62	6.52	(4) .50	4.00
SAE-1603	35.62			
SAE-1604	44.62			
SAE-1605	53.62			
SAE-1606	62.62			
SAE-1607	71.62			
SAE-1608	80.62			
SAE-1609	89.62			
SAE-1610	98.62			



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R
SAE-701	13.28	3.30	(2) .38	1.00	.88
SAE-702	22.28				
SAE-703	31.28				
SAE-704	40.28				
SAE-1002	23.29	3.80	(2) .38	1.50	1.19
SAE-1003	32.29				
SAE-1004	41.29				
SAE-1202	23.94	4.56	(2) .50	2.00	1.44
SAE-1203	32.81				
SAE-1204	41.69				
SAE-1205	50.69				
SAE-1206	59.81				
SAE-1207	68.81				
SAE-1208	77.69				
SAE-1209	86.69				
SAE-1210	95.69				
SAE-1602	25.10	6.08	(2) .50	2.50	1.88
SAE-1603	34.10				
SAE-1604	43.10				
SAE-1605	52.10				
SAE-1606	61.10				
SAE-1607	70.10				
SAE-1608	79.10				
SAE-1609	88.10				
SAE-1610	97.10				



FOUR PASS (FP)

Model	M	N	P NPT	Q NPT	R	S
SAE-701	13.42	3.24	(3) .38	.75	.62	.88
SAE-702	22.42					
SAE-703	31.42					
SAE-704	40.42					
SAE-1002	23.55	4.06	(3) .38	1.00	.75	1.19
SAE-1003	32.55					
SAE-1004	41.55					
SAE-1202	24.44	4.90	(3) .50	1.50	1.06	1.44
SAE-1203	33.31					
SAE-1204	42.19					
SAE-1205	51.19					
SAE-1206	60.31					
SAE-1207	69.31					
SAE-1208	78.19					
SAE-1209	87.19					
SAE-1210	96.19					
SAE-1602	25.05	6.48	(3) .50	2.00	1.38	1.88
SAE-1603	34.05					
SAE-1604	43.05					
SAE-1605	52.05					
SAE-1606	61.05					
SAE-1607	70.05					
SAE-1608	79.05					
SAE-1609	88.05					
SAE-1610	97.05					

* For SAE-1602 Through SAE-1610 only.

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J NPT	K SAE	L	Approx. Weight	Model
SAE-401	2.13	7.62	3.50	11.12	1.94	2.62	.88	.41ϕ	-	#8	1.72	7	SAE-401
SAE-402		16.62		20.12						3/4-16		10	SAE-402
SAE-701	3.66	7.00	6.25	12.38	3.62	5.25	1.50	.44ϕ x 1.00	(2) .38	#16	2.69	23	SAE-701
SAE-702		16.00		21.38						1 5/16-12		29	SAE-702
SAE-703		25.00		30.38								33	SAE-703
SAE-704		34.00		39.38								49	SAE-704
SAE-1002	5.13	15.50	7.38	21.62	4.00	6.75	2.00	.44ϕ x 1.00	(6) .38	#24	3.06	54	SAE-1002
SAE-1003		24.50		30.62						1 7/8-12		76	SAE-1003
SAE-1004		33.50		39.62								82	SAE-1004
SAE-1202	6.13	14.62	8.81	21.50	4.75	7.50	2.50	.44ϕ x 1.00	(6) .38	#32	3.44	79	SAE-1202
SAE-1203		23.50		30.38						2 1/2-12		98	SAE-1203
SAE-1204		32.38		39.25								115	SAE-1204
SAE-1205		41.38		48.25								130	SAE-1205
SAE-1206		50.50		57.38								150	SAE-1206
SAE-1207		59.50		66.38								170	SAE-1207
SAE-1208		68.38		75.25								190	SAE-1208
SAE-1209		77.38		84.25								210	SAE-1209
SAE-1210		86.38		93.25								230	SAE-1210
SAE-1602	8.00	13.60	12.13	22.38	6.50	10.00	3.50	.44ϕ x 1.00	(6) .38	3.0" Four bolt Flange	4.39	145	SAE-1602
SAE-1603		22.60		31.38								170	SAE-1603
SAE-1604		31.60		40.38								200	SAE-1604
SAE-1605		40.60		49.38								225	SAE-1605
SAE-1606		49.60		58.38								250	SAE-1606
SAE-1607		58.60		67.38								275	SAE-1607
SAE-1608		67.60		76.38								315	SAE-1608
SAE-1609		76.60		85.38								350	SAE-1609
SAE-1610		85.60		94.38								390	SAE-1610

note: AIHTI reserves the right to make reasonable design changes without notice.

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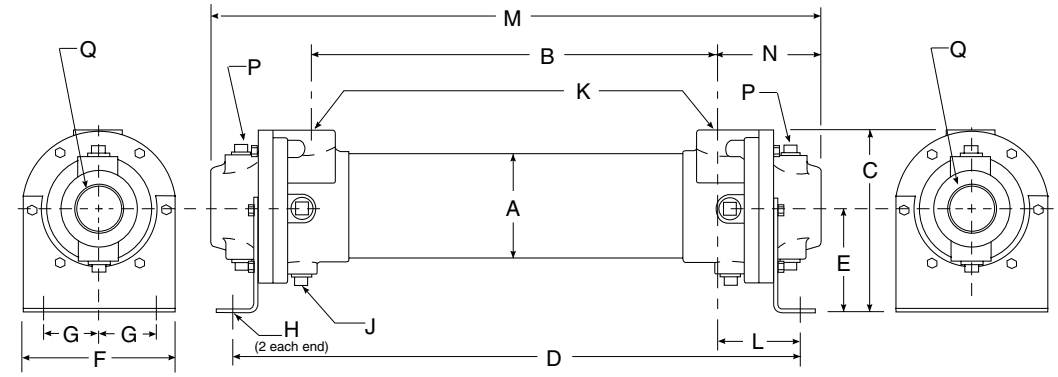
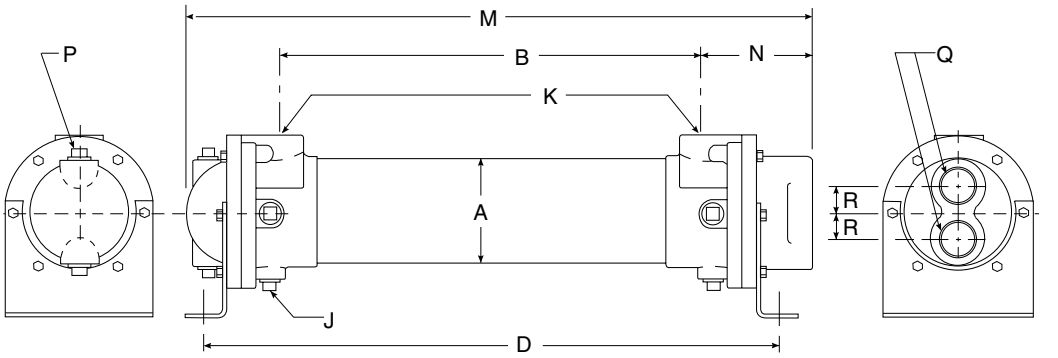


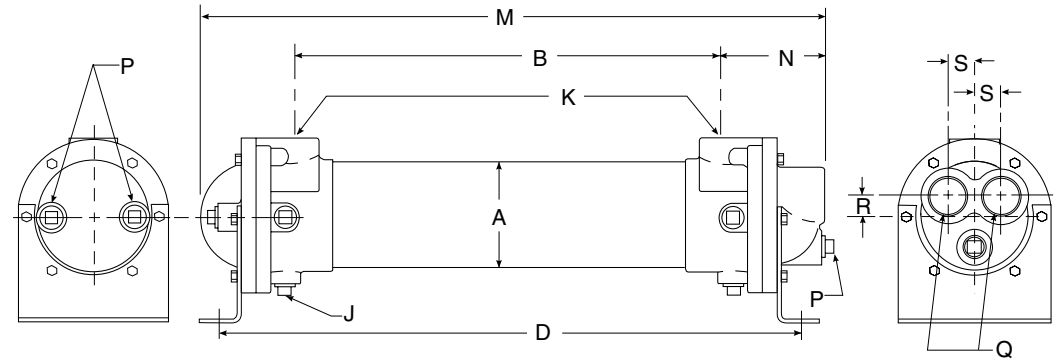
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT
STS-401	11.24	1.81	-	1.00
STS-402	20.24			
STS-701	13.47	3.24	(4) .38	1.50
STS-702	22.47			
STS-703	31.47			
STS-704	40.47			
STS-1002	23.60	4.05	(4) .38	2.00
STS-1003	32.60			
STS-1004	41.60			
STS-1202	24.38	4.88	(4) .50	3.00
STS-1203	33.25			
STS-1204	42.12			
STS-1205	51.12			
STS-1206	60.25			
STS-1207	69.25			
STS-1208	78.12			
STS-1209	87.12			
STS-1210	96.12			
STS-1602	26.62	6.52	(4) .50	4.00
STS-1603	35.62			
STS-1604	44.62			
STS-1605	53.62			
STS-1606	62.62			
STS-1607	71.62			
STS-1608	80.62			
STS-1609	89.62			
STS-1610	98.62			



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R
STS-701	13.28	3.30	(2) .38	1.00	.88
STS-702	22.28				
STS-703	31.28				
STS-704	40.28				
STS-1002	23.29	3.80	(2) .38	1.50	1.19
STS-1003	32.29				
STS-1004	41.29				
STS-1202	23.94	4.56	(2) .50	2.00	1.44
STS-1203	32.81				
STS-1204	41.69				
STS-1205	50.69				
STS-1206	59.81				
STS-1207	68.81				
STS-1208	77.69				
STS-1209	86.69				
STS-1210	95.69				
STS-1602	25.10	6.08	(2) .50	2.50	1.88
STS-1603	34.10				
STS-1604	43.10				
STS-1605	52.10				
STS-1606	61.10				
STS-1607	70.10				
STS-1608	79.10				
STS-1609	88.10				
STS-1610	97.10				



FOUR PASS (FP)

Model	M	N	P NPT	Q NPT	R	S
STS-701	13.42	3.24	(3) .38	.75	.62	.88
STS-702	22.42					
STS-703	31.42					
STS-704	40.42					
STS-1002	23.55	4.06	(3) .38	1.00	.75	1.19
STS-1003	32.55					
STS-1004	41.55					
STS-1202	24.44	4.90	(3) .50	1.50	1.06	1.44
STS-1203	33.31					
STS-1204	42.19					
STS-1205	51.19					
STS-1206	60.31					
STS-1207	69.31					
STS-1208	78.19					
STS-1209	87.19					
STS-1210	96.19					
STS-1602	25.05	6.48	(3) .50	2.00	1.38	1.88
STS-1603	34.05					
STS-1604	43.05					
STS-1605	52.05					
STS-1606	61.05					
STS-1607	70.05					
STS-1608	79.05					
STS-1609	88.05					
STS-1610	97.05					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J NPT	K NPT	L	Approx. Weight	Model
STS-401	2.13	7.62	3.50	11.12	1.94	2.62	.88	.41ϕ	-	.50	1.72	7	STS-401
STS-402		16.62		20.12								10	STS-402
STS-701	3.66	7.00	6.25	12.38	3.62	5.25	1.50	.44ϕ x 1.00	(2) .38	1.00	2.69	23	STS-701
STS-702		16.00		21.38								29	STS-702
STS-703		25.00		30.38								33	STS-703
STS-704		34.00		39.38								49	STS-704
STS-1002	5.13	15.50	7.38	21.62	4.00	6.75	2.00	.44ϕ x 1.00	(6) .38	1.50	3.06	54	STS-1002
STS-1003		24.50		30.62								76	STS-1003
STS-1004		33.50		39.62								82	STS-1004
STS-1202	6.13	14.62	8.81	21.50	4.75	7.50	2.50	.44ϕ x 1.00	(6) .38	2.00	3.44	79	STS-1202
STS-1203		23.50		30.38								98	STS-1203
STS-1204		32.38		39.25								115	STS-1204
STS-1205		41.38		48.25								130	STS-1205
STS-1206		50.50		57.38								150	STS-1206
STS-1207		59.50		66.38								170	STS-1207
STS-1208		68.38		75.25								190	STS-1208
STS-1209		77.38		84.25								210	STS-1209
STS-1210		86.38		93.25								230	STS-1210
STS-1602	8.00	13.60	12.13	22.38	6.50	10.00	3.50	.44ϕ x 1.00	(6) .38	3.00	4.39	145	STS-1602
STS-1603		22.60		31.38								170	STS-1603
STS-1604		31.60		40.38								200	STS-1604
STS-1605		40.60		49.38								225	STS-1605
STS-1606		49.60		58.38								250	STS-1606
STS-1607		58.60		67.38								275	STS-1607
STS-1608		67.60		76.38								315	STS-1608
STS-1609		76.60		85.38								350	STS-1609
STS-1610		85.60		94.38								390	STS-1610

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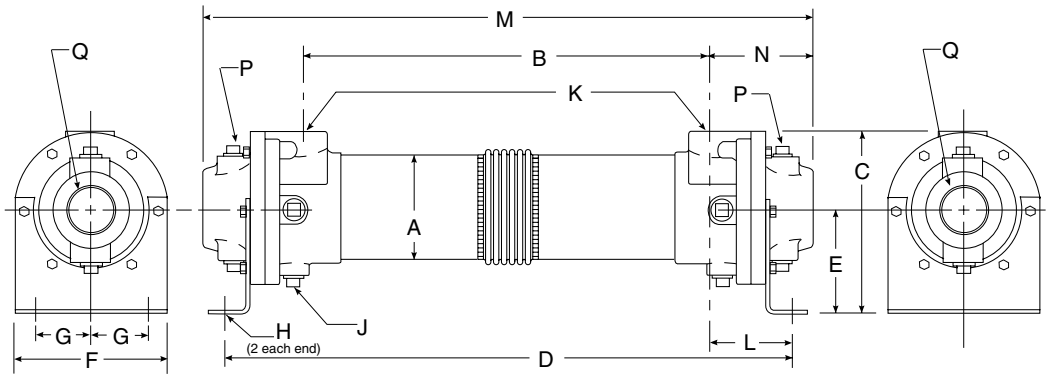
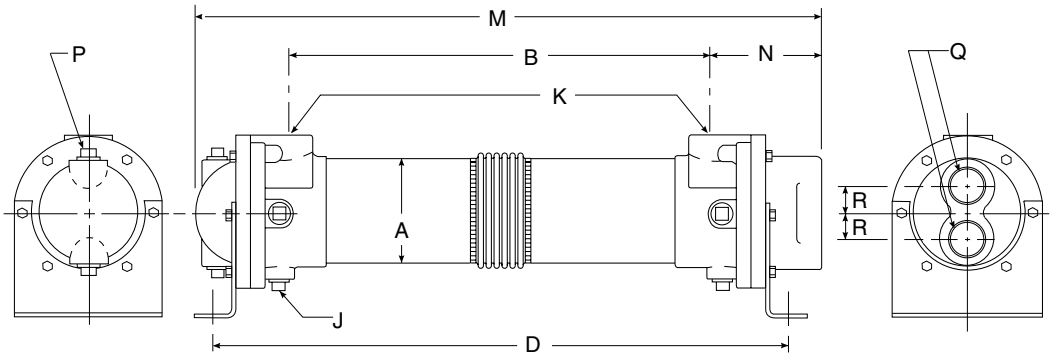
EAB Series *dimensions*



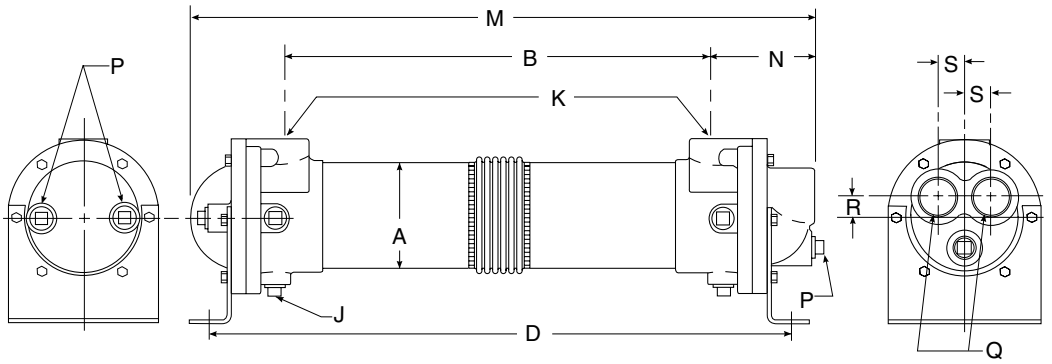
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT
EAB-701	13.47	3.24	(4) .38	1.50
EAB-702	22.47			
EAB-703	31.47			
EAB-704	40.47			
EAB-1002	23.60	4.05	(4) .38	2.00
EAB-1003	32.60			
EAB-1004	41.60			
EAB-1202	24.38	4.88	(4) .50	3.00
EAB-1203	33.25			
EAB-1204	42.12			
EAB-1205	51.12			
EAB-1206	60.25			
EAB-1207	69.25			
EAB-1208	78.12			
EAB-1209	87.12			
EAB-1210	96.12			
EAB-1602	26.62	6.52	(4) .50	4.00
EAB-1603	35.62			
EAB-1604	44.62			
EAB-1605	53.62			
EAB-1606	62.62			
EAB-1607	71.62			
EAB-1608	80.62			
EAB-1609	89.62			
EAB-1610	98.62			



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R
EAB-701	13.28	3.30	(2) .38	1.00	.88
EAB-702	22.28				
EAB-703	31.28				
EAB-704	40.28				
EAB-1002	23.29	3.80	(2) .38	1.50	1.19
EAB-1003	32.29				
EAB-1004	41.29				
EAB-1202	23.94	4.56	(2) .50	2.00	1.44
EAB-1203	32.81				
EAB-1204	41.69				
EAB-1205	50.69				
EAB-1206	59.81				
EAB-1207	68.81				
EAB-1208	77.69				
EAB-1209	86.69				
EAB-1210	95.69				
EAB-1602	25.10	6.08	(2) .50	2.50	1.88
EAB-1603	34.10				
EAB-1604	43.10				
EAB-1605	52.10				
EAB-1606	61.10				
EAB-1607	70.10				
EAB-1608	79.10				
EAB-1609	88.10				
EAB-1610	97.10				



FOUR PASS (FP)

Model	M	N	P NPT	Q NPT	R	S
EAB-701	13.42	3.24	(3) .38	.75	.62	.88
EAB-702	22.42					
EAB-703	31.42					
EAB-704	40.42					
EAB-1002	23.55	4.06	(3) .38	1.00	.75	1.19
EAB-1003	32.55					
EAB-1004	41.55					
EAB-1202	24.44	4.90	(3) .50	1.50	1.06	1.44
EAB-1203	33.31					
EAB-1204	42.19					
EAB-1205	51.19					
EAB-1206	60.31					
EAB-1207	69.31					
EAB-1208	78.19					
EAB-1209	87.19					
EAB-1210	96.19					
EAB-1602	25.05	6.48	(3) .50	2.00	1.38	1.88
EAB-1603	34.05					
EAB-1604	43.05					
EAB-1605	52.05					
EAB-1606	61.05					
EAB-1607	70.05					
EAB-1608	79.05					
EAB-1609	88.05					
EAB-1610	97.05					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J NPT	K NPT	L	Approx. Weight	Model
EAB-701	3.66	7.00	6.25	12.38	3.62	5.25	1.50	.44ϕ x 1.00	(2) .38	1.00	2.69	23	EAB-701
EAB-702		16.00		21.38								29	EAB-702
EAB-703		25.00		30.38								33	EAB-703
EAB-704		34.00		39.38								49	EAB-704
EAB-1002	5.13	15.50	7.38	21.62	4.00	6.75	2.00	.44ϕ x 1.00	(6) .38	1.50	3.06	54	EAB-1002
EAB-1003		24.50		30.62								76	EAB-1003
EAB-1004		33.50		39.62								82	EAB-1004
EAB-1202	6.13	14.62	8.81	21.50	4.75	7.50	2.50	.44ϕ x 1.00	(6) .38	2.00	3.44	79	EAB-1202
EAB-1203		23.50		30.38								98	EAB-1203
EAB-1204		32.38		39.25								115	EAB-1204
EAB-1205		41.38		48.25								130	EAB-1205
EAB-1206		50.50		57.38								150	EAB-1206
EAB-1207		59.50		66.38								170	EAB-1207
EAB-1208		68.38		75.25								190	EAB-1208
EAB-1209		77.38		84.25								210	EAB-1209
EAB-1210		86.38		93.25								230	EAB-1210
EAB-1602	8.00	13.60	12.13	22.38	6.50	10.00	3.50	.44ϕ x 1.00	(6) .38	3.00	4.39	145	EAB-1602
EAB-1603		22.60		31.38								170	EAB-1603
EAB-1604		31.60		40.38								200	EAB-1604
EAB-1605		40.60		49.38								225	EAB-1605
EAB-1606		49.60		58.38								250	EAB-1606
EAB-1607		58.60		67.38								275	EAB-1607
EAB-1608		67.60		76.38								315	EAB-1608
EAB-1609		76.60		85.38								350	EAB-1609
EAB-1610		85.60		94.38								390	EAB-1610

note: AIHTI reserves the right to make reasonable design changes without notice.

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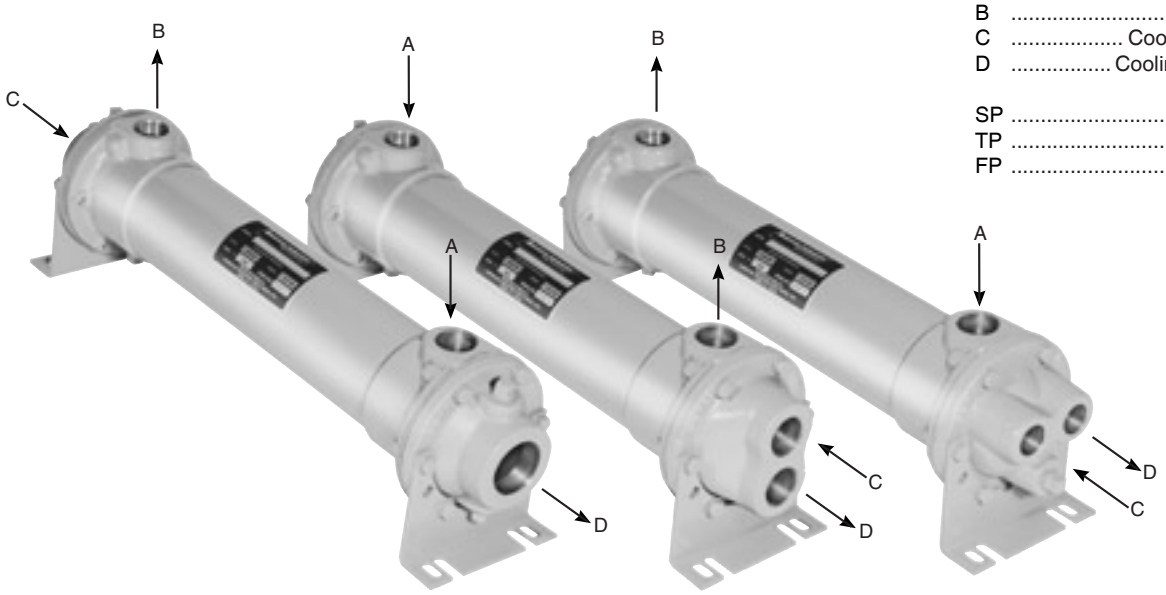
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP .....Four Pass



SINGLE PASS **TWO PASS** **FOUR PASS**

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.
Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of flushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the hot fluid to be cooled through the shell side and the cold fluid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock.

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In instances where the fluids are required to be reversed, *hot fluid in the tubes and cold fluid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a fluid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the complete bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) When installing a series EAB heat exchanger (expansion bellow), it is recommended to use a shoulder bolt to allow the heat exchanger to move freely while expanding and contracting due to high differential temperatures.

i) It is recommended to use flexible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate flow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high flow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

j) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side fluid and the entering tube side fluid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the fluids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a floating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

k) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the flow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water flow.

l) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external fluid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to flush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic fluid is in question, the shell side should be disconnected and flushed on a yearly basis with a clean flushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be flushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor fluid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, flush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

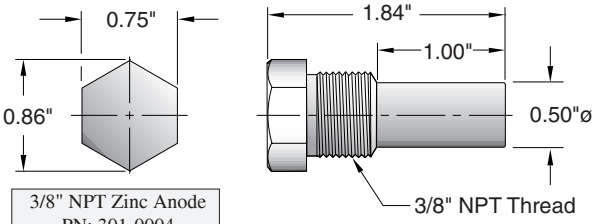
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, flow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

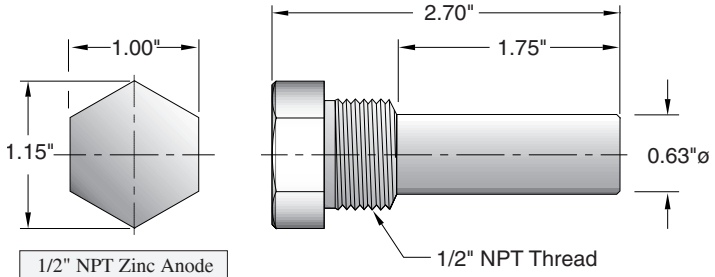
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

AB2000 SERIES

SINGLE PASS | TWO PASS | FOUR PASS

Fixed Tube Bundle / Liquid Cooled

HEAT EXCHANGERS

- High thermal capacity.
- Large flow capacity.
- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 225 PSI.
- Operating temperature 250 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

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AB 2000 Series *selection*

STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other fluids that are commonly used with shell & tube heat exchangers.

Terms

GPM = Gallons Per Minute
CN = Constant Number for a given fluid
△T = Temperature differential across the potential
PSI = Pounds per Square Inch (pressure) of the operating side of the system
MHP = Horsepower of the electric motor driving the hydraulic pump
Kw = Kilowatt (watts x 1000)
T_{in} = Hot fluid entering temperature in °F
T_{out} = Hot fluid exiting temperature in °F
t_{in} = Cold fluid temperature entering in °F
t_{out} = Cold fluid temperature exiting in °F
Q = BTU / HR

For example purposes, a hydraulic system has a 250 HP (186Kw) electric motor installed coupled to a pump that produces a flow of 200 GPM @ 2000 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 4.3°F. Even though our return line pressure operates below 100 psi, we must calculate the system heat load potential (Q) based upon the prime movers (pump) capability. We can use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =200 x 210 x 4 .3°F = 180,600 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(2000x200)/1714] x .30 x 2545 = 178,179 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =250 x .30 x 2545 = 190,875 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =186 x .30 x 3415 = 190,557 BTU/HR
E) Q = HP to be removed x 2545	E) Q =75 x 2545 = 190,875 BTU/HR

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid flow rate to derive the cold side △T. If your water flow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

Formula

HOT FLUID △T Oil $= \dfrac{Q}{CN \times GPM}$

COLD FLUID △ t Water $= \dfrac{BTU / hr}{CN \times GPM}$

Example

$\triangle T = \dfrac{190{,}875\ BTU/hr}{210\ CN \times 200GPM}$ (from step 1,item c) $= 4.54°F$ = △T Rejected

$\triangle t = \dfrac{190{,}875\ BTU/hr}{500\ CN \times 100GPM}$ (for a 2:1 ratio) $= 3.81°F$ = △t Absorbed

T_{in} = Hot Fluid entering temperature in degrees F
T_{out} = Hot Fluid exiting temperature in degrees F
t_{in} = Cold Fluid entering temperature in degrees F
t_{out} = Cold Fluid exiting temperature in degrees F

T_{in} = 104.54 °F
T_{out} = 100.0 °F
t_{in} = 90.0 °F
t_{out} = 93.81 °F

$\dfrac{T_{out} - t_{in}}{T_{in} - t_{out}} = \dfrac{S[\text{smaller temperature difference}]}{L\ [\text{larger temperature difference}]} = \left(\dfrac{S}{L}\right)$

$\dfrac{100.0°F - 90.0°F = 10.0°F}{104.54°F - 93.81°F = 10.73°F} = \dfrac{10.0°F}{10.73°F} = .931$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;

$LMTD_i$ = L x M (L = Larger temperature difference from step 2.) x (M = S/L number (LOCATED IN TABLE A))

$LMTD_i$ = 10.73 x .964 (FROM TABLE A) = 10.34

To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula

$\mathbf{R} = \dfrac{T_{in} - T_{out}}{t_{out} - t_{in}}$

$\mathbf{K} = \dfrac{t_{out} - t_{in}}{T_{in} - t_{in}}$

Example

$\mathbf{R} = \dfrac{104.54°F - 100°F}{93.81°F - 90°F} = \dfrac{4.54°F}{3.81°F} =$ **{1.191=R}**

$\mathbf{K} = \dfrac{93.81°F - 90°F}{104.54°F - 90°F} = \dfrac{3.81°F}{14.54°F} =$ **{0.262=K}**

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 10.34 x .98 = **10.13**

TABLE E- Flow Rate for Shell & Tube

Shell dia .	Max. Liquid Flow - Shell Side					Liquid Flow - Tube Side					
	Baffle Spacing					SP		TP		FP	
Code	A	B	C	D	E	Min.	Max.	Min.	Max.	Min.	Max.
2000	–	–	190	370	550	90	650	45	320	25	160

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

note: AIHTI reserves the right to make reasonable design changes without notice.

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STEP 4: Calculate the area required

Required Area sq.ft. = $\frac{\text{Q (BTU / HR)}}{\text{LMTD}_c \text{ x U (FROM TABLE C)}}$ $\frac{190{,}875}{10.13 \text{ x } 100}$ = **188.4 sq.ft.**

STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits your flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 200 GPM = Series Required from Table E = **2000 Series**
Baffle Spacing from Table E = **D baffle**
Water Flow Rate = 100 GPM = Passes required in 2000 series = **4 (FP)**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 188.4 sq.ft Closest model required based upon sq.ft. & series = **AB-2007-D6-FP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

R

TABLE B- LMTD correction factor for Multipass Exchangers

	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

K

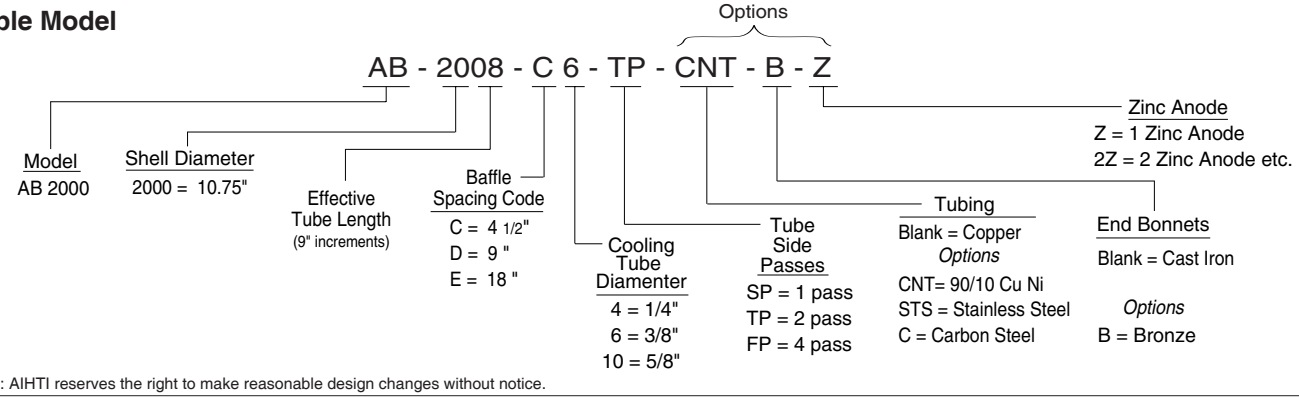
STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	AB-2000 Series	Standard Unit Ratings
Shell	Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 225 psig Operating Temperature 250 °F
Tubes	Copper	
Baffle	Steel	
Tube Sheet	Steel	
End Bonnets	Cast Iron	
Mounting Brackets	Steel	
Gasket	Hypalon Composite	

TABLE D- Surface Area

Model Number	Surface Area in Sq.ft.		
	1/4" O.D Tubing	3/8" O.D Tubing	5/8 O.D Tubing
AB-2004	155.1	110.7	60.8
AB-2005	193.8	138.4	76.1
AB-2006	232.6	166.1	91.3
AB-2007	271.4	193.8	106.5
AB-2008	310.2	221.4	121.7
AB-2009	349.0	249.1	137.0
AB-2010	387.7	276.8	152.2
AB-2011	426.5	304.5	167.4
AB-2012	465.3	332.2	182.7
AB-2013	504.1	359.9	197.9
AB-2014	542.9	387.6	213.2
AB-2015	581.7	415.3	228.4

Example Model



note: AIHTI reserves the right to make reasonable design changes without notice.

AB 2000 Series *performance*

Instructions

The selection chart provided contains an array of popular sizes for quick sizing. It does not provide curves for all models available. Refer to page 14 & 15 for detailed calculation information.

Computer selection data sheets for standard or special models are available through the engineering department of American Industrial. To use the followings graphs correctly, refer to the instruction notes "1-5".

1) HP Curves are based upon a 40°F approach temperature; for example: oil leaving a cooler at 125°F, using 85°F cooling water (125°F – 85°F = 40°F).

2) The oil to water ratio of 1:1 or 2:1 means that for every 1 gallon of oil circulated, a minimum of 1 or 1/2 gallon (respectively) of 85°F water must be circulated to match the curve results.

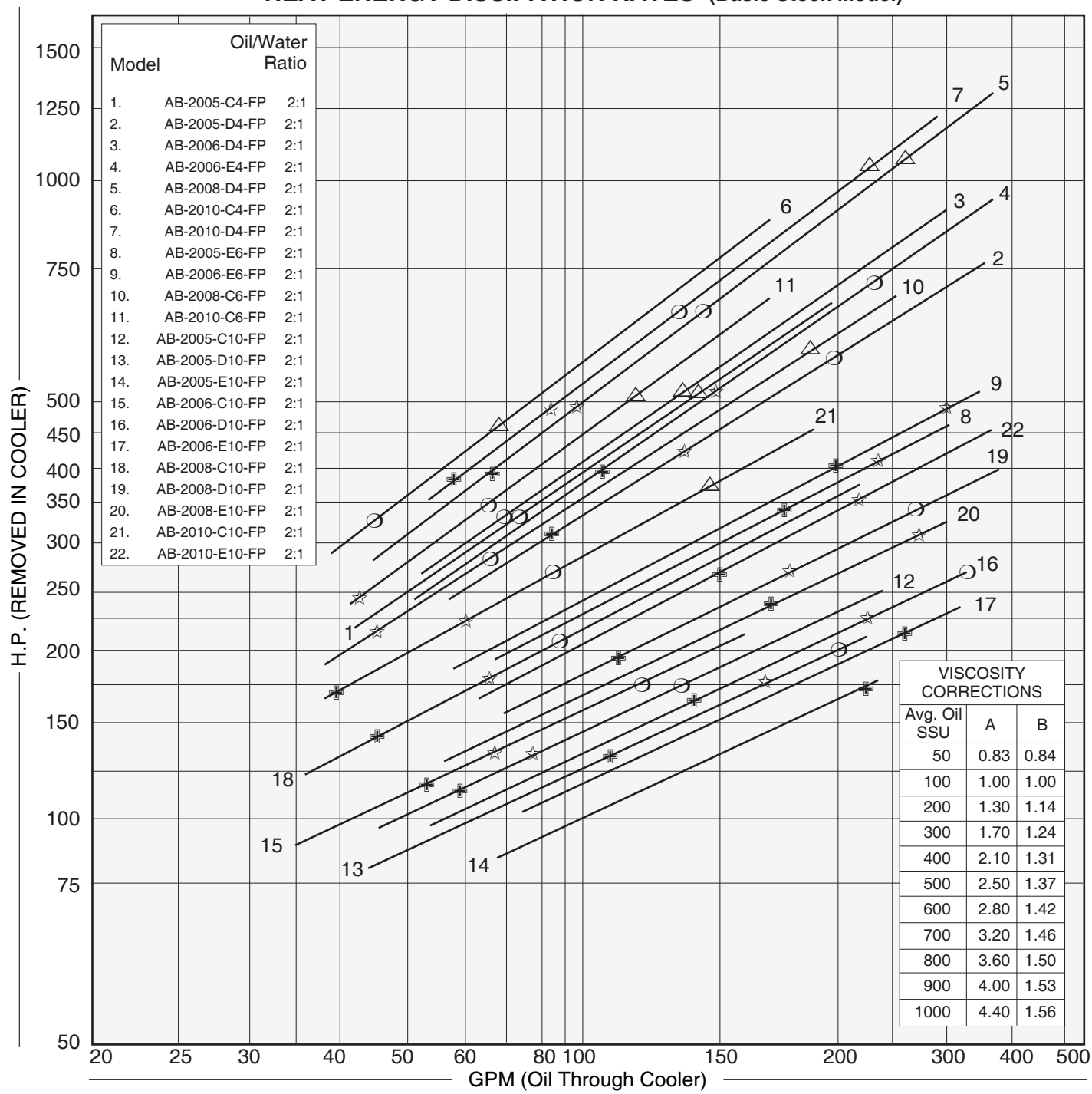
3) OIL PRESSURE DROP CODING: ✙ = 5 psi; ☆= 10 psi; ❍ = 20 psi; △ = 50psi. Curves that have no pressure drop code symbols indicate that the oil pressure drop is less than 5 psi for the flow rate shown.

4) Pressure Drop is based upon oil with an average viscosity of 100 SSU. If the average oil viscosity is other than 100 SSU, then multiply the indicated Pressure Drop by the corresponding value from corrections table A.

5) Corrections for approach temperature and oil viscosity are as follows:

$$H.P.\left(\tfrac{\text{Removed}}{\text{In Cooler}}\right) = H.P.\left(\tfrac{\text{Actual}}{\text{Heat Load}}\right) \times \left(\frac{40}{\text{Actual Approach}}\right) \times B.$$

HEAT ENERGY DISSIPATION RATES (Basic Stock Model)



Model		Oil/Water Ratio
1.	AB-2005-C4-FP	2:1
2.	AB-2005-D4-FP	2:1
3.	AB-2006-D4-FP	2:1
4.	AB-2006-E4-FP	2:1
5.	AB-2008-D4-FP	2:1
6.	AB-2010-C4-FP	2:1
7.	AB-2010-D4-FP	2:1
8.	AB-2005-E6-FP	2:1
9.	AB-2006-E6-FP	2:1
10.	AB-2008-C6-FP	2:1
11.	AB-2010-C6-FP	2:1
12.	AB-2005-C10-FP	2:1
13.	AB-2005-D10-FP	2:1
14.	AB-2005-E10-FP	2:1
15.	AB-2006-C10-FP	2:1
16.	AB-2006-D10-FP	2:1
17.	AB-2006-E10-FP	2:1
18.	AB-2008-C10-FP	2:1
19.	AB-2008-D10-FP	2:1
20.	AB-2008-E10-FP	2:1
21.	AB-2010-C10-FP	2:1
22.	AB-2010-E10-FP	2:1

VISCOSITY CORRECTIONS		
Avg. Oil SSU	A	B
50	0.83	0.84
100	1.00	1.00
200	1.30	1.14
300	1.70	1.24
400	2.10	1.31
500	2.50	1.37
600	2.80	1.42
700	3.20	1.46
800	3.60	1.50
900	4.00	1.53
1000	4.40	1.56

note: AIHTI reserves the right to make reasonable design changes without notice.

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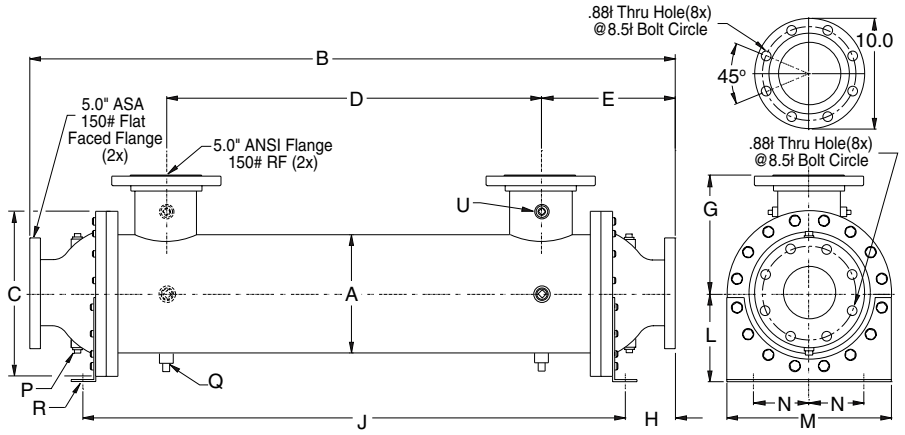
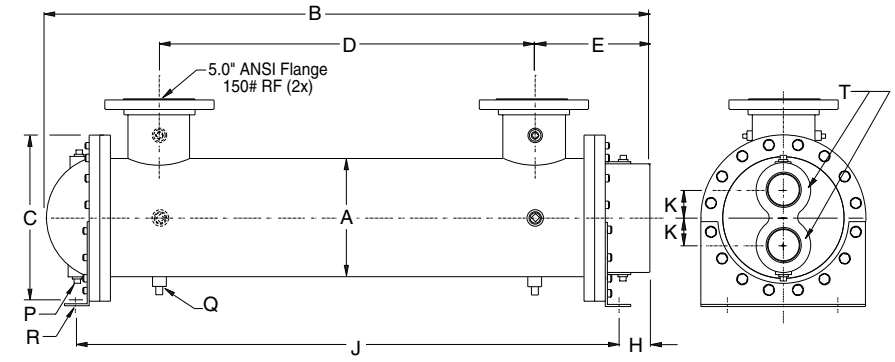


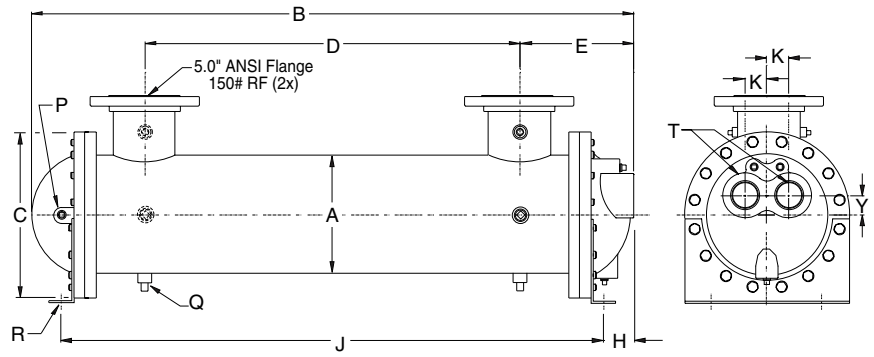
SINGLE PASS (SP)

Model	B	E	H	P NPT
AB-2005	59.88	12.88	4.63	(4) .50
AB-2006	68.88			
AB-2007	77.88			
AB-2008	86.88			
AB-2009	95.88			
AB-2010	104.88			
AB-2011	113.88			
AB-2012	122.88			
AB-2013	131.88			
AB-2014	140.88			



TWO PASS (TP)

Model	B	E	H	K	P NPT	T NPT
AB-2005	55.63	10.88	2.43	2.50	(4) .50	3.00
AB-2006	64.63					
AB-2007	73.63					
AB-2008	82.63					
AB-2009	91.63					
AB-2010	100.63					
AB-2011	109.63					
AB-2012	118.63					
AB-2013	127.63					
AB-2014	136.63					



FOUR PASS (FP)

Model	B	E	H	K	P NPT	Y	T NPT
AB-2005	55.63	10.88	2.50	2.00	(5) .50	1.75	2.50
AB-2006	64.63						
AB-2007	73.63						
AB-2008	82.63						
AB-2009	91.63						
AB-2010	100.63						
AB-2011	109.63						
AB-2012	118.63						
AB-2013	127.63						
AB-2014	136.63						

COMMON DIMENSIONS & WEIGHTS

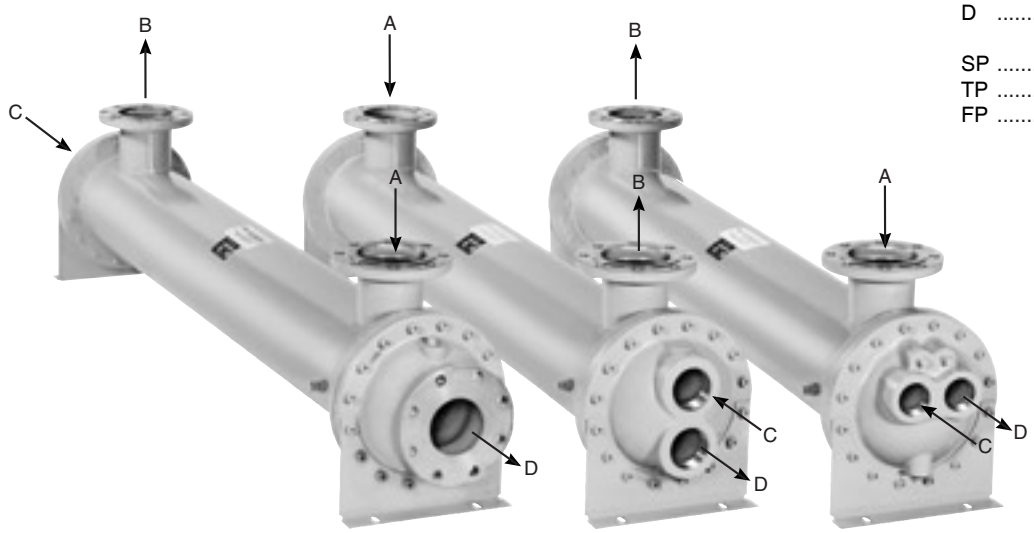
Model	A	C	D	G	J	L	M	N	Q NPT	R	U NPT	Weight	Model
AB-2005	10.75	15.00	34.12	10.75	51.00	8.00	15.00	5.00	.50 (4x)	.75"ø x 1.25" Thru Slot	.38 (2x)	670	AB-2005
AB-2006			43.12		60.00							720	AB-2006
AB-2007			52.12		69.00							770	AB-2007
AB-2008			61.12		78.00							820	AB-2008
AB-2009			70.12		87.00							870	AB-2009
AB-2010			79.12		96.00							820	AB-2010
AB-2011			88.12		105.00							970	AB-2011
AB-2012			97.12		114.00							1020	AB-2012
AB-2013			106.12		123.00							1070	AB-2013
AB-2014			115.12		132.00							1120	AB-2014

note: AIHTI reserves the right to make reasonable design changes without notice.

PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP .....Four Pass



ONE PASS **TWO PASS** **FOUR PASS**

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.
Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of flushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the

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hot fluid to be cooled through the shell side and the cold fluid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the fluids are required to be reversed, *hot fluid in the tubes and cold fluid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a fluid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the complete bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use flexible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate flow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high flow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side fluid and the entering tube side fluid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the fluids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a floating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the flow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water flow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external fluid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to flush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic fluid is in question, the shell side should be disconnected and flushed on a yearly basis with a clean flushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be flushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor fluid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, flush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

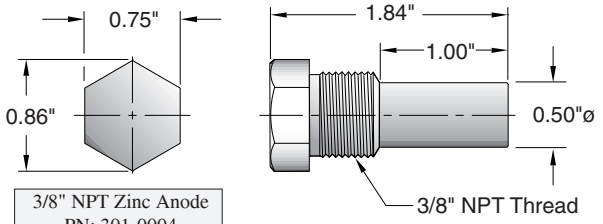
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, flow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

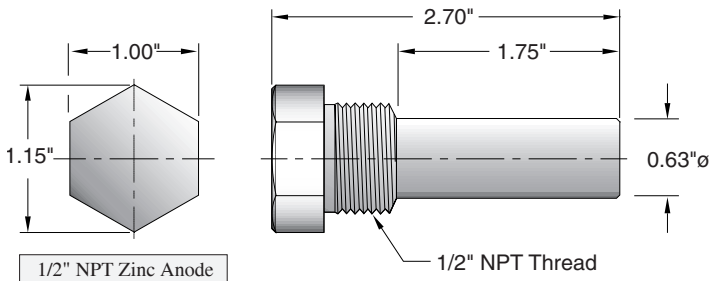
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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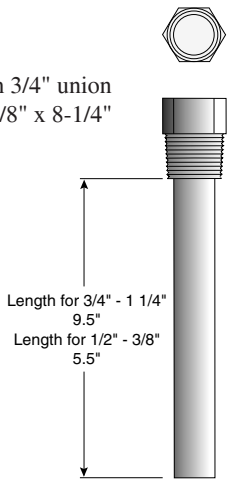
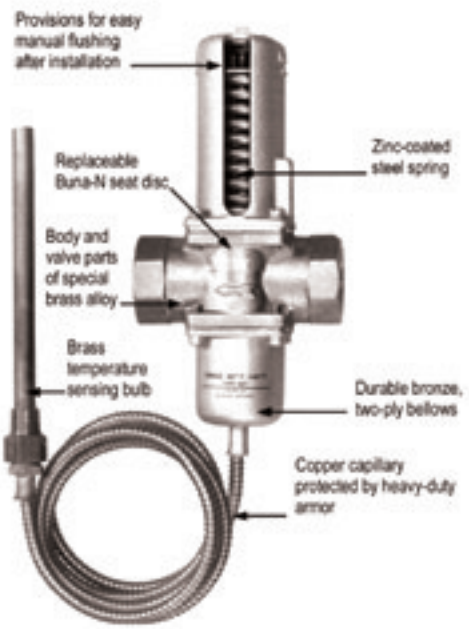
56T THERMOSTATIC MODULATING WATER VALVE WITH BULB WELL ASSEMBLY

(for Shell & Tube Heat Exchangers And Air/Oil Coolers)

SPECIFICATIONS

Sizes	0.375", 0.50", 0.75", 1.00", 1.25" FPT
Fluid Pressure	125psi (max.)
Standard Temperature	40° - 100° F., 60° - 140° F., 100° - 175° F., 125° - 200° F., 140° - 240° F., 200° - 275°F.
Body	Brass alloy casting
Valve Parts	Brass alloy
Standard Capillary Length	6' & 20' foot
Standard Bulbs	For 3/8" & 1/2" valve sizes: 5/8" x 6 with 3/4" union connections. For 3/4" & 1" valve sizes: 5/8" x 8-1/4" with 3/4" union connections. Stainless steel construction available.
Standard Bulb Mounting	3/4" NPT
Seat Disk	Buna-N-replaceable
Seat Bead	Stainless Steel - replaceable





APPLICATION INFORMATION

- Built for rugged machine tool and hydraulic applications.
- Adjustable temperature range to meet your requirements.
- Quick response to temperature changes.
- Extra heavy-duty direct acting bellows for longer service.

Note: Please consult factory if a non-cataloged temperature is required.

The type 56-T valve gives smooth regulation of water and other fluids. It's designed for the most rugged application. For example: hydraulic power packaging equipment, hydraulic presses, plastic molding equipment, and anywhere reliability in temperature control is demanded. The type 56-t valve is a better designed product that won't leak or chatter. To insure dependability, every valve is factory tested three times in different temperature baths. Extra performance can be expected of the bellows also. They are direct acting with sturdy walls, and the inner spring is zinc coated. The seat beads are stainless steel to resist the erosive effects of *wire drawing* and provide longer life for your needs. Additional features include mounting in any position, Buna-N seat disc, and manual flushing.

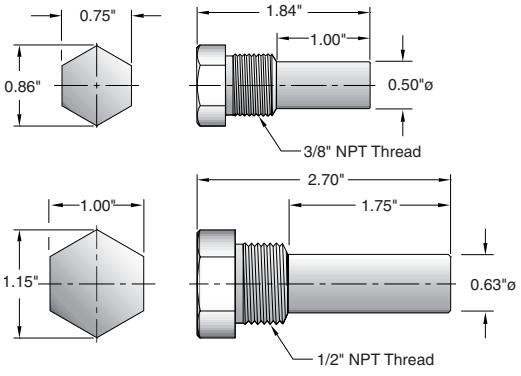
Thermostatic Modulating Water Valve

Part Number	Description	
	Size NPT	Temp. Range
310-1001	3/8"	60 °F - 140 °F
310-1004	1/2"	60 °F - 140 °F
310-1008	3/4"	60 °F - 140 °F
310-1014	1"	60 °F - 140 °F
310-1020	1-1/4"	60 °F - 140 °F
310-1046	1-1/2"	60 °F - 140 °F
310-1047	2"	60 °F - 140 °F
310-1025	3/8"	100 °F - 175 °F
310-1005	1/2"	100 °F - 175 °F
310-1010	3/4"	100 °F - 175 °F
310-1015	1"	100 °F - 175 °F
310-1026	1-1/4"	100 °F - 175 °F

Bulb Well	
Part Number Brass	Part Number Stainless Steel
310-2001	310-2003
310-2001	310-2003
310-2002	310-2004
310-2002	310-2004
310-2002	310-2004
310-2001	310-2003
310-2001	310-2003
310-2002	310-2004
310-2002	310-2004
310-2002	310-2004

Zinc Anode List Prices

Description	
Part Number	Size NPT
301-0004	3/8" NPT
301-0003	1/2" NPT



note: AIHTI reserves the right to make reasonable design changes without notice.

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

AA - STA SERIES

Fixed Tube Bundle Liquid Cooled

HEAT EXCHANGERS

- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 300 PSI.
- Operating temperature 300 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

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AA & STA Series *overview*

AA SERIES

Fixed tube construction heat exchangers with NPT connections. Made of brass with copper cooling tubes and cast iron end bonnets. Standard sizes from 2" through 8" diameters, and from 1.3 to 200 sq.ft. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tubes, bronze end bonnets and zinc anodes. Can be customized to fit your requirements.

Optional 10” diameter units in brass are available upon request.

SAA Series

Similar to AA series with the exception of steel shell material. For use in applications where the shell fluid is non-corrosive with steel. *Offered in 5" through 8" shell diameter.*

STA SERIES

Similar in design to AA series with fixed tube construction and NPT connections made of all 316 stainless steel. Standard sizes from 2” through 8” diameters. From 1.3 to 200 sq. ft. Standard one, two and four pass models are available. Larger diameters available upon request. Can be customized to fit your requirements.

FBF SERIES

Similar to AA series with the exception of shell ports. FBF series offered from 5” through 8” diameter has SAE code 61 four bolt flange shell port connections. Available with single pass, two pass, and four pass end bonnets. Options include 90/10 copper nickel and 316 stainless steel cooling tubes, bronze end bonnets, and zinc anodes. In applications where shell fluid is non-corrosive with steel, SFBF series can be used.

(See Page 31)

AC SERIES with electric drive

Air-cooled oil coolers with AC electric , DC electric, and hydraulic fan drive motors. Eight standard sizes with optional washable air filter. Rated flow from 2 to 120 GPM. Thermal capacity up to 100 hp (75Kw). NPT, flange, or SAE straight thread port connections. Optional built-in bypass relief valve 30 PSI or 65 PSI. Can be modified to meet your requirements. Suitable for most hydraulic oils, lubrications oils, synthetic compressor oils, phosphate ester, ethylene glycol, and many other fluids compatible with listed material.

In applications where water is not available for cooling (see page 131)

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CAST BONNET
Provides fluid into tubes with minimum restriction. One, two, or four pass interchangeability.

TUBE JOINT
Roller expanded tube joint to integral forged hub.

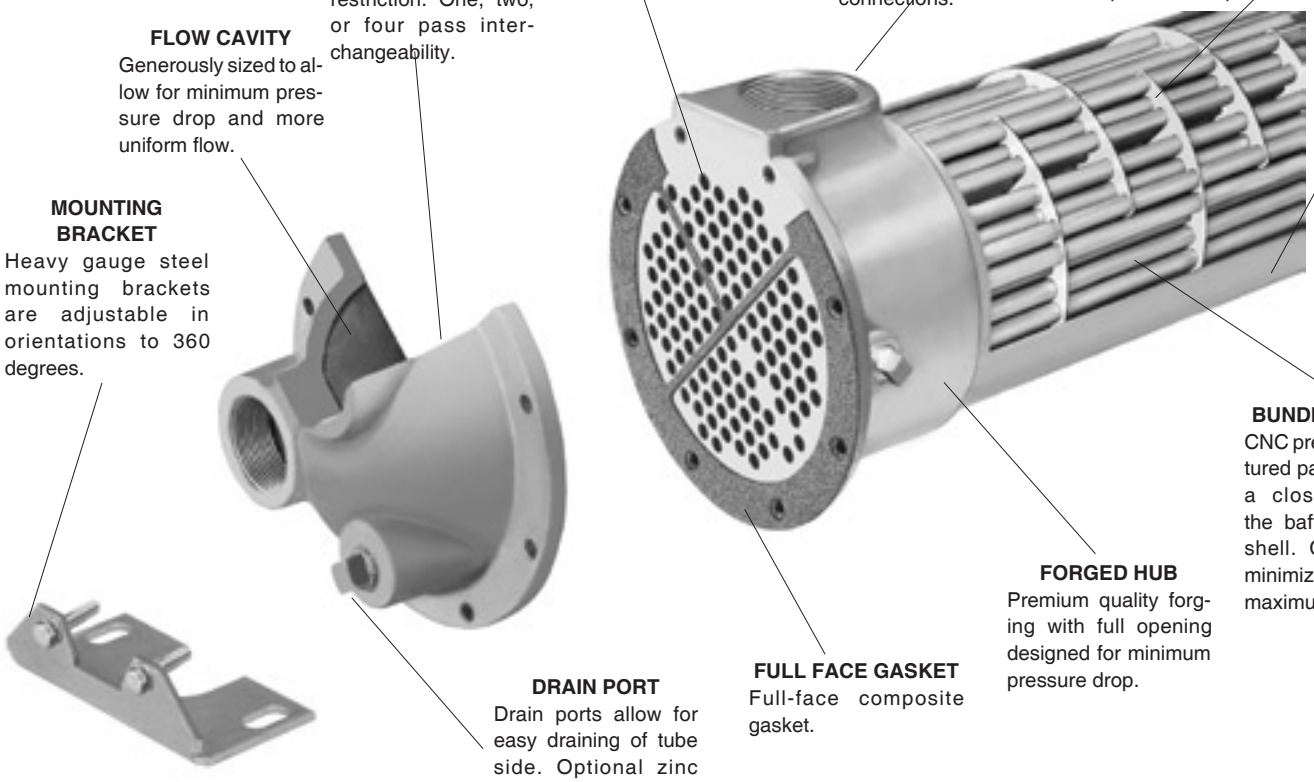
THREAD
CNC precision threading to provide accurate leakproof connections.

BAFFLES
CNC manufactured baffles to provide maximum turbulence and heat transfer with a minimum fluid pressure drop.

FLOW CAVITY
Generously sized to allow for minimum pressure drop and more uniform flow.

FINISH
Gray semi-gloss enamel. Can be used as a base for additional coats.

MOUNTING BRACKET
Heavy gauge steel mounting brackets are adjustable in orientations to 360 degrees.



BUNDLE ASSEMBLY
CNC precision manufactured parts to guarantee a close fit between the baffles, tubes, and shell. Clearances are minimized to provide for maximum heat transfer.

FORGED HUB
Premium quality forging with full opening designed for minimum pressure drop.

FULL FACE GASKET
Full-face composite gasket.

DRAIN PORT
Drain ports allow for easy draining of tube side. Optional zinc anode can be inserted in place of plug.

UNIT CODING

Example Model

Options

AA - 1224 - 4 - 6 - TP - CNT - B - Z

Model
AA
SAA
STA

Shell Diameter
400 = 2.13"
600 = 3.13"
800 = 4.13"
1000 = 5.13"
1200 = 6.13"
1600 = 8.00"

Effective Tube Length
(12" increments)

Baffle Spacing Code
1.5"
2.0"
3.0"
4.0"
6.0"

Cooling Tube Diamenter
4 = 1/4"
6 = 3/8"
10 = 5/8"

Tube Side Passes
SP = 1 pass
TP = 2 pass
FP = 4 pass

Tubing
Blank = Copper

Options
CNT= 90/10 Cu Ni
STS = Stainless Steel

End Bonnets
Blank = Cast Iron

Options
B = Bronze

Zinc Anode
Z = 1 Zinc Anode
2Z = 2 Zinc Anode etc.

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	AA Series	SAA Series*	STA Series	Standard Unit Ratings
Shell	Brass	Steel	316 Stainless Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 300 psig Operating Temperature 300 °F
Tubes	Copper	Copper	316 Stainless Steel	
Baffle	Brass	Steel	316 Stainless Steel	
Integral End Hub	Forged Brass	Forged Brass	316 Stainless Steel	
End Bonnets	Cast Iron	Cast Iron	316 Stainless Steel	
Mounting Brackets	Steel	Steel	Steel	
Gasket	Hypalon Composite	Hypalon Composite	Hypalon Composite	

*Offered in 5" through 8" shell diameter.

note: AIHTI reserves the right to make reasonable design changes without notice.

STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other fluids that are commonly used with shell & tube heat exchangers.

Terms

GPM = Gallons Per Minute
CN = Constant Number for a given fluid
△T = Temperature differential across the potential
PSI = Pounds per Square Inch (pressure) of the operating side of the system
MHP = Horsepower of the electric motor driving the hydraulic pump
Kw = Kilowatt (watts x 1000)
T_{in} = Hot fluid entering temperature in °F
T_{out} = Hot fluid exiting temperature in °F
t_{in} = Cold fluid temperature entering in °F
t_{out} = Cold fluid temperature exiting in °F
Q = BTU / HR

For example purposes, a hydraulic system has a 125 HP (93Kw) electric motor installed coupled to a pump that produces a flow of 80 GPM @ 2500 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 5.3°F. Even though our return line pressure operates below 100 psi, we must calculate the system heat load potential (Q) based upon the prime movers (pump) capability. We can use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =80 x 210 x 5.3°F = 89,040 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(2500x80)/1714] x .30 x 2545 = 89,090 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =125 x .30 x 2545 = 95,347 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =28 x 3415 = 95,620 BTU/HR
E) Q = HP to be removed x 2545	E) Q =37.5 x 2545 = 95,437 BTU/HR

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid flow rate to derive the cold side △T. If your water flow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

Formula	Example
HOT FLUID △T = Oil $\frac{Q}{CN \times GPM}$	△**T** = $\frac{89{,}090\ BTU/hr}{210\ CN \times 80GPM}$ (from step 1,item B) = 5.3°F = △T Rejected
COLD FLUID △ t = Water $\frac{BTU / hr}{CN \times GPM}$	△**t** = $\frac{89{,}090\ BTU/hr}{500\ CN \times 40GPM}$ (for a 2:1 ratio) = 4.45°F = △T Absorbed

T_{in} = Hot Fluid entering temperature in degrees F
T_{out} = Hot Fluid exiting temperature in degrees F
t_{in} = Cold Fluid entering temperature in degrees F
t_{out} = Cold Fluid exiting temperature in degrees F

T_{in} = 125.3 °F
T_{out} = 120.0 °F
t_{in} = 700 °F
t_{out} = 74.5 °F

$$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S\text{[smaller temperature difference]}}{L\text{ [larger temperature difference]}} = \left(\frac{S}{L}\right)$$

$$\frac{120.0°F - 70.0°F = 50.0°F}{125.3°F - 74.5°F = 50.8°F} = \frac{50.0°F}{50.8°F} = .984$$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;

L = Larger temperature difference from step 2.
M = S/L number (LOCATED IN TABLE A).

$LMTD_i$ = L x M

$LMTD_i$ = 50.8 x .992 (FROM TABLE A) = 50.39

To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula	Example
$R = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$	$R = \frac{125.3°F - 120°F}{74.5°F - 70°F} = \frac{5.3°F}{4.5°F} =$ **{1.17=R}**
$K = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$	$K = \frac{74.5°F - 70°F}{124.5°F - 70°F} = \frac{4.5°F}{55.4°F} =$ **{0.081=K}**

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 50.39 x 1 = **50.39**

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STEP 4: Calculate the area required

Required Area sq.ft. = $\frac{\text{Q (BTU / HR)}}{\text{LMTD}_c \text{ x U (FROM TABLE C)}}$ $\frac{89{,}090}{50.39 \text{ x } 100}$ = **17.68 sq.ft.**

STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits your flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 80 GPM = Series Required from Table E = **1200 Series**
Baffle Spacing from Table E = **4**
Water Flow Rate = 40 GPM = Passes required in 1200 series = **4 (FP)**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 17.68sq.ft Closest model required based upon sq.ft. & series = **AA-1224-4-6-FP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

TABLE B- LMTD correction factor for Multipass Exchangers

R \ K	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

TABLE D- Surface Area

Model Number	Surface Area in Sq.ft. 1/4" O.D Tubing	3/8" O.D Tubing	5/8 O.D Tubing	Model Number	Surface Area in Sq.ft. 1/4" O.D Tubing	3/8" O.D Tubing	5/8 O.D Tubing
AA-408	1.3	–	–	AA-1224	–	23.6	11.8
				AA-1236	–	35.3	17.7
AA-608	2.6	–	–	AA-1248	–	47.1	23.6
AA-614	4.6	–	–	AA-1260	–	58.9	29.5
AA-624	7.9	–	–	AA-1272	–	70.6	35.4
AA-636	11.2	–	–	AA-1284	–	82.3	41.3
				AA-1296	–	94.0	47.2
AA-814	8.3	–	–				
AA-824	14.1	–	–	AA-1624	–	41.0	23.6
AA-836	21.2	–	–	AA-1636	–	62.0	35.3
AA-848	28.3	–	–	AA-1648	–	82.0	47.1
				AA-1660	–	103.0	58.9
AA-1014	–	9.1	4.6	AA-1672	–	124.0	70.7
AA-1024	–	16.0	7.8	AA-1684	–	145.0	82.5
AA-1036	–	24.0	11.8	AA-1696	–	166.0	94.3
AA-1048	–	32.0	15.8	AA-16108	–	187.0	106.1
AA-1060	–	40.0	19.8	AA-16120	–	208.0	117.9

TABLE E- Flow Rate for Shell & Tube

Shell dia . Code	Max. liquid Flow - Shell Side Baffle Spacing 1.5	2	3	4	6	Liquid Flow - Tube Side SP Min.	SP Max.	TP Min.	TP Max.	FP Min.	FP Max.
400	10	19	–	–	–	3.5	20	–	–	–	–
600	15	20	25	30	–	7.5	48	3.5	24	2	12
800	20	35	45	60	–	10	70	4.5	38	3	21
1000	24	35	60	70	–	20	120	10	70	5.0	37
1200	35	45	70	100	120	30	220	15	112	7.5	56
1600	38	70	150	200	220	57	300	29	180	14	90

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

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AA & STA Series *performance*

Instructions

The selection chart provided contains an array of popular sizes for quick sizing. It does not provide curves for all models available. Refer to page 24 & 25 for detailed calculation information.

Computer selection data sheets for standard or special models are available through the engineering department of American Industrial. To use the followings graphs correctly, refer to the instruction notes "1-5".

1) HP Curves are based upon a 40°F approach temperature; for example: oil leaving a cooler at 125°F, using 85°F cooling water (125°F – 85°F = 40°F).

2) The oil to water ratio of 1:1 or 2:1 means that for every 1 gallon of oil circulated, a minimum of 1 or 1/2 gallon (respectively) of 85°F water must be circulated to match the curve results.

3) OIL PRESSURE DROP CODING: ✙ = 5 psi; ☆= 10 psi; ❍ = 20 psi; △ = 50psi. Curves that have no pressure drop code symbols indicate that the oil pressure drop is less than 5 psi for the flow rate shown.

4) Pressure Drop is based upon oil with an average viscosity of 100 SSU. If the average oil viscosity is other than 100 SSU, then multiply the indicated Pressure Drop by the corresponding value from corrections table A.

5) Corrections for approach temperature and oil viscosity are as follows:

$$H.P.\left(\begin{smallmatrix}\text{Removed}\\ \text{In Cooler}\end{smallmatrix}\right) = H.P.\left(\begin{smallmatrix}\text{Actual}\\ \text{Heat Load}\end{smallmatrix}\right) \times \left(\frac{40}{\text{Actual Approach}}\right) \times B.$$

HEAT ENERGY DISSIPATION RATES (Basic Stock Model)

VISCOSITY CORRECTIONS		
Avg. Oil SSU	A	B
50	0.83	0.84
100	1.00	1.00
200	1.30	1.14
300	1.70	1.24
400	2.10	1.31
500	2.50	1.37
600	2.80	1.42
700	3.20	1.46
800	3.60	1.50
900	4.00	1.53
1000	4.40	1.56

	Model	Oil/Water Ratio
1.	408-2-4-SP	1:1
2.	408-1-4-SP	1:1
3.	608-2-4-FP	2:1
4.	614-4-4-FP	2:1
5.	624-4-4-FP	2:1
6.	608-1-4-FP	2:1
7.	614-1.5-4-FP	2:1
8.	624-2-4-FP	2:1
9.	814-3-4-FP	2:1
10.	824-4-4-FP	2:1
11.	836-4-4-FP	2:1
12.	814-1.5-4-FP	2:1
13.	824-2-4-FP	2:1
14.	836-2-4-FP	2:1
15.	1014-3-6-FP	2:1
16.	1024-4-6-FP	2:1
17.	1036-4-6-FP	2:1
18.	1024-2-6-FP	2:1
19.	1036-2-6-FP	2:1
20.	1224-4-6-FP	2:1
21.	1236-6-6-FP	2:1
22.	1248-6-6-FP	2:1
23.	1260-6-6-FP	2:1
24.	1224-2-6-FP	2:1
25.	1236-3-6-FP	2:1
26.	1248-3-6-FP	2:1
27.	1260-4-6-FP	2:1
28.	1624-6-6-FP	2:1
29.	1636-6-6-FP	2:1
30.	1648-6-6-FP	2:1
31.	1660-6-6-FP	2:1
32.	1672-6-6-FP	2:1
33.	1624-2-6-FP	2:1
34.	1636-3-6-FP	2:1
35.	1648-3-6-FP	2:1
36.	1660-4-6-FP	2:1
37.	1672-4-6-FP	2:1

H.P. (REMOVED IN COOLER)

GPM (Oil Through Cooler)

note: AIHTI reserves the right to make reasonable design changes without notice.

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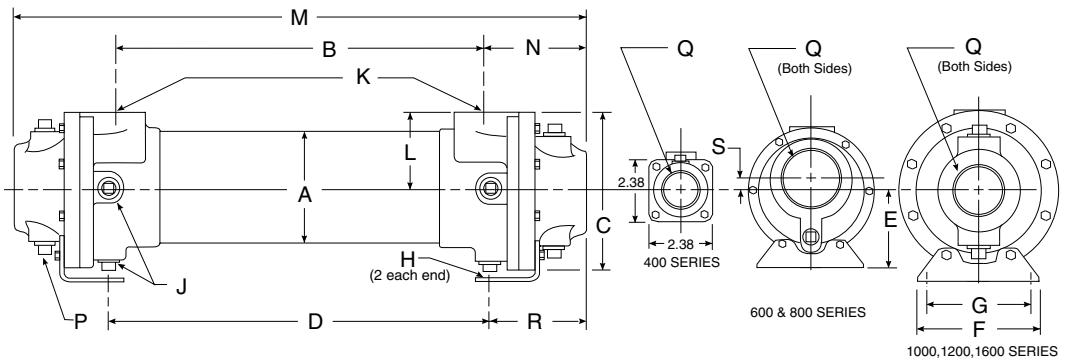
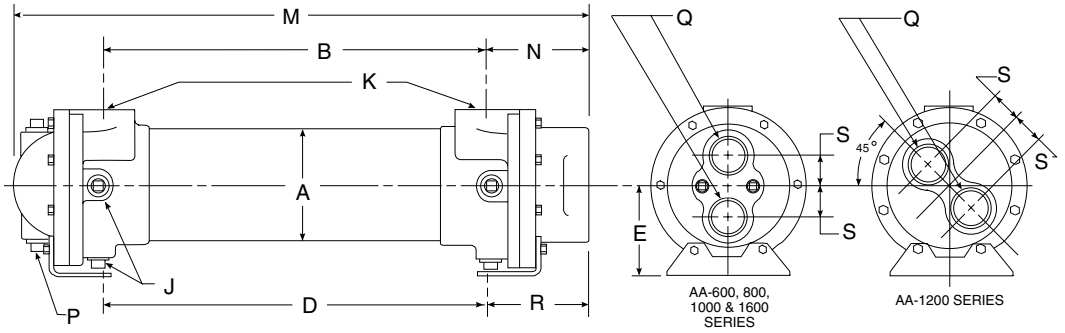


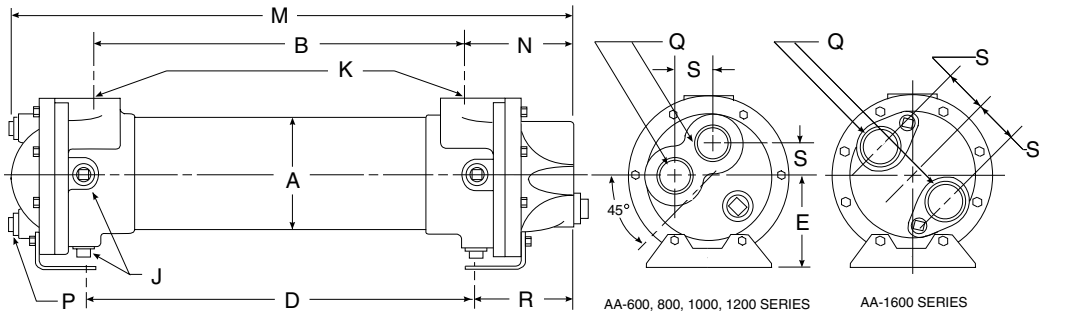
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT	R	S
AA-408	11.00	2.38	-	1.00	-	-
AA-608	11.25					
AA-614	17.25	2.56	(2) .38	1.50	3.06	0.38
AA-624	27.25					
AA-814	18.00					
AA-824	28.00	3.44	(2) .38	2.00	2.56	0.50
AA-836	40.00					
AA-1014	18.50					
AA-1024	28.50	3.69	(4) .38	2.50	3.38	-
AA-1036	40.50					
AA-1224	29.25					
AA-1236	41.25					
AA-1248	53.25	4.25	(4) .50	3.00	3.75	-
AA-1260	65.25					
AA-1272	77.25					
AA-1624	31.25					
AA-1636	43.25					
AA-1648	55.25					
AA-1660	67.25	6.52	(4) .50	4.00	5.25	-
AA-1672	79.25					
AA-1684	91.25					



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R	S
AA-608	10.75					
AA-614	16.75	2.44	(2) .38	1.00	2.94	1.00
AA-624	26.75					
AA-814	17.62					
AA-824	27.62	3.44	(2) .38	1.25	2.56	1.19
AA-836	39.62					
AA-1014	18.50					
AA-1024	28.50	3.69	(2) .38	1.50	3.50	1.50
AA-1036	40.50					
AA-1224	28.75					
AA-1236	40.75					
AA-1248	52.75	4.25	(2) .50	2.00	3.75	1.44
AA-1260	64.75					
AA-1272	76.75					
AA-1624	30.50					
AA-1636	42.50					
AA-1648	54.50					
AA-1660	66.50	6.00	(2) .50	2.50	5.25	1.88
AA-1672	78.50					
AA-1684	90.50					



FOUR PASS (FP)

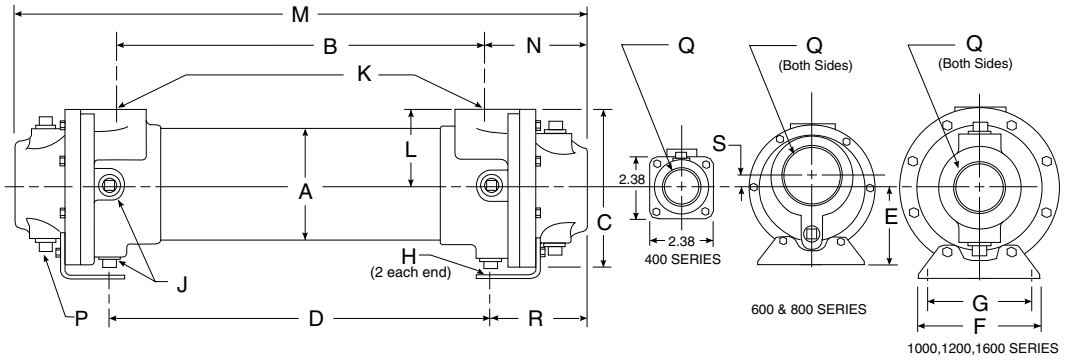
Model	M	N	P NPT	Q NPT	R	S
AA-608	10.88					
AA-614	16.88	2.44	(2) .38	.75	2.81	1.00
AA-624	26.88					
AA-814	17.62					
AA-824	27.62	3.44	(2) .38	.75	2.56	1.06
AA-836	39.62					
AA-1014	18.50					
AA-1024	28.50	3.80	(3) .38	1.00	3.25	1.69
AA-1036	40.50					
AA-1224	29.50					
AA-1236	41.50					
AA-1248	53.50	4.56	(3) .50	1.50	3.75	2.00
AA-1260	65.50					
AA-1272	77.50					
AA-1624	30.75					
AA-1636	42.75					
AA-1648	54.75					
AA-1660	66.75	6.08	(4) .50	2.00	5.25	2.62
AA-1672	78.75					
AA-1684	90.75					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J NPT	K NPT	L	Approx. Weight	Model
AA-408	2.125	6.25	-	-	-	-	-	-	-	.50	1.69	7	AA-408
AA-608		6.12		5.12								12	AA-608
AA-614	3.125	12.12	4.19	11.12	2.44	3.50	2.50	.38øx.88	(2) .25	1.00	2.44	16	AA-614
AA-624		22.12		21.12								20	AA-624
AA-814		11.12		12.88								37	AA-814
AA-824	4.125	21.12	5.88	22.88	3.50	4.75	3.50	.50øx1.62	(6) .38	1.50	3.12	47	AA-824
AA-836		33.12		34.88								67	AA-836
AA-1014		11.12		11.75								45	AA-1014
AA-1024	5.125	21.12	6.50	21.75	3.75	5.00	4.00	.50øx.88	(6) .38	1.50	3.62	60	AA-1024
AA-1036		33.12		33.75								82	AA-1036
AA-1224		20.50		21.50								90	AA-1224
AA-1236		32.50		33.50								110	AA-1236
AA-1248	6.125	44.50	7.50	45.50	4.12	6.00	5.00	.50øx.88	(6) .38	2.00	4.25	130	AA-1248
AA-1260		56.50		57.50								150	AA-1260
AA-1272		68.50		69.50								180	AA-1272
AA-1624		19.00		20.50								160	AA-1624
AA-1636		31.00		32.50								185	AA-1636
AA-1648		43.00		44.50								205	AA-1648
AA-1660	8.00	55.00	9.75	56.50	5.38	8.25	7.00	.62øx1.12	(6) .38	3.00	5.62	235	AA-1660
AA-1672		67.00		68.50								280	AA-1672
AA-1684		79.00		80.50								320	AA-1684

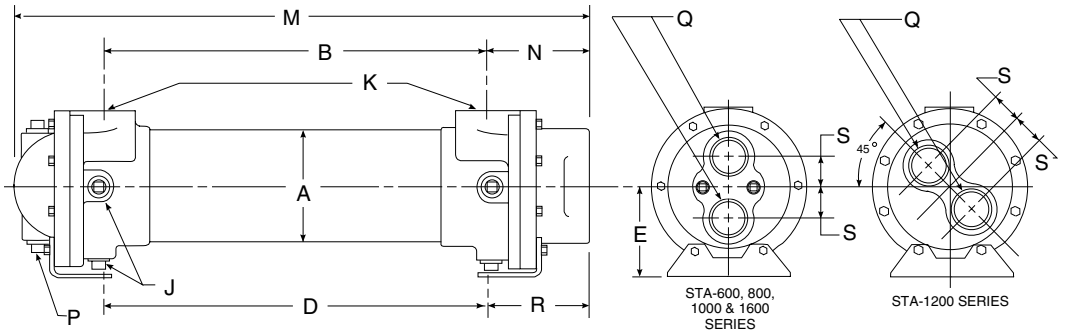
note: AIHTI reserves the right to make reasonable design changes without notice.

STA Series *dimensions*



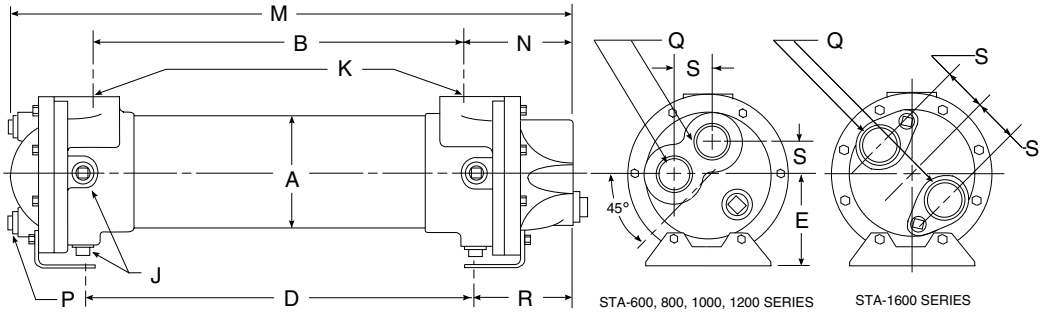
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT	R	S
STA-408	11.00	2.38	-	1.00	-	-
STA-608	11.25					
STA-614	17.25	2.56	(2) .38	1.50	3.06	0.38
STA-624	27.25					
STA-814	18.00					
STA-824	28.00	3.44	(2) .38	2.00	2.56	0.50
STA-836	40.00					
STA-1014	18.50					
STA-1024	28.50	3.69	(4) .38	2.50	3.38	-
STA-1036	40.50					
STA-1224	29.25					
STA-1236	41.25					
STA-1248	53.25	4.25	(4) .50	3.00	3.75	-
STA-1260	65.25					
STA-1272	77.25					
STA-1624	31.25					
STA-1636	43.25					
STA-1648	55.25					
STA-1660	67.25	6.52	(4) .50	4.00	5.25	-
STA-1672	79.25					
STA-1684	91.25					



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R	S
STA-608	10.75					
STA-614	16.75	2.44	(2) .38	1.00	2.94	1.00
STA-624	26.75					
STA-814	17.62					
STA-824	27.62	3.44	(2) .38	1.25	2.56	1.19
STA-836	39.62					
STA-1014	18.50					
STA-1024	28.50	3.69	(2) .38	1.50	3.50	1.50
STA-1036	40.50					
STA-1224	28.75					
STA-1236	40.75					
STA-1248	52.75	4.25	(2) .50	2.00	3.75	1.56
STA-1260	64.75					
STA-1272	76.75					
STA-1624	30.50					
STA-1636	42.50					
STA-1648	54.50					
STA-1660	66.50	6.00	(2) .50	2.50	5.25	2.25
STA-1672	78.50					
STA-1684	90.50					



FOUR PASS (FP)

Model	M	N	P NPT	Q NPT	R	S
STA-608	10.88					
STA-614	16.88	2.44	(2) .38	.75	2.81	1.00
STA-624	26.88					
STA-814	17.62					
STA-824	27.62	3.44	(2) .38	.75	2.56	1.06
STA-836	39.62					
STA-1014	18.50					
STA-1024	28.50	3.80	(3) .38	1.00	3.25	1.69
STA-1036	40.50					
STA-1224	29.50					
STA-1236	41.50					
STA-1248	53.50	4.56	(3) .50	1.50	3.75	2.00
STA-1260	65.50					
STA-1272	77.50					
STA-1624	30.75					
STA-1636	42.75					
STA-1648	54.75					
STA-1660	66.75	6.08	(4) .50	2.00	5.25	2.62
STA-1672	78.75					
STA-1684	90.75					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J NPT	K	L	Approx. Weight	Model
STA-408	2.125	6.25	-	-	-	-	-	-	-	.50	1.69	7	STA-408
STA-608		6.12		5.12								12	STA-608
STA-614	3.125	12.12	4.19	11.12	2.44	3.50	2.50	.38øx.88	(2) .25	1.00	2.44	16	STA-614
STA-624		22.12		21.12								20	STA-624
STA-814		11.12		12.88								37	STA-814
STA-824	4.125	21.12	5.88	22.88	3.50	4.75	3.50	.50øx1.62	(6) .38	1.50	3.12	47	STA-824
STA-836		33.12		34.88								67	STA-836
STA-1014		11.12		11.75								45	STA-1014
STA-1024	5.125	21.12	6.50	21.75	3.75	5.00	4.00	.50øx.88	(6) .38	1.50	3.62	60	STA-1024
STA-1036		33.12		33.75								82	STA-1036
STA-1224		20.50		21.50								90	STA-1224
STA-1236		32.50		33.50								110	STA-1236
STA-1248	6.125	44.50	7.50	45.50	4.12	6.00	5.00	.50øx.88	(6) .38	2.00	4.25	130	STA-1248
STA-1260		56.50		57.50								150	STA-1260
STA-1272		68.50		69.50								180	STA-1272
STA-1624		19.00		20.50								160	STA-1624
STA-1636		31.00		32.50								185	STA-1636
STA-1648		43.00		44.50								205	STA-1648
STA-1660	8.00	55.00	9.75	56.50	5.38	8.25	7.00	.62øx1.12	(6) .38	3.00	5.62	235	STA-1660
STA-1672		67.00		68.50								280	STA-1672
STA-1684		79.00		80.50								320	STA-1684

note: AIHTI reserves the right to make reasonable design changes without notice.

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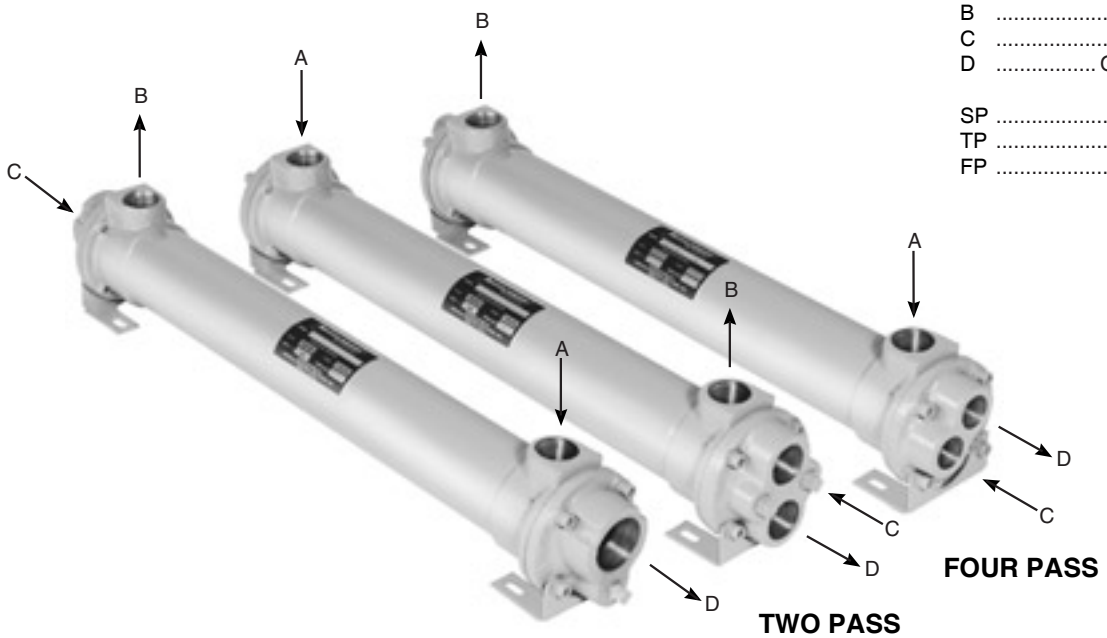
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP .....Four Pass



FOUR PASS

TWO PASS

SINGLE PASS

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.
Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

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g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the complete bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

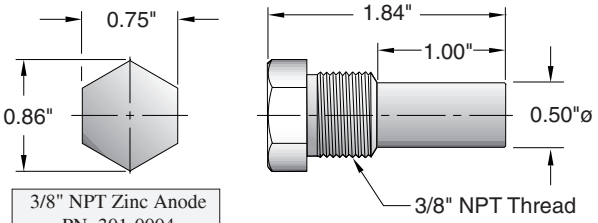
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

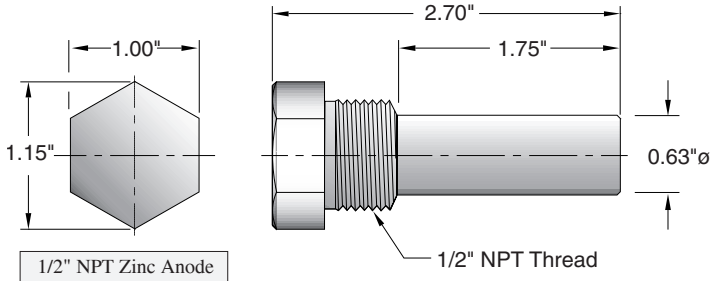
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

FBF SERIES

FOUR PASS

Fixed Tube Bundle Liquid Cooled

HEAT EXCHANGERS

with SAE four bolt ange

- Available in single, two, and four pass.
- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 300 PSI.
- Operating temperature 300 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

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FBF Series *overview*

FBF SERIES

Similar to AA series with the exception of shell ports. FBF series offered from 5” through 8” diameter has SAE code 61 four bolt flange shell port connections. Available with single pass, two pass, and four pass end bonnets. Options include 90/10 copper nickel and 316 stainless steel cooling tubes, bronze end bonnets, and zinc anodes.

SFBF Series

Similar to FBF series with the exception of steel shell material. For use in applications where the shell fluid is non-corrosive with steel. *Offered in 5" through 8" shell diameter.*

AA SERIES

Fixed tube construction heat exchangers with NPT connections. Made of brass with copper cooling tubes and cast iron end bonnets. Standard sizes from 2" through 8" diameters, and from 1.3 to 200 sq.ft. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tubes, bronze end bonnets and zinc anodes. Can be customized to fit your requirements.

Optional 10” diameter units in brass are available upon request. In applications where the shell fluid is non-corrosive with steel, SAA series can be used. See AA Series on (page 21).

CS SERIES

Fixed tube construction heat exchangers with NPT connections. Made of steel with copper cooling tubes and cast iron end bonnets. Standard sizes from 3” through 8” diameters. From 4.6 to 200 sq. ft. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tube, and zinc anodes. Can be customized to fit your requirements. See CS Series on (page 41).

EOC & EOCF with electric drive

Mobile & industrial air-cooled oil coolers. Brazed or serviceable core ®, mobile and industrial series heat exchangers available with optional washable filter and integral relief valve, 30 PSI or 65 PSI. Standard single phase, three phase, hydraulic,12 volt DC (21amp) or 24 volt DC (10.5 amp) motors with single or dual cooling fans. Standard flow rates to 180 GPM. Thermal capacity up to 225 hp (168 Kw). NPT or SAE strait thread O-ring port connections. Can be modified to meet your requirements. Suitable for most hydraulic oils, lubrication oils, synthetic compressor oils, ethylene glycol, and many other fluids compatible with listed materials.

In applications where water is not available for cooling (see page 169)

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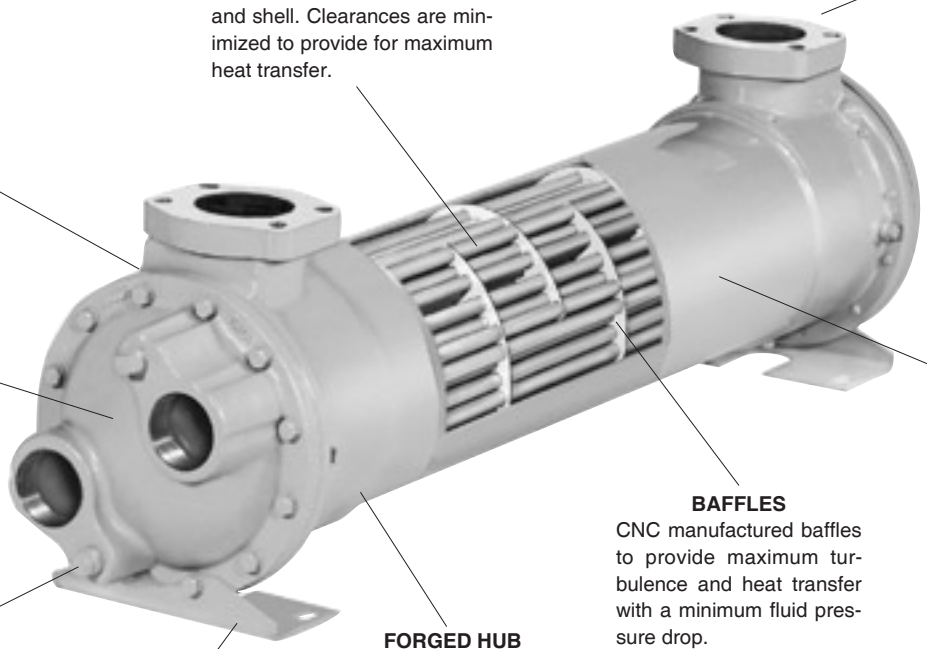

BUNDLE ASSEMBLY
CNC precision manufactured parts to guarantee a close fit between the baffles, tubes, and shell. Clearances are minimized to provide for maximum heat transfer.

FOUR BOLT FLANGE
SAE Code 61 four bolt ange.

TUBE JOINT
Roller expanded tube joint to integral forged hub.

CAST BONNET
Provides fluid into tubes with minimum restriction. One, two, or four pass interchangeability.

FINISH
Gray semigloss enamel. Can be used as a base for additional coats.

BAFFLES
CNC manufactured baffles to provide maximum turbulence and heat transfer with a minimum fluid pressure drop.

DRAIN PORT
Drain ports allow for easy draining of tube side. Optional zinc anode can be inserted in place of plug.

MOUNTING BRACKET
Heavy gauge steel mounting brackets are adjustable in orientations to 360 degrees.

FORGED HUB
Premium quality forging with full opening designed for minimum pressure drop.

UNIT CODING

Example Model

Options

FBF - 1224 - 4 - 6 - TP - CNT - B - Z

Model
FBF
SFBF

Shell Diameter
1000 = 5.13"
1200 = 6.13"
1600 = 8.00"

Effective Tube Length
(12" increments)

Baffle Spacing Code
1.5"
2.0"
3.0"
4.0"
6.0"

Cooling Tube Diamenter
6 = 3/8"
10 = 5/8"

Tube Side Passes
SP = 1 pass
TP = 2 pass
FP = 4 pass

Tubing
Blank = Copper
Options
CNT= 90/10 Cu Ni
STS = Stainless Steel

End Bonnets
Blank = Cast Iron
Options
B = Bronze

Zinc Anode
Z = 1 Zinc Anode
2Z = 2 Zinc Anode etc.

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	FBF Series	SFBF Series*	Standard Unit Ratings
Shell	Brass	Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 300 psig Operating Temperature 300 °F
Tubes	Copper	Copper	
Baffle	Brass	Steel	
Integral End Hub	Forged Brass	Forged Brass	
Flanges	Code 61 Steel	Code 61 Steel	
End Bonnets	Cast Iron	Cast Iron	
Mounting Brackets	Steel	Steel	
Gasket	Hypalon Composite	Hypalon Composite	

*Offered in 5" through 8" shell diameter.

note: AIHTI reserves the right to make reasonable design changes without notice.

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STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other fluids that are commonly used with shell & tube heat exchangers.

Terms

GPM = Gallons Per Minute
CN = Constant Number for a given fluid
△T = Temperature differential across the potential
PSI = Pounds per Square Inch (pressure) of the operating side of the system
MHP = Horsepower of the electric motor driving the hydraulic pump
Kw = Kilowatt (watts x 1000)
T_{in} = Hot fluid entering temperature in °F
T_{out} = Hot fluid exiting temperature in °F
t_{in} = Cold fluid temperature entering in °F
t_{out} = Cold fluid temperature exiting in °F
Q = BTU / HR

For example purposes, a hydraulic system has a 125 HP (93Kw) electric motor installed coupled to a pump that produces a flow of 80 GPM @ 2500 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 5.3°F. Even though our return line pressure operates below 100 psi, we must calculate the system heat load potential (Q) based upon the prime movers (pump) capability. We can use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =80 x 210 x 5.3°F = 89,040 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(2500x80)/1714] x .30 x 2545 = 89,090 BTU/HR
	C) Q =125 x .30 x 2545 = 95,347 BTU/HR
C) Q = MHP x (*v*) x 2545	D) Q =28 x 3415 = 95,620 BTU/HR
D) Q = Kw to be removed x 3415	E) Q =37.5 x 2545 = 95,437 BTU/HR
E) Q = HP to be removed x 2545	

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid flow rate to derive the cold side △T. If your water flow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

Formula

$$\textbf{HOT FLUID Oil } \triangle T = \frac{Q}{CN \times GPM}$$

$$\textbf{COLD FLUID Water } \triangle t = \frac{BTU / hr}{CN \times GPM}$$

Example

$$\triangle T = \frac{89{,}090\ BTU/hr \text{ (from step 1,item B)}}{210\ CN \times 80GPM} = 5.3°F = \triangle T\ Rejected$$

$$\triangle t = \frac{89{,}090\ BTU/hr}{500\ CN \times 40GPM \text{ (for a 2:1 ratio)}} = 4.45°F = \triangle T\ Absorbed$$

T_{in} = Hot Fluid entering temperature in degrees F
T_{out} = Hot Fluid exiting temperature in degrees F
t_{in} = Cold Fluid entering temperature in degrees F
t_{out} = Cold Fluid exiting temperature in degrees F

T_{in} = 125.3 °F
T_{out} = 120.0 °F
t_{in} = 700 °F
t_{out} = 74.5 °F

$$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S[\text{smaller temperature difference}]}{L\ [\text{larger temperature difference}]} = \left(\frac{S}{L}\right)$$

$$\frac{120.0°F - 70.0°F = 50.0°F}{125.3°F - 74.5°F = 50.8°F} = \frac{50.0°F}{50.8°F} = .984$$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)
To calculate the LMTD please use the following method;

L = Larger temperature difference from step 2.
M = S/L number (LOCATED IN TABLE A).
$LMTD_i = L \times M$
$LMTD_i$ = 50.8 x .992 (FROM TABLE A) = 50.39

To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula

$$\mathbf{R} = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$$

$$\mathbf{K} = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$$

Example

$$\mathbf{R} = \frac{125.3°F - 120°F}{74.5°F - 70°F} = \frac{5.3°F}{4.5°F} = \mathbf{\{1.17=R\}}$$

$$\mathbf{K} = \frac{74.5°F - 70°F}{124.5°F - 70°F} = \frac{4.5°F}{55.4°F} = \mathbf{\{0.081=K\}}$$

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 50.39 x 1 = **50.39**

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STEP 4: Calculate the area required

Required Area sq.ft. = $\frac{\text{Q (BTU / HR)}}{\text{LMTD}_c \text{ x U (FROM TABLE C)}}$ $\frac{89{,}090}{50.39 \text{ x } 100}$ = **17.68 sq.ft.**

STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits your flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 80 GPM = Series Required from Table E = **1200 Series**
Baffle Spacing from Table E = **4**
Water Flow Rate = 40 GPM = Passes required in 1200 series = **4 (FP)**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 17.68sq.ft Closest model required based upon sq.ft. & series = **FBF-1224-4-6-FP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

TABLE B- LMTD correction factor for Multipass Exchangers

R \ K	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

TABLE D- Surface Area

Model Number	Surface Area in Sq. ft.	
	3/8" O.D. Tubing	5/8" O.D. Tubing
FBF-1014	9.1	4.6
FBF-1024	16.0	7.8
FBF-1036	24.0	11.8
FBF-1048	32.0	15.8
FBF-1224	23.6	11.8
FBF-1236	35.3	17.7
FBF-1248	47.1	23.6
FBF-1260	58.9	29.5
FBF-1272	70.6	35.4
FBF-1624	41.0	23.6
FBF-1636	62.0	35.3
FBF-1648	82.0	47.1
FBF-1660	103.0	58.9
FBF-1672	124.0	70.7
FBF-1684	145.0	82.5

TABLE E- Flow Rate for Shell & Tube

Shell dia . Code	Max. liquid Flow - Shell Side					Liquid Flow - Tube Side					
	Baffle Spacing					SP		TP		FP	
	1.5	2	3	4	6	Min.	Max.	Min.	Max.	Min.	Max.
1000	24	35	60	70	–	20	120	10	70	5.0	37
1200	35	45	70	100	120	30	220	15	112	7.5	56
1600	38	70	150	200	220	57	300	29	180	14	90

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

FBF Series *performance*

Instructions

The selection chart provided contains an array of popular sizes for quick sizing. It does not provide curves for all models available. Refer to page 34 & 35 for detailed calculation information.

Computer selection data sheets for standard or special models are available through the engineering department of American Industrial. To use the followings graphs correctly, refer to the instruction notes "1-5".

1) HP Curves are based upon a 40°F approach temperature; for example: oil leaving a cooler at 125°F, using 85°F cooling water (125°F – 85°F = 40°F).

2) The oil to water ratio of 1:1 or 2:1 means that for every 1 gallon of oil circulated, a minimum of 1 or 1/2 gallon (respectively) of 85°F water must be circulated to match the curve results.

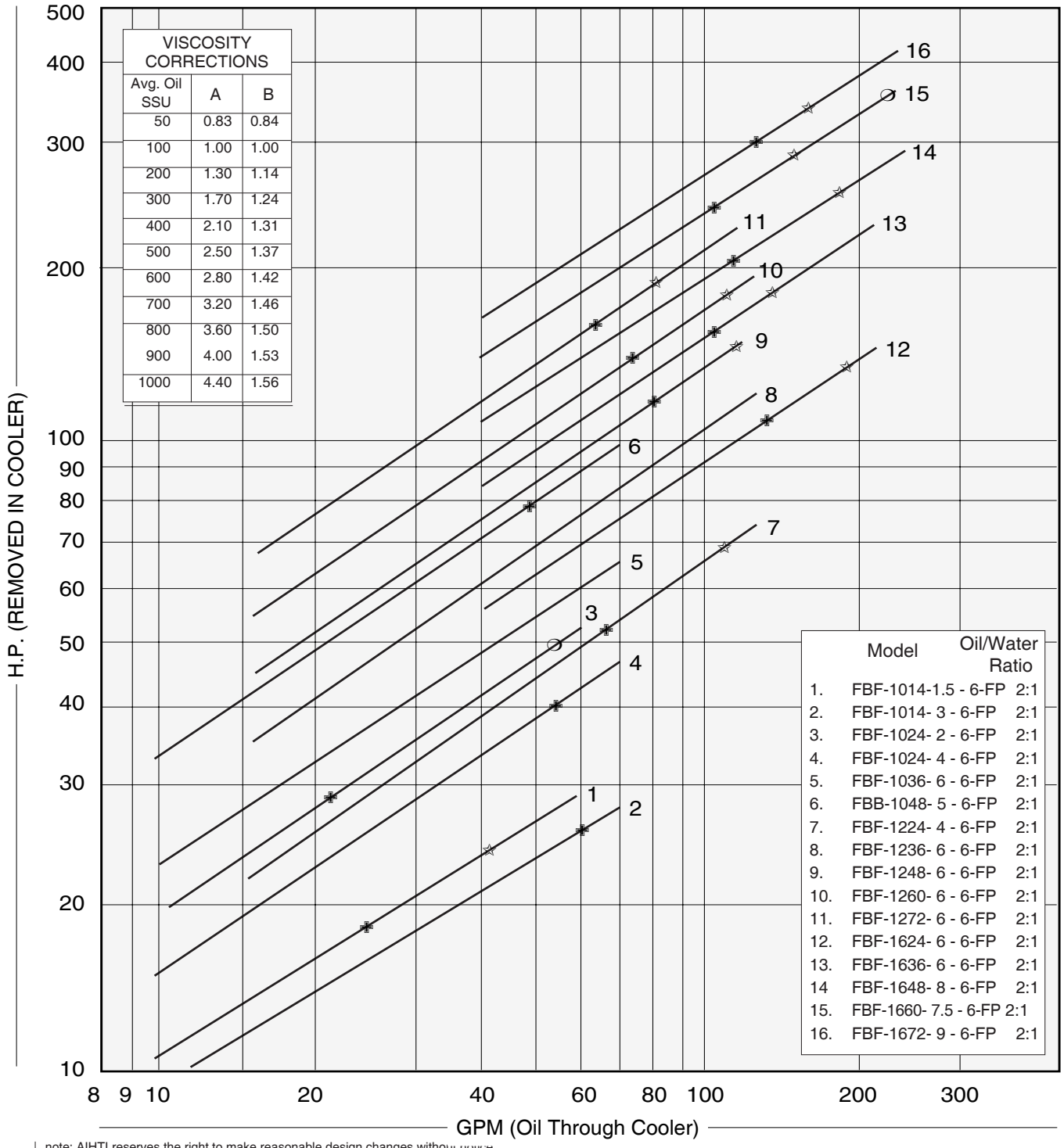
3) OIL PRESSURE DROP CODING: ✙ = 5 psi; ☆= 10 psi; ❍ = 20 psi; △ = 50psi. Curves that have no pressure drop code symbols indicate that the oil pressure drop is less than 5 psi for the flow rate shown.

4) Pressure Drop is based upon oil with an average viscosity of 100 SSU. If the average oil viscosity is other than 100 SSU, then multiply the indicated Pressure Drop by the corresponding value from corrections table A.

5) Corrections for approach temperature and oil viscosity are as follows:

$$H.P.\left(\begin{smallmatrix}\text{Removed}\\ \text{In Cooler}\end{smallmatrix}\right) = H.P.\left(\begin{smallmatrix}\text{Actual}\\ \text{Heat Load}\end{smallmatrix}\right) \times \left(\frac{40}{\text{Actual Approach}}\right) \times B.$$

HEAT ENERGY DISSIPATION RATES (Basic Stock Model)



note: AIHTI reserves the right to make reasonable design changes without notice.

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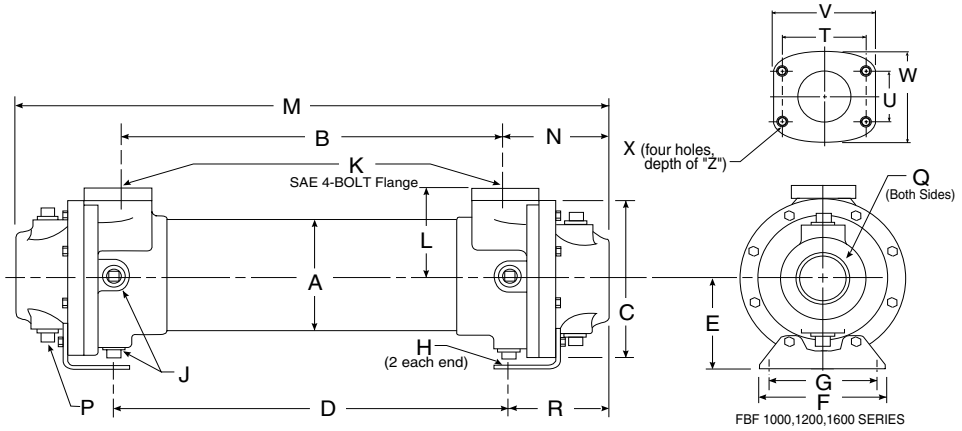
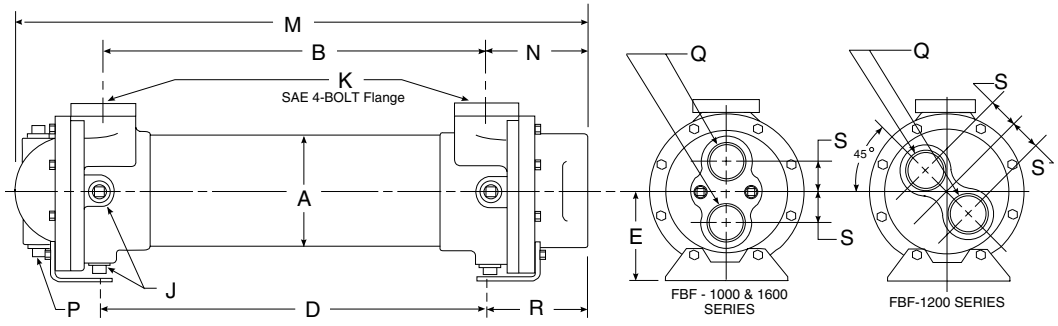


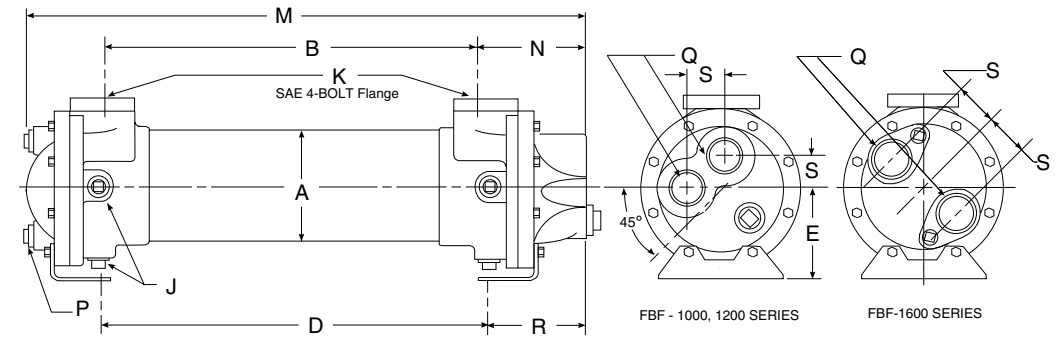
SINGLE PASS (SP)

Model	M	N	P NPT	Q NPT	R	S
1014	18.50					
1024	28.50					
1036	40.50	3.69	(4) .38	2.00	3.38	-
1048	52.50					
1224	29.25					
1236	41.25					
1248	53.25	4.25	(4) .38	3.00	3.75	-
1260	65.25					
1272	77.25					
1624	32.25					
1636	43.25					
1648	55.25					
1660	67.25	6.52	(4) .50	4.00	5.25	-
1672	79.25					
1684	91.25					



TWO PASS (TP)

Model	M	N	P NPT	Q NPT	R	S
1014	18.50					
1024	28.50					
1036	40.50	3.69	(2) .38	1.50	3.50	1.50
1048	52.50					
1224	28.75					
1236	40.75					
1248	52.75	4.25	(2) .38	2.00	3.75	1.56
1260	64.75					
1272	76.75					
1624	30.50					
1636	42.50					
1648	54.50					
1660	66.50	6.00	(2) .50	2.50	5.25	2.25
1672	78.50					
1684	90.50					



FOUR PASS (FP)

Model	M	N	P NPT	Q NPT	R	S
1014	18.50					
1024	28.50					
1036	40.50	3.80	(3) .38	1.00	3.25	1.69
1048	52.50					
1224	29.50					
1236	41.50					
1248	53.50	4.56	(3) .50	1.50	3.75	2.00
1260	65.50					
1272	77.50					
1624	30.75					
1636	42.75					
1648	54.75					
1660	66.75	6.08	(4) .50	2.00	5.25	2.62
1672	78.75					
1684	90.75					

COMMON DIMENSIONS & WEIGHTS

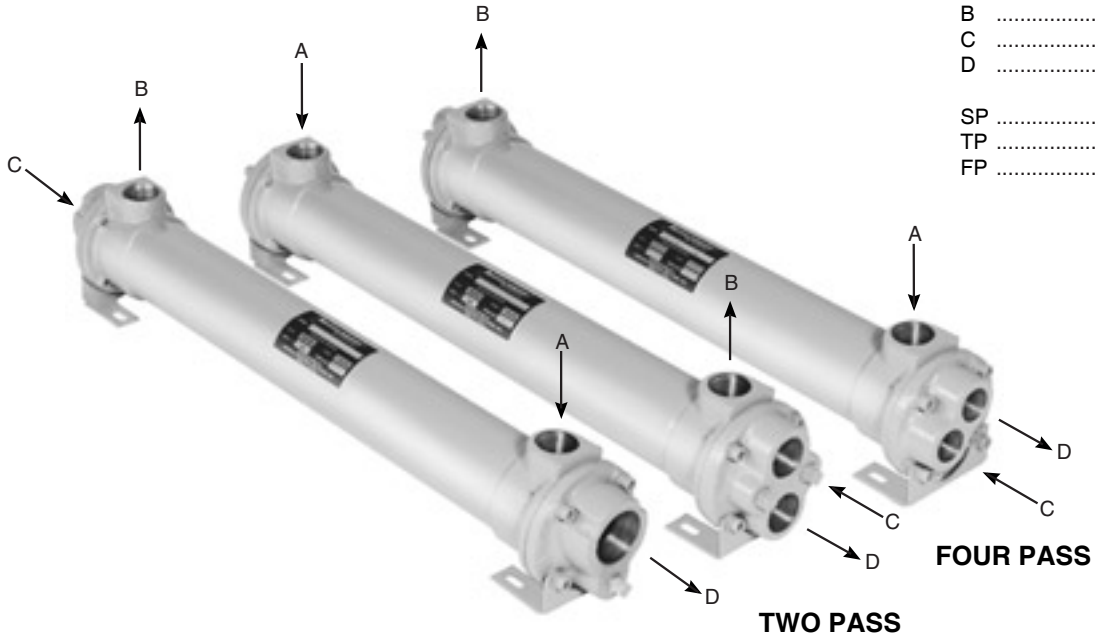
Model	A	B	C	D	E	F	G	H	J NPT	K SAE	L	T	U	V	W	X	Z	Approx. Weight
FBF-1014		11.12		11.75						1.50								45
FBF-1024	5.13	21.12	6.50	21.75	3.75	5.00	4.00	.50øx.88	(6) .38	SAE Four Bolt Flange	4.62	2.75	1.41	3.68	2.75	1/2-13	.75	60
FBF-1036		33.12		33.75														82
FBF-1048		45.12		45.75														94
FBF-1224		20.50		21.50														90
FBF-1236		32.50		33.50						2.00								110
FBF-1248	6.13	44.50	7.50	45.50	4.12	6.00	5.00	.50øx.88	(6) .38	SAE Four Bolt Flange	5.25	3.06	1.69	4.00	3.31	1/2-13	.75	130
FBF-1260		56.50		57.50														150
FBF-1272		68.50		69.50														170
FBF-1624		19.00		20.50														160
FBF-1636		31.00		32.50						3.00								185
FBF-1648	8.00	43.00	9.75	44.50	5.38	8.25	7.00	.62øx1.12	(6) .38	SAE Four Bolt Flange	6.62	4.19	2.44	5.31	4.69	5/8-11	.88	235
FBF-1660		55.00		56.50														265
FBF-1672		67.00		68.50														296
FBF-1684		79.00		80.50														330

note: AIHTI reserves the right to make reasonable design changes without notice.

PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP .....Four Pass



FOUR PASS

TWO PASS

ONE PASS

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.

Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the

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hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the complete bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

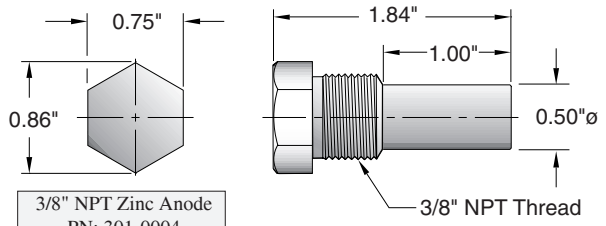
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

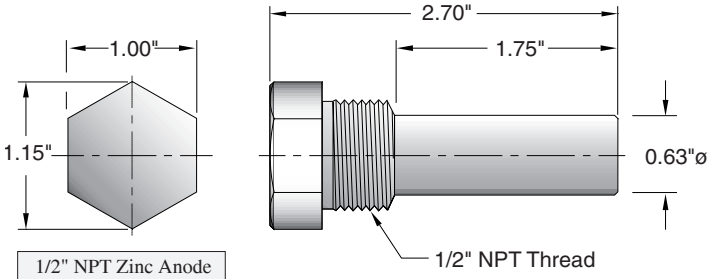
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

"Y" STRAINER (for Shell & Tube Heat Exchangers And Air/Oil Coolers)

APPLICATIONS & SPECS. ("Y" Strainers)

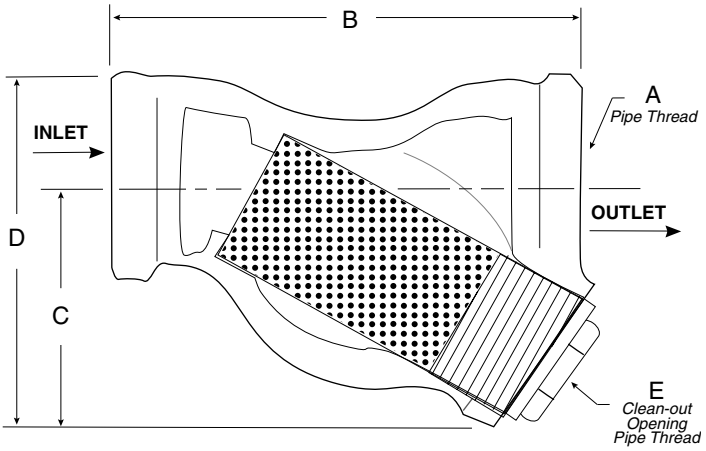
These strainers are engineered for water or steam, and are adaptable for many other uses. Cleaning is accomplished by simply removing a pipe plug without disconnecting any piping. Or, if it is desirable to clean without interrupting service, a blow-off valve can be connected to the clean-out opening. ***Note:*** Pumps, control valves, traps, or other equipment controlling the flow of liquids or gases require proper protection with strainers for trouble free operation.

18 - Y BRASS STRAINERS

The 18 - Y strainer body is a sturdy red brass casting. Standard units have 50 mesh brass wire screens. Brazing connections are available on special order instead of pipe threads.

20 - Y STRAINERS

The 20 - Y strainer has a heavy cast iron body with accurately machined pipe thread inlet and outlet (National Pipe Thread N.P.T.). It contains a strainer screen of 0.02" thick brass with 100, 1/16" perforations per inch.



MODEL	SIZE A (NPT)	DIMENSIONS (Inches) B	C	D	E (NPT)	WT. (lbs.)
18 - Y	0.38"	2.50"	2.63"	2.00"	0.25"	0.75
	0.50"	2.50"	2.63"	2.00"	0.25"	0.75
	0.75"	3.50"	3.75"	2.75"	0.50"	1.75
	1.00"	3.50"	3.75"	2.75"	0.50"	1.75
20 - Y	0.50"	4.00"	3.25"	2.50"	0.38"	1.75
	0.75"	4.00"	3.25"	2.50"	0.38"	1.75
	1.00"	4.75"	4.38"	3.38"	0.75"	4.00
	1.25"	6.00"	5.13"	3.88"	0.75"	4.75
	1.50"	6.00"	5.13"	3.88"	0.75"	4.75
	2.00"	8.13"	6.38"	4.63"	0.75"	13.00
PRESSURE RATINGS, ALL MODELS: 125lbs. per Sq.In.						

Part Number	Description		Part Number	Description	
	Size NPT	Material		Size NPT	Material
310-3002	1/2"	Cast Iron	310-3001	3/8"	Brass
310-3004	3/4"		310-3003	1/2"	
310-3006	1"		310-3005	3/4"	
310-3008	1-1/4"		310-3007	1"	
310-3009	1-1/2"		310-3013	1-1/4"	
310-3010	2"		310-3014	1-1/2"	
310-3011	2-1/2"		310-3015	2	
310-3012	3"		310-3016	2-1/2"	
			310-3017	3"	

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

CS - STC SERIES

SINGLE PASS | TWO PASS | FOUR PASS

Fixed Tube Bundle / Liquid Cooled

HEAT EXCHANGERS

- Steel or stainless steel construction.
- Operating pressure for tubes 150 PSI
- Operating pressure for shell 300 PSI.
- Operating temperature 300 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

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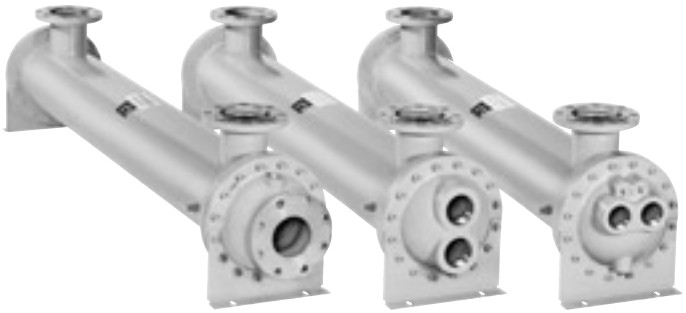
CS & STC Series *overview*

CS SERIES

Fixed tube construction heat exchangers with NPT connections. Made of steel with copper cooling tubes and cast iron end bonnets. Standard sizes from 3” through 8” diameters. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tube, and zinc anodes. Can be customized to fit your requirements.

STC SERIES

Similar in design to CS series with fixed tube construction and NPT connections made of 316 stainless steel. Standard sizes from 3” through 8” diameters. Standard one, two, and four pass models are available. Larger diameter units available upon request. Can be customized to fit your requirements.



CS 2000 SERIES

Fixed tube construction heat exchangers with ANSI ange connections. Made of Steel with copper cooling tubes and cast iron end bonnets. Standard 10” diameter from 111 to 442 sq. ft. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tubes, and zinc anodes. Can be customized to fit your requirements.

(See Page 51)

CS 2400 - CS 4800 SERIES

Strait tube large capacity heat exchangers with fixed tube bundle. Standard one, two and four pass units available. Sizes from 12" to 24" diameters. Made of steel with copper cooling tubes and steel channels. Options include 90/10 copper nickel and 316 stainless steel cooling tube, and zinc anodes. Can be customized to fit your requirements.

(See Page 57)

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CAST BONNET
Provides fluid into tubes with minimum restriction. One, two, or four pass interchangeability.

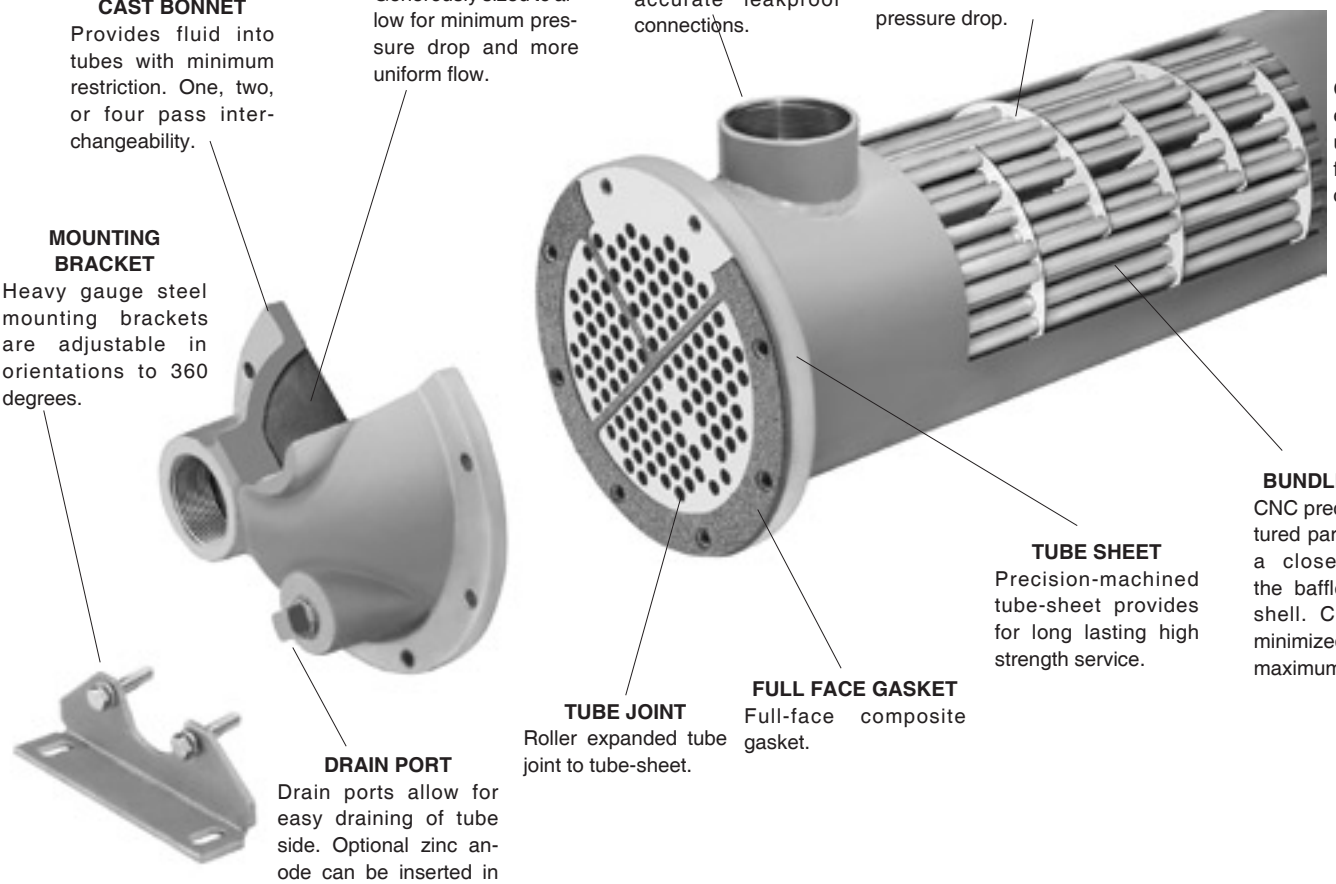
FLOW CAVITY
Generously sized to allow for minimum pressure drop and more uniform flow.

THREAD
CNC precision threading to provide accurate leakproof connections.

BAFFLES
CNC manufactured baffles to provide maximum turbulence and heat transfer with a minimum fluid pressure drop.

FINISH
Gray semigloss enamel. Can be used as a base for additional coats.

MOUNTING BRACKET
Heavy gauge steel mounting brackets are adjustable in orientations to 360 degrees.



BUNDLE ASSEMBLY
CNC precision manufactured parts to guarantee a close fit between the baffles, tubes, and shell. Clearances are minimized to provide for maximum heat transfer.

TUBE SHEET
Precision-machined tube-sheet provides for long lasting high strength service.

FULL FACE GASKET
Full-face composite gasket.

TUBE JOINT
Roller expanded tube joint to tube-sheet.

DRAIN PORT
Drain ports allow for easy draining of tube side. Optional zinc anode can be inserted in place of plug.

UNIT CODING

Example Model

Options

CS - 1224 - 4 - 6 - TP - CNT - B - Z

Model
CS
STC

Shell Diameter
600 = 3.25"
800 = 4.25"
1000 = 5.25"
1200 = 6.25"
1700 = 8.00"

Effective Tube Length
(12" increments)

Baffle Spacing Code
1.5"
2.0"
3.0"
4.0"
6.0"
8.0"

Cooling Tube Diamenter
6 = 3/8"
10 = 5/8"

Tube Side Passes
SP = 1 pass
TP = 2 pass
FP = 4 pass

Tubing
Blank = Copper

Options
CNT= 90/10 Cu Ni
STS = Stainless Steel
C = Carbon Steel

End Bonnets
Blank = Cast Iron

Options
B = Bronze

Zinc Anode
Z = 1 Zinc Anode
2Z = 2 Zinc Anode etc.

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	CS Series	STC Series	Standard Unit Ratings
Shell	Steel	316 Stainless Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 300 psig Operating Temperature 300 °F
Tubes	Copper	316 Stainless Steel	
Baffle	Steel	316 Stainless Steel	
Tube Sheet	Steel	316 Stainless Steel	
End Bonnets	Cast Iron	316 Stainless Steel	
Mounting Brackets	Steel	Steel	
Gasket	Hypalon Composite	Hypalon Composite	

note: AIHTI reserves the right to make reasonable design changes without notice.

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STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other fluids that are commonly used with shell & tube heat exchangers.

Terms

GPM = Gallons Per Minute
CN = Constant Number for a given fluid
△T = Temperature differential across the potential
PSI = Pounds per Square Inch (pressure) of the operating side of the system
MHP = Horsepower of the electric motor driving the hydraulic pump
Kw = Kilowatt (watts x 1000)
T_{in} = Hot fluid entering temperature in °F
T_{out} = Hot fluid exiting temperature in °F
t_{in} = Cold fluid temperature entering in °F
t_{out} = Cold fluid temperature exiting in °F
Q = BTU / HR

For example purposes, a hydraulic system has a 125 HP (93Kw) electric motor installed coupled to a pump that produces a flow of 80 GPM @ 2500 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 5.3°F. Even though our return line pressure operates below 100 psi, we must calculate the system heat load potential (Q) based upon the prime movers (pump) capability. We can use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =80 x 210 x 5.3°F = 89,040 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(2500x80)/1714] x .30 x 2545 = 89,090 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =125 x .30 x 2545 = 95,347 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =28 x 3415 = 95,620 BTU/HR
E) Q = HP to be removed x 2545	

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid flow rate to derive the cold side △T. If your water flow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

Formula	Example
HOT FLUID △T Oil $= \frac{Q}{CN \times GPM}$	$\triangle T = \frac{89{,}090\ BTU/hr}{210\ CN \times 80GPM}$ (from step 1,item B) $= 5.3°F$ = △T Rejected
COLD FLUID △ t Water $= \frac{BTU / hr}{CN \times GPM}$	$\triangle t = \frac{89{,}090\ BTU/hr}{500\ CN \times 40GPM}$ (for a 2:1 ratio) $= 4.45°F$ = △T Absorbed

T_{in} = Hot Fluid entering temperature in degrees F — T_{in} = 125.3 °F
T_{out} = Hot Fluid exiting temperature in degrees F — T_{out} = 120.0 °F
t_{in} = Cold Fluid entering temperature in degrees F — t_{in} = 70.0 °F
t_{out} = Cold Fluid exiting temperature in degrees F — t_{out} = 74.5 °F

$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S[\text{smaller temperature difference}]}{L\ [\text{larger temperature difference}]} = \left(\frac{S}{L}\right)$

$\frac{120.0°F - 70.0°F = 50.0°F}{125.3°F - 74.5°F = 50.8°F} = \frac{50.0°F}{50.8°F} = .984$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;

L = Larger temperature difference from step 2.
M = S/L number (LOCATED IN TABLE A).

$LMTD_i = L \times M$

$LMTD_i$ = 50.8 x .992 (FROM TABLE A) = 50.39

To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula	Example
$R = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$	$R = \frac{125.3°F - 120°F}{74.5°F - 70°F} = \frac{5.3°F}{4.5°F} =$ **{1.17=R}**
$K = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$	$K = \frac{74.5°F - 70°F}{124.5°F - 70°F} = \frac{4.5°F}{55.4°F} =$ **{0.081=K}**

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 50.39 x 1 = **50.39**

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STEP 4: Calculate the area required

Required Area sq.ft. = $\frac{\text{Q (BTU / HR)}}{\text{LMTD}_c \text{ x U (FROM TABLE C)}}$ $\frac{89{,}090}{50.39 \text{ x } 100}$ = **17.68 sq.ft.**

STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits your flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 80 GPM = Series Required from Table E = **1200 Series**
Baffle Spacing from Table E = **4**
Water Flow Rate = 40 GPM = Passes required in 1200 series = **4 (FP)**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 17.68sq.ft Closest model required based upon sq.ft. & series = **CS - 1224 - 4 - 6 - FP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

TABLE B- LMTD correction factor for Multipass Exchangers

R \ K	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

TABLE D- Surface Area

Model Number	Surface Area in Sq.ft. 3/8" O.D Tubing CODE 6	Surface Area in Sq.ft. 5/8" O.D Tubing CODE 10	Model Number	Surface Area in Sq.ft. 3/8" O.D Tubing CODE 6	Surface Area in Sq.ft. 5/8" O.D Tubing CODE 10
CS-614	–	–	CS-1236	35.3	17.7
CS-624	–	–	CS-1248	47.1	23.6
CS-636	–	–	CS-1260	58.9	29.5
			CS-1272	70.6	35.4
CS-814	–	–	CS-1284	82.3	41.3
CS-824	–	–	CS-1296	94.0	47.2
CS-836	–	–			
CS-848	–	–	CS-1724	44.0	23.6
			CS-1736	66.0	35.3
CS-1014	8.7	4.6	CS-1748	88.0	47.1
CS-1024	14.9	7.8	CS-1760	110.0	58.9
CS-1036	22.4	11.8	CS-1772	132.0	70.7
CS-1048	29.9	15.8	CS-1784	154.0	82.5
CS-1060	37.4	19.8	CS-1796	176.0	94.3
			CS-17108	198.0	106.1
CS-1224	23.6	11.8	CS-17120	220.0	117.9

TABLE E- Flow Rate for Shell & Tube

Shell dia. Code	Max Liquid Flow - Shell Side					Liquid Flow - Tube Side			
	Baf e Spacing					TP		FP	
	1.5	2	3	4	6	Min.	Max.	Min.	Max.
600	15	20	25	30	–	3.5	24	2	12
800	20	34	45	60	–	4.5	38	3	21
1000	30	36	50	65	–	10	70	5	37
1200	45	50	70	100	125	15	112	7.5	56
1700	50	65	100	140	220	29	180	14	90
2000	60	80	100	160	240	45	320	25	160

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

note: AIHTI reserves the right to make reasonable design changes without notice.

CS & STC Series *performance*

Instructions

The selection chart provided contains an array of popular sizes for quick sizing. It does not provide curves for all models available. Refer to page 44 & 45 for detailed calculation information.

Computer selection data sheets for standard or special models are available through the engineering department of American Industrial. To use the followings graphs correctly, refer to the instruction notes "1-5".

1) HP Curves are based upon a 40°F approach temperature; for example: oil leaving a cooler at 125°F, using 85°F cooling water (125°F – 85°F = 40°F).

2) The oil to water ratio of 1:1 or 2:1 means that for every 1 gallon of oil circulated, a minimum of 1 or 1/2 gallon (respectively) of 85°F water must be circulated to match the curve results.

3) OIL PRESSURE DROP CODING: ✙ = 5 psi; ☆= 10 psi; ❍ = 20 psi; △= 50psi. Curves that have no pressure drop code symbols indicate that the oil pressure drop is less than 5 psi for the flow rate shown.

4) Pressure Drop is based upon oil with an average viscosity of 100 SSU. If the average oil viscosity is other than 100 SSU, then multiply the indicated Pressure Drop by the corresponding value from corrections table A.

5) Corrections for approach temperature and oil viscosity are as follows:

$$H.P.\left(\begin{smallmatrix}\text{Removed}\\ \text{In Cooler}\end{smallmatrix}\right) = H.P.\left(\begin{smallmatrix}\text{Actual}\\ \text{Heat Load}\end{smallmatrix}\right) \times \left(\frac{40}{\text{Actual Approach}}\right) \times B.$$

HEAT ENERGY DISSIPATION RATES (Basic Stock Model)

	Model	Oil/Water Ratio
1.	614 - 1.3-4-FP	2:1
2.	614 - 3-4-FP	2:1
3.	624 - 1.3-4-FP	2:1
4.	624 - 3-6-FP	2:1
5.	814 - 1.7-4-FP	2:1
6.	814 - 4- 4-FP	2:1
7.	824 - 1.7 -4-FP	2:1
8.	824 - 4-4-FP	2:1
9.	836 - 1.7-4-FP	2:1
10.	836 - 4-4-FP	2:1
11.	1014 - 2-6-FP	2:1
12.	1014 - 5-6-FP	2:1
13.	1024 - 2-6-FP	2:1
14.	1024 - 5-6-FP	2:1
15.	1036 - 2-6-FP	2:1
16.	1036 - 5-6-FP	2:1
17.	1224 - 2.5-6-FP	2:1
18.	1224 - 6 -6-FP	2:1
19.	1236 - 2.5-6-FP	2:1
20.	1236 - 6-6-FP	2:1
21.	1248 - 2.5-6-FP	2:1
22.	1248 - 6-6-FP	2:1
23.	1260 - 2.5-6-FP	2:1
24.	1260 - 6-6-FP	2:1
25.	1724 - 3.5-6-FP	2:1
26.	1724 - 8.4-6-FP	2:1
27.	1736 - 3.5-6-FP	2:1
28.	1736 - 8.4-6-FP	2:1
29.	1748 - 3.5-6-FP	2:1
30.	1748 - 8.4-6-FP	2:1
31.	1760 - 3.5-6-FP	2:1
32.	1760 - 8.4-6-FP	2:1
33.	1772 - 3.5-6-FP	2:1
34.	1772 - 8.4-6-FP	2:1

VISCOSITY CORRECTIONS		
Avg. Oil SSU	A	B
50	0.83	0.84
100	1.00	1.00
200	1.30	1.14
300	1.70	1.24
400	2.10	1.31
500	2.50	1.37
600	2.80	1.42
700	3.20	1.46
800	3.60	1.50
900	4.00	1.53
1000	4.40	1.56

H.P. (REMOVED IN COOLER)

GPM (Oil Through Cooler)

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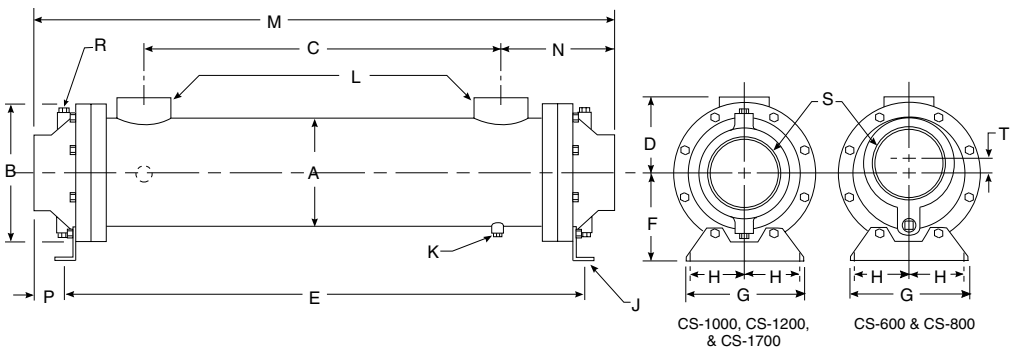
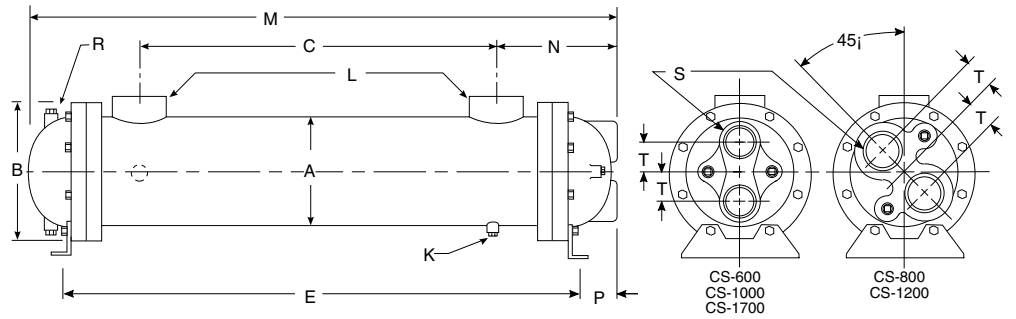


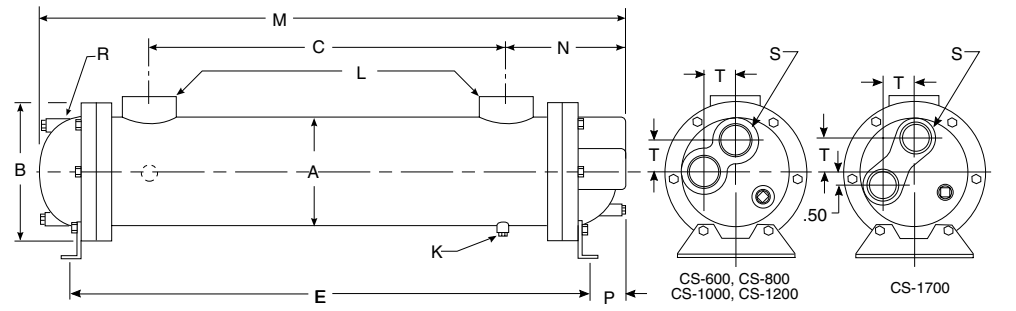
SINGLE PASS (SP)

Model	M	N	P	R NPT	S NPT	T
CS-614	17.18	3.70	.40	(2) .38	1.50	.38
CS-624	27.18					
CS-814	17.88	4.44	.63	(2) .38	2.00	.50
CS-824	27.88					
CS-836	39.88					
CS-1014	19.09	5.05	.92	(4) .38	2.00	-
CS-1024	29.09					
CS-1036	41.09					
CS-1224	30.00	5.88	1.43	(4) .50	3.00	-
CS-1236	42.00					
CS-1248	54.00					
CS-1260	66.00					
CS-1272	78.00					
CS-1724	31.47	7.23	1.99	(4) .50	4.00	-
CS-1736	43.47					
CS-1748	55.47					
CS-1760	67.47					
CS-1772	79.47					
CS-1784	91.47					



TWO PASS (TP)

Model	M	N	P	R NPT	S NPT	T
CS-614	17.12	3.70	.38	(2) .38	1.00	1.00
CS-624	27.12					
CS-814	17.88	4.44	.63	(2) .38	1.25	1.19
CS-824	27.88					
CS-836	39.88					
CS-1014	18.62	5.00	.94	(2) .38	1.50	1.19
CS-1024	28.62					
CS-1036	40.62					
CS-1224	29.03	5.44	1.00	(2) .50	2.00	1.44
CS-1236	41.03					
CS-1248	53.03					
CS-1260	65.03					
CS-1272	77.03					
CS-1724	30.62	7.06	1.81	(2) .50	2.50	1.88
CS-1736	42.62					
CS-1748	54.62					
CS-1760	66.62					
CS-1772	78.62					
CS-1784	90.62					



FOUR PASS (FP)

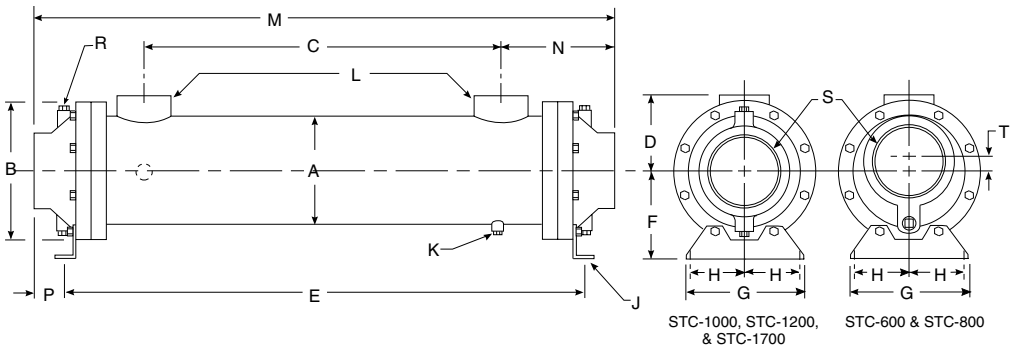
Model	M	N	P	R NPT	S NPT	T
CS-614	17.12	3.70	.38	(2) .38	.75	1.00
CS-624	27.12					
CS-814	17.88	4.44	.63	(3) .38	.75	1.06
CS-824	27.88					
CS-836	39.88					
CS-1014	18.81	4.81	.75	(3) .38	1.00	1.69
CS-1024	28.81					
CS-1036	40.81					
CS-1224	29.13	5.44	1.00	(3) .50	1.50	2.00
CS-1236	41.13					
CS-1248	53.13					
CS-1260	65.13					
CS-1272	77.13					
CS-1724	29.86	7.06	1.81	(3) .50	2.00	2.50
CS-1736	41.86					
CS-1748	53.86					
CS-1760	65.86					
CS-1772	77.86					
CS-1784	89.86					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J	K NPT	L NPT	Approx. Weight	Model
CS-614	3.25	4.50	10.00	2.63	17.00	2.75	4.18	1.62	.38ϕx0.88	(2) .25	1.00	17	CS-614
CS-624			20.00		27.00							24	CS-624
CS-814	4.25	6.00	9.00	3.12	16.62	3.50	4.25	1.75	.44ϕx1.00	(2) .25	1.50	32	CS-814
CS-824			19.00		26.62							41	CS-824
CS-836			31.00		38.62							53	CS-836
CS-1014	5.25	7.00	9.00	3.62	17.12	4.00	5.25	2.00	.44ϕx1.00	(2) .38	1.50	43	CS-1014
CS-1024			19.00		27.12							57	CS-1024
CS-1036			31.00		39.12							72	CS-1036
CS-1224	6.25	8.00	18.25	4.16	27.13	4.50	6.25	2.50	.44ϕx1.00	(2) .38	2.00	85	CS-1224
CS-1236			30.25		39.13							110	CS-1236
CS-1248			42.25		51.13							135	CS-1248
CS-1260			54.25		63.13							160	CS-1260
CS-1272			66.25		75.13							185	CS-1272
CS-1724	8.00	10.00	17.00	5.62	27.50	5.75	8.25	3.50	.44ϕx1.00	(2) .38	3.00	140	CS-1724
CS-1736			29.00		39.50							180	CS-1736
CS-1748			41.00		51.50							220	CS-1748
CS-1760			53.00		63.50							260	CS-1760
CS-1772			65.00		75.50							300	CS-1772
CS-1784			77.00		87.50							340	CS-1784

note: AIHTI reserves the right to make reasonable design changes without notice.

STC Series *dimensions*

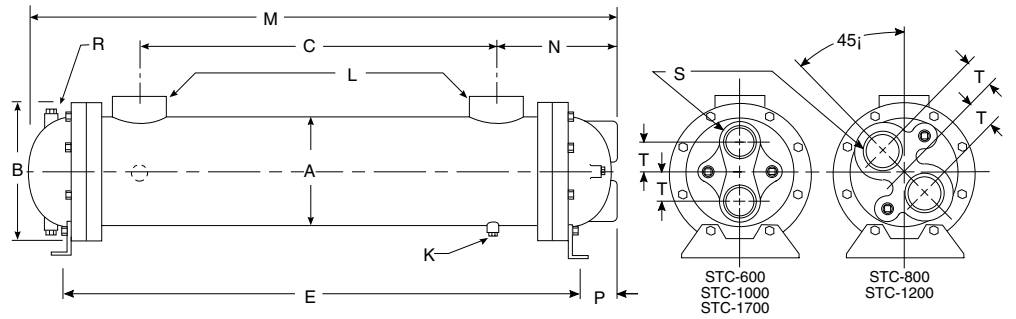


STC-1000, STC-1200, & STC-1700

STC-600 & STC-800

SINGLE PASS (SP)

Model	M	N	P	R NPT	S NPT	T
STC-614	17.18	3.70	.40	(2) .38	1.50	.38
STC-624	27.18					
STC-814	17.88	4.44	.63	(2) .38	2.00	.50
STC-824	27.88					
STC-836	39.88					
STC-1014	19.09	5.05	.92	(4) .38	2.00	-
STC-1024	29.09					
STC-1036	41.09					
STC-1224	30.00	5.88	1.43	(4) .50	3.00	-
STC-1236	42.00					
STC-1248	54.00					
STC-1260	66.00					
STC-1272	78.00					
STC-1724	31.47	7.23	1.99	(4) .50	4.00	-
STC-1736	43.47					
STC-1748	55.47					
STC-1760	67.47					
STC-1772	79.47					
STC-1784	91.47					

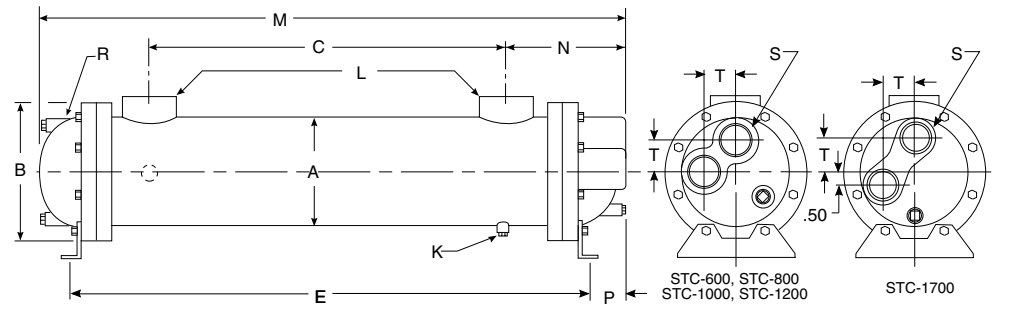


STC-600
STC-1000
STC-1700

STC-800
STC-1200

TWO PASS (TP)

Model	M	N	P	R NPT	S NPT	T
STC-614	17.12	3.70	.38	(2) .38	1.00	1.00
STC-624	27.12					
STC-814	17.88	4.44	.63	(2) .38	1.25	1.19
STC-824	27.88					
STC-836	39.88					
STC-1014	18.62	5.00	.94	(2) .38	1.50	1.19
STC-1024	28.62					
STC-1036	40.62					
STC-1224	29.03	5.44	1.00	(2) .50	2.00	1.44
STC-1236	41.03					
STC-1248	53.03					
STC-1260	65.03					
STC-1272	77.03					
STC-1724	30.62	7.06	1.81	(2) .50	2.50	1.88
STC-1736	42.62					
STC-1748	54.62					
STC-1760	66.62					
STC-1772	78.62					
STC-1784	90.62					



STC-600, STC-800
STC-1000, STC-1200

STC-1700

FOUR PASS (FP)

Model	M	N	P	R NPT	S NPT	T
STC-614	17.12	3.70	.38	(2) .38	.75	1.00
STC-624	27.12					
STC-814	17.88	4.44	.63	(3) .38	.75	1.06
STC-824	27.88					
STC-836	39.88					
STC-1014	18.81	4.81	.75	(3) .38	1.00	1.69
STC-1024	28.81					
STC-1036	40.81					
STC-1224	29.13	5.44	1.00	(3) .50	1.50	2.00
STC-1236	41.13					
STC-1248	53.13					
STC-1260	65.13					
STC-1272	77.13					
STC-1724	29.86	7.06	1.81	(3) .50	2.00	2.50
STC-1736	41.86					
STC-1748	53.86					
STC-1760	65.86					
STC-1772	77.86					
STC-1784	89.86					

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	G	H	J	K NPT	L NPT	Approx. Weight	Model
STC-614	3.12	4.50	10.00	2.31	17.00	2.75	4.18	1.62	.38ϕx0.88	(2) .25	1.00	17	STC-614
STC-624			20.00		27.00							24	STC-624
STC-814	4.12	6.00	9.00	3.12	16.62	3.50	4.25	1.75	.44ϕx1.00	(2) .25	1.50	32	STC-814
STC-824			19.00		26.62							41	STC-824
STC-836			31.00		38.62							53	STC-836
STC-1014	5.12	7.00	9.00	3.62	17.12	4.00	5.25	2.00	.44ϕx1.00	(2) .38	1.50	43	STC-1014
STC-1024			19.00		27.12							57	STC-1024
STC-1036			31.00		39.12							72	STC-1036
STC-1224	6.12	8.00	18.25	4.16	27.13	4.50	6.25	2.50	.44ϕx1.00	(2) .38	2.00	85	STC-1224
STC-1236			30.25		39.13							110	STC-1236
STC-1248			42.25		51.13							135	STC-1248
STC-1260			54.25		63.13							160	STC-1260
STC-1272			66.25		75.13							185	STC-1272
STC-1724	8.00	10.00	17.00	5.62	27.50	5.75	8.25	3.50	.44ϕx1.00	(2) .38	3.00	140	STC-1724
STC-1736			29.00		39.50							180	STC-1736
STC-1748			41.00		51.50							220	STC-1748
STC-1760			53.00		63.50							260	STC-1760
STC-1772			65.00		75.50							300	STC-1772
STC-1784			77.00		87.50							340	STC-1784

note: AIHTI reserves the right to make reasonable design changes without notice.

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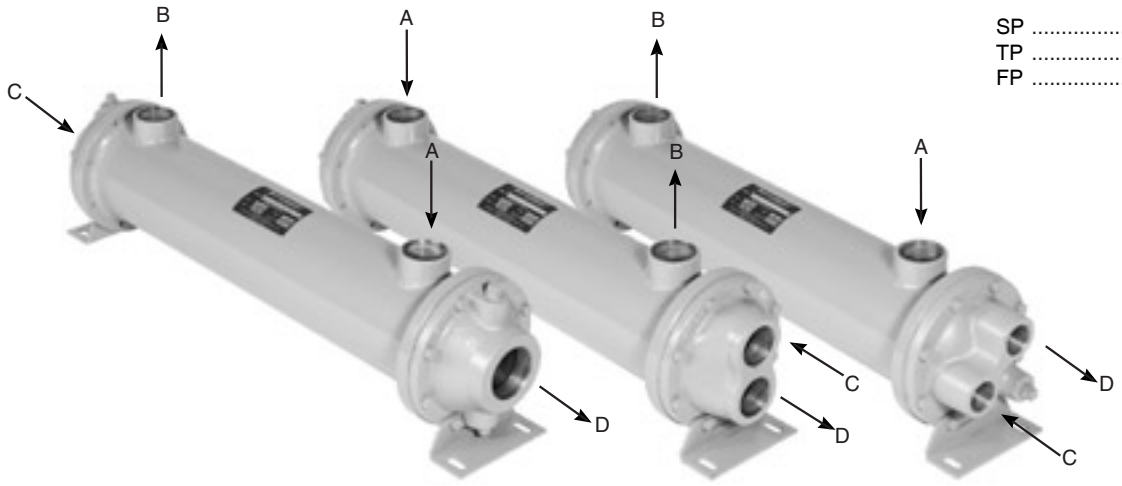
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP ..... Four Pass



ONE PASS **TWO PASS** **FOUR PASS**

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.
Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70ºF and 105ºF (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

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g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the complete bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

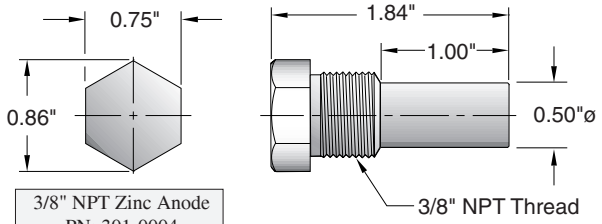
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

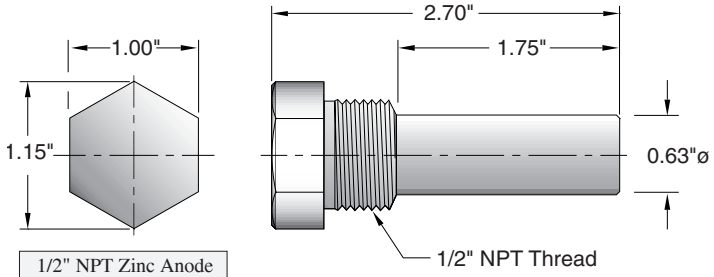
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

CS 2000 SERIES

SINGLE PASS | TWO PASS | FOUR PASS

Fixed Tube Bundle / Liquid Cooled

HEAT EXCHANGERS

- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 225 PSI.
- Operating temperature 250 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

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CS 2000 Series *selection*

STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other fluids that are commonly used with shell & tube heat exchangers.

Terms

GPM = Gallons Per Minute
CN = Constant Number for a given fluid
△T = Temperature differential across the potential
PSI = Pounds per Square Inch (pressure) of the operating side of the system
MHP = Horsepower of the electric motor driving the hydraulic pump
Kw = Kilowatt (watts x 1000)
T_{in} = Hot fluid entering temperature in °F
T_{out} = Hot fluid exiting temperature in °F
t_{in} = Cold fluid temperature entering in °F
t_{out} = Cold fluid temperature exiting in °F
Q = BTU / HR

For example purposes, a hydraulic system has a 250 HP (186Kw) electric motor installed coupled to a pump that produces a flow of 200 GPM @ 2000 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 4.3°F. Even though the return line pressure operates below 100 psi, calculate the system heat load potential (Q) based upon the prime movers (pump) capability.

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =200 x 210 x 4 .3°F = 180,600 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(2000x200)/1714] x .30 x 2545 = 178,179 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =250 x .30 x 2545 = 190,875 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =186 x .30 x 3415 = 190,557 BTU/HR
E) Q = HP to be removed x 2545	

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid flow rate to derive the cold side △T. If your water flow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

Formula

$$\textbf{HOT FLUID (Oil)}\ \triangle T = \frac{Q}{CN \times GPM}$$

$$\textbf{COLD FLUID (Water)}\ \triangle t = \frac{BTU/hr}{CN \times GPM}$$

Example

$$\triangle T = \frac{190{,}875\ BTU/hr}{210\ CN \times 200GPM}\ (\text{from step 1,item C}) = 4.54°F = \triangle T\ \text{Rejected}$$

$$\triangle t = \frac{190{,}875\ BTU/hr}{500\ CN \times 100GPM}\ (\text{for a 2:1 ratio}) = 3.81°F = \triangle t\ \text{Absorbed}$$

T_{in} = Hot Fluid entering temperature in degrees F
T_{out} = Hot Fluid exiting temperature in degrees F
t_{in} = Cold Fluid entering temperature in degrees F
t_{out} = Cold Fluid exiting temperature in degrees F

T_{in} = 104.54 °F
T_{out} = 100.0 °F
t_{in} = 90.0 °F
t_{out} = 93.81 °F

$$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S[\text{smaller temperature difference}]}{L\ [\text{larger temperature difference}]} = \left(\frac{S}{L}\right)$$

$$\frac{100.0°F - 90.0°F = 10.0°F}{104.54°F - 93.81°F = 10.73°F} = \frac{\overline{10.0°F}}{10.73°F} = .931$$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;

$LMTD_i$ = L x M (L = Larger temperature difference from step 2) x (M = S/L number (LOCATED IN TABLE A))

$LMTD_i$ = 10.73 x .964 (FROM TABLE A) = 10.34

To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula

$$R = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$$

$$K = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$$

Example

$$R = \frac{104.54°F - 100°F}{93.81°F - 90°F} = \frac{4.54°F}{3.81°F} = \textbf{\{1.191=R\}}$$

$$K = \frac{93.81°F - 90°F}{104.54°F - 90°F} = \frac{3.81°F}{14.54°F} = \textbf{\{0.262=K\}}$$

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 10.34 x .98 = **10.13**

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

TABLE E- Flow Rate for Shell & Tube

Shell dia .	Max. Liquid Flow - Shell Side					Liquid Flow - Tube Side					
	Baffle Spacing					SP		TP		FP	
Code	2	4	6	8	12	Min.	Max.	Min.	Max.	Min.	Max.
2000	80	160	240	320	500	90	650	45	320	25	160

note: AIHTI reserves the right to make reasonable design changes without notice.

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STEP 4: Calculate the area required

Required Area sq.ft. = $\frac{Q\ (BTU / HR)}{LMTD_c \times U\ (\text{FROM TABLE C})}$ $\frac{190{,}875}{10.13 \times 100}$ = **188.4 sq.ft.**

STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits the flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 200 GPM = Series Required from Table E = **2000 Series**
Baffle Spacing from Table E = **6"**
Water Flow Rate = 100 GPM = Passes required in 2000 series = **4 (FP)**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 188.4 sq.ft Closest model required based upon sq.ft. & series = **CS-2072-6-6-FP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

TABLE B- LMTD correction factor for Multipass Exchangers

R

	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

K

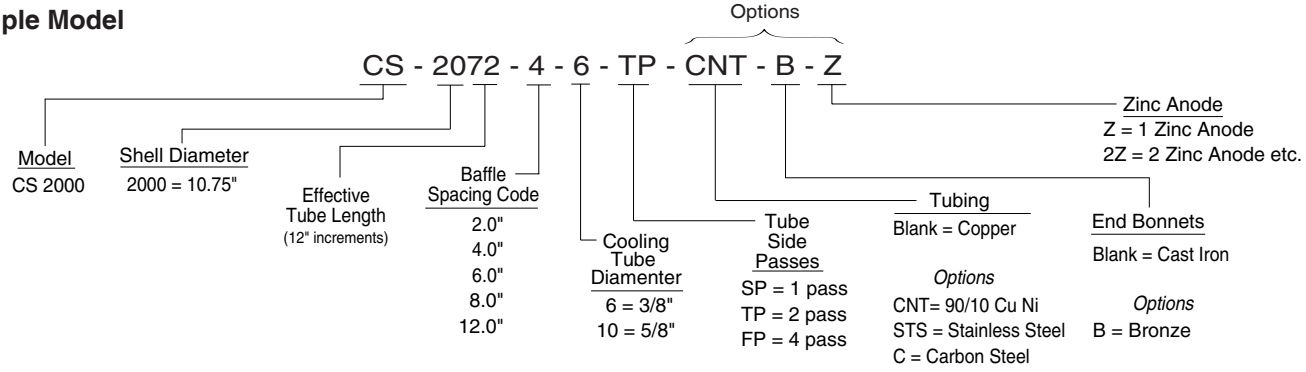
STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	AB-2000 Series	Standard Unit Ratings
Shell	Steel	
Tubes	Copper	Operating Pressure Tubes
Baffle	Steel	150 psig
Tube Sheet	Steel	Operating Pressure Shell
End Bonnets	Cast Iron	225 psig
Mounting Brackets	Steel	Operating Temperature
Gasket	Hypalon Composite	250 °F

TABLE D- Surface Area

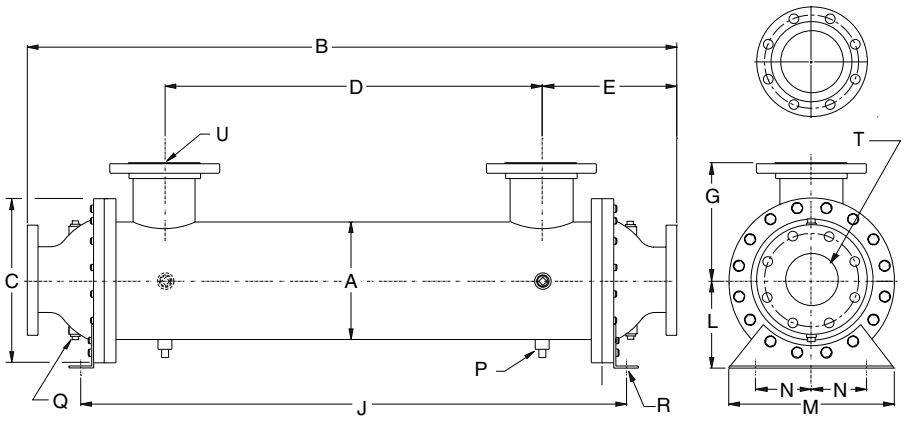
Model Number	Surface Area in Sq.ft.	
	3/8" O.D Tubing	5/8 O.D Tubing
CS-2036	110.7	61.8
CS-2048	147.6	82.4
CS-2060	184.5	103.0
CS-2072	221.4	123.7
CS-2084	258.3	144.3
CS-2096	295.3	164.9
CS-20108	332.2	185.5
CS-20120	369.1	206.1
CS-20132	406.0	226.7
CS-20144	442.9	247.4

Example Model



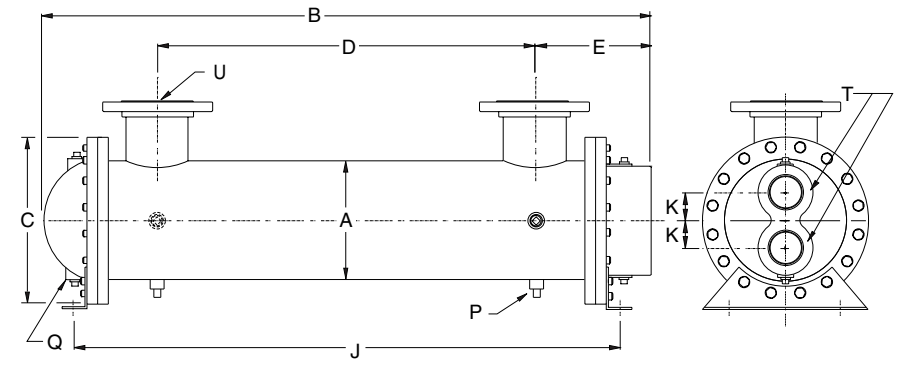
note: AIHTI reserves the right to make reasonable design changes without notice.

CS 2000 Series *dimensions*



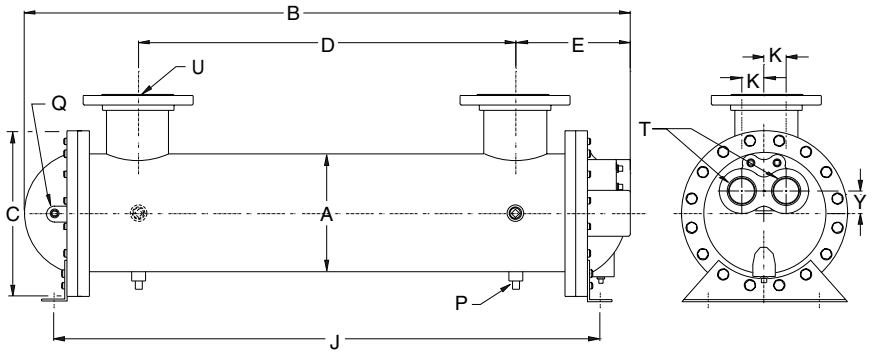
SINGLE PASS (SP)

Model	B	E	Q NPT	T NPT
CS-2036	50.13	12.06	.50 (4x)	5.00" 150# ASME / ANSI Flat Face Flange 8 holes .88 dia. on 8.5 DBC both ends
CS-2048	62.13			
CS-2060	74.13			
CS-2072	86.13			
CS-2084	98.13			
CS-2096	110.13			
CS-20108	122.13			
CS-20120	134.13			
CS-20132	146.13			
CS-20144	158.13			



TWO PASS (TP)

Model	B	E	K	Q NPT	T NPT
CS-2036	45.50	9.83	2.50	.50 (4x)	3.00
CS-2048	57.50				
CS-2060	69.50				
CS-2072	81.50				
CS-2084	93.50				
CS-2096	105.50				
CS-20108	117.50				
CS-20120	129.50				
CS-20132	141.50				
CS-20144	153.50				



FOUR PASS (FP)

Model	B	E	K	Q NPT	Y	T NPT
CS-2036	45.80	9.93	2.00	.50 (5x)	1.75	2.50
CS-2048	57.80					
CS-2060	69.80					
CS-2072	81.80					
CS-2084	93.80					
CS-2096	105.80					
CS-20108	117.80					
CS-20120	129.80					
CS-20132	141.80					
CS-20144	153.80					

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J	L	M	N	P NPT	R	U	Weight	Model
CS-2036	10.75	15.00	26.00	10.38	42.00	8.00	12.00	5.00	.50 (4x)	.75"Ø x 1.25" Thru Slot	4.00" ANSI Flange 150# RF	690	CS-2036
CS-2048			38.00		54.00							750	CS-2048
CS-2060			50.00		66.00							810	CS-2060
CS-2072			62.00		78.00							870	CS-2072
CS-2084			74.00		90.00							930	CS-2084
CS-2096			86.00		102.00							990	CS-2096
CS-20108			98.00		114.00							1050	CS-20108
CS-20120			110.00		126.00							1110	CS-20120
CS-20132			122.00		138.00							1170	CS-20132
CS-20144			134.00		150.00							1230	CS-20144

note: AIHTI reserves the right to make reasonable design changes without notice.

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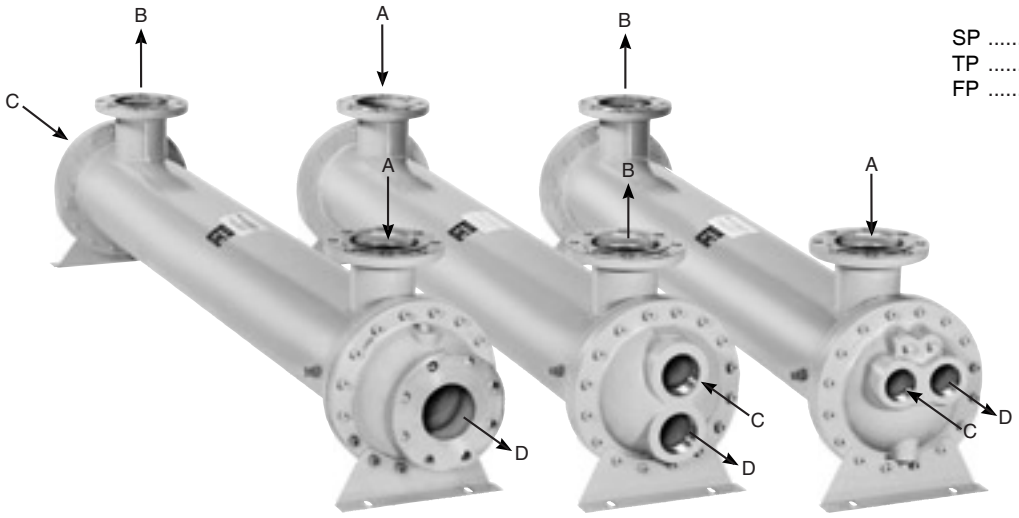
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP .....Four Pass



ONE PASS **TWO PASS** **FOUR PASS**

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.
Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the

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hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the complete bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

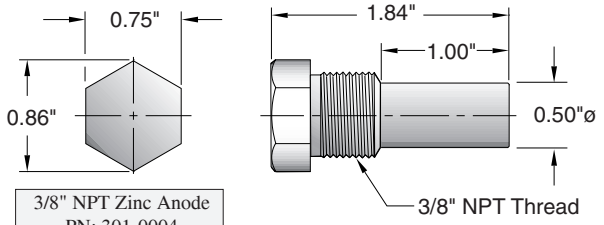
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

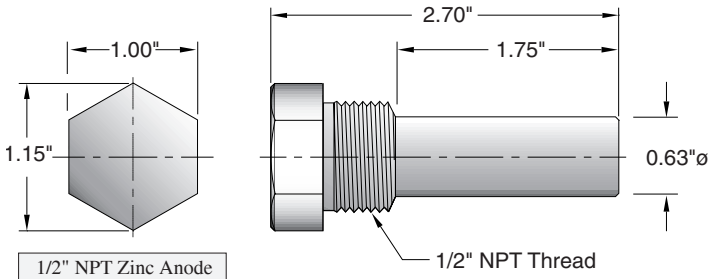
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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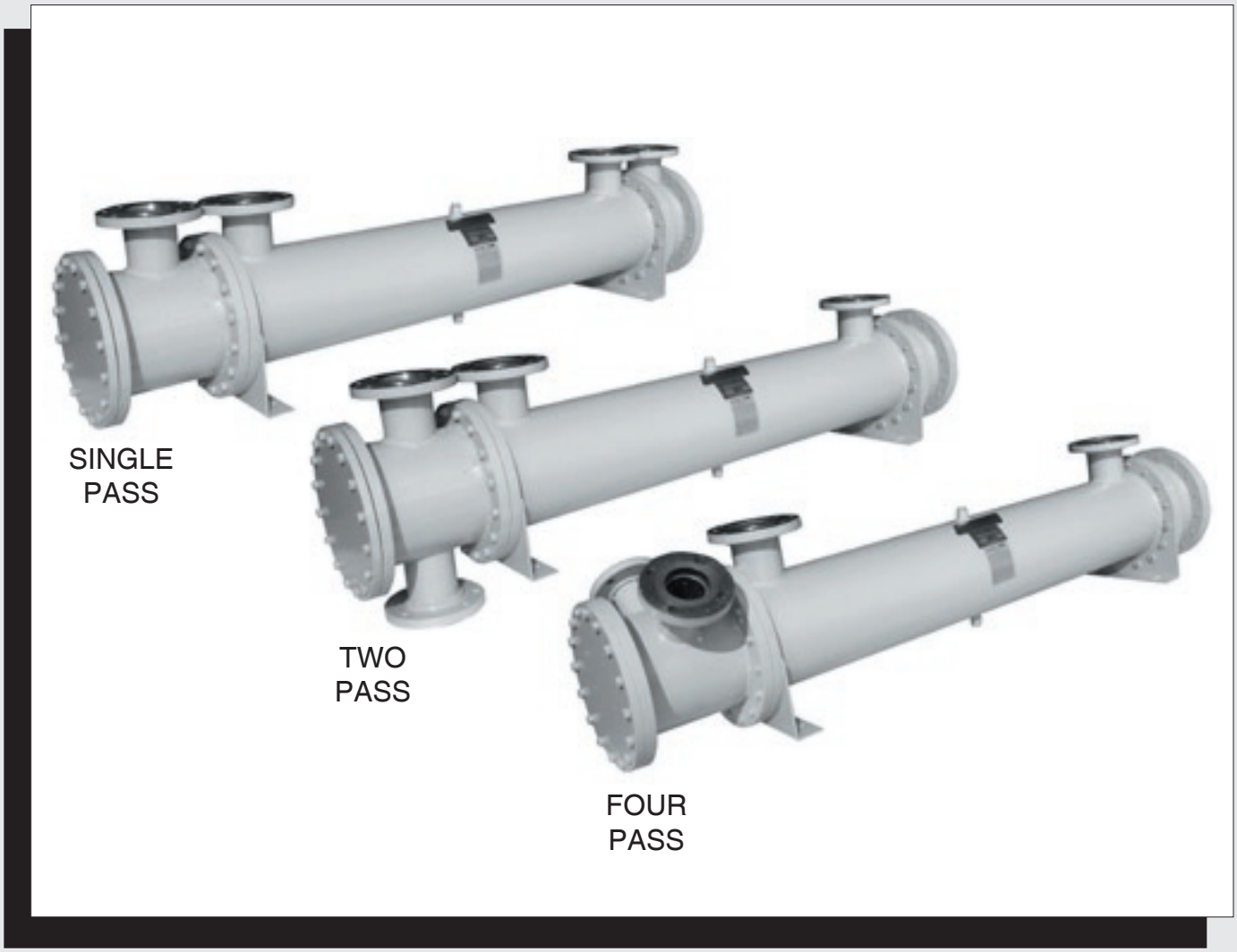
American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

CS 2400 - 4800 SERIES



Fixed Tube Bundle / Liquid Cooled

HEAT EXCHANGERS

- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 225 PSI.
- Operating temperature 250 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

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CS 2400 - CS 4800 Series *overview*

CS 2400 - CS 4800 SERIES

Strait tube large capacity heat exchangers with fixed tube bundle. Standard one, two and four pass units available. Sizes from 12" to 24" diameters. Made of steel with copper cooling tubes and steel channels. Options include 90/10 copper nickel and 316 stainless steel cooling tube, and zinc anodes. Can be customized to fit your requirements.

SRCS SERIES

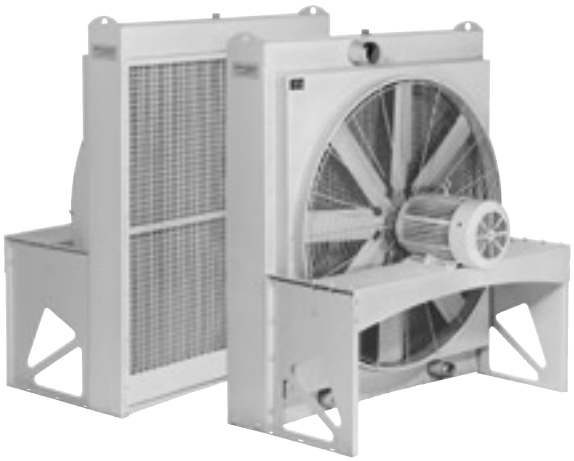
Strait tube heat exchangers with removeable tube bundle for fluids with high differential inlet temperatures or in applications where tube bundle requires removal. Standard one and two pass units available. Normally applied when the differential temperature between the hot uid entering and the cooling fluid entering is 150°F or greater. Strait tube design allows tubing to freely expand and contract independently of the shell. Welded outer shell construction made of carbon steel. Sizes from 6" to 20" diameters. Optional 90/10 copper nickel, stainless steel, and carbon steel tube. Can be modified to meet your requirements.

(See Page 71)

CS SERIES

Fixed tube construction heat exchangers with NPT connections. Made of steel with copper cooling tubes and cast iron end bonnets. Standard sizes from 3” through 8” diameters. Standard one, two, and four pass models are available. Options include 90/10 copper nickel and 316 stainless steel cooling tube, and zinc anodes. Can be customized to fit your requirements.

(See Page 41)



AOCS Series *WITH ELECTRIC DRIVE*

Severe duty air-cooled oil coolers, super capacity, rolled tube industrial series heat exchangers with direct electric drive cooling fan, OSHA guard, and heavy duty front screen. Rated operating temperature of 300°F at 200 PSIG. Standard flow rates from 10 to 600 GPM. NPT, ANSI flange, or SAE code 61 four bolt flange port connections. Optional built-in bypass relief valve 30 PSI or 65 PSI. Can be modified to meet your requirements. Suitable for most hydraulic oils, lubrications oils, synthetic compressor oils, ethylene glycol, and many other fluids compatible with listed material.

In applications where water is not available for cooling (see page 157)

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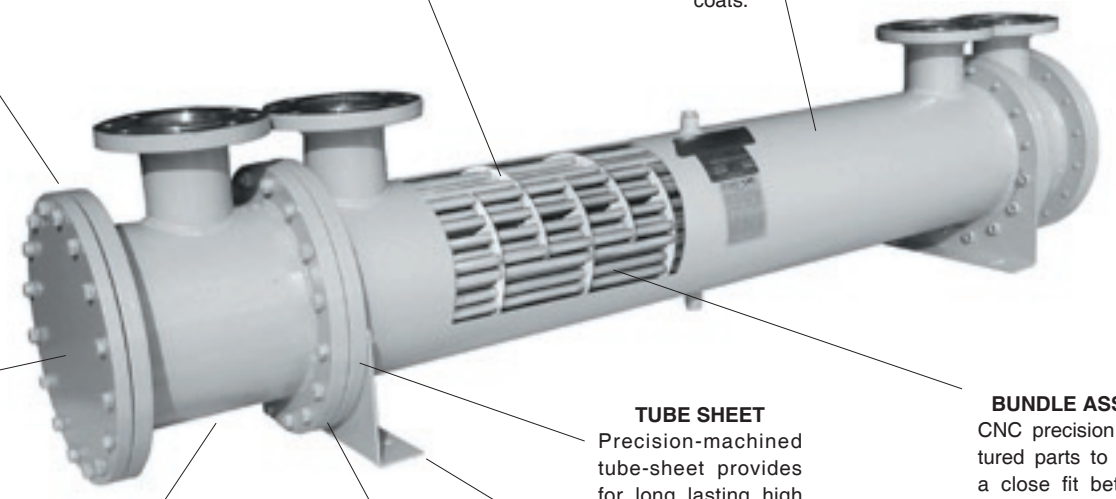
BAFFLES
CNC manufactured baffles to provide maximum turbulence and heat transfer with a minimum fluid pressure drop.

FINISH
Gray semigloss enamel suitable for outdoor service. Can be used as a base for additional coats.

FULL FACE GASKET
Full-face composite gasket.



REMOVABLE CHANNEL COVER
For easy access to tubes for cleaning without removing the channel.

TUBE SHEET
Precision-machined tube-sheet provides for long lasting high strength service.

BUNDLE ASSEMBLY
CNC precision manufactured parts to guarantee a close fit between the baffles, tubes, and shell. Clearances are minimized to provide for maximum heat transfer.

FABRICATED CHANNEL
Provides fluid into tubes with minimum restriction. One, two, or four pass interchangeability.

TUBE JOINT
Roller expanded tube joint to tube-sheet.

ADJUSTABLE MOUNTING CRADLE
Heavy gauge steel mounting cradles are adjustable in orientations 360° and length.

UNIT CODING

Example Model

Options

CS - 3648 - 4 - 6 - TP - CNT - SB - Z

Model
CS

Shell Diameter
2400 = 12.75"
2800 = 14.00"
3200 = 16.00"
3600 = 18.00"
4000 = 20.00"
4400 = 22.00"
4800 = 24.00"

Effective Tube Length
(12" increments)

Baffle Spacing Code
4.0"
6.0"
8.0"
12.0"
18.0"
24.0"

Cooling Tube Diamenter
6 = 3/8"
10 = 5/8"

Tube Side Passes
SP = 1 pass
TP = 2 pass
FP = 4 pass

Tubing
Blank = Copper

Options
CNT= 90/10 Cu Ni
STS = Stainless Steel
C = Carbon Steel

End Bonnets
Blank = Cast Iron

Options
SB = Stainless

Zinc Anode
Z = 1 Zinc Anode
2Z = 2 Zinc Anode etc.

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	CS 2400 - 4800	Options	Standard Unit Ratings
Shell	Steel	Stainless Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 225 psig Operating Temperature 250 °F
Tubes	Copper	90/10 Copper Nickel / Stainless Steel	
Baffle	Steel	Brass / Stainless Steel	
Tube Sheet	Steel	Stainless Steel	
End Bonnets	Fabricated Steel	Stainless Steel	
Mounting Brackets	Steel	Steel	
Gasket	Hypalon Composite	O-Ring	

note: AIHTI reserves the right to make reasonable design changes without notice.

CS 2400 - 4800 Series *selection*

STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other uids that are commonly used with shell & tube heat exchangers.

Terms					
GPM	=	Gallons Per Minute	Kw	=	Kilowatt (watts x 1000)
CN	=	Constant Number for a given fluid	T_{in}	=	Hot fluid entering temperature in °F
△T	=	Temperature differential across the potential	T_{out}	=	Hot fluid exiting temperature in °F
PSI	=	Pounds per Square Inch (pressure) of the operating side of the system	t_{in}	=	Cold fluid temperature entering in °F
MHP	=	Horsepower of the electric motor driving the hydraulic pump	t_{out}	=	Cold fluid temperature exiting in °F
			Q	=	BTU / HR

For example purposes, a hydraulic system has a total input 1200 HP (894Kw) electric motor installed coupled to a pump that produces a ow of 600 GPM @ 3000 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 6.6°F. Even though the return line pressure operates below 200 psi, calculate the system heat load potential (Q) based upon the prime movers (pump) capability, cooling uid is water @ 80ºF use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =600 x 210 x 6.6°F = 831,600 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(3000x600)/1714] x .30 x 2545 = 801,808 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =1200 x .30 x 2545 = 916,200 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =894 x .30 x 3415 = 915,909 BTU/HR
E) Q = HP to be removed x 2545	E) Q =300 x 2545 = 736,500 BTU/HR

Constant for a given fluid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid ow rate to derive the cold side △T. If the water ow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

	Formula	Example (from step 1,item C)
HOT FLUID Oil	$\triangle T = \frac{Q}{CN \times GPM}$	$\triangle T = \frac{916{,}200\ BTU/hr}{210\ CN \times 600GPM} = 7.37°F$ = △T Rejected
COLD FLUID Water	$\triangle t = \frac{BTU / hr}{CN \times GPM}$	$\triangle t = \frac{916{,}200\ BTU/hr}{500\ CN \times 300GPM} = 3.81°F$ = △t Absorbed

T_{in} =	Hot Fluid entering temperature in degrees F	117.3 °F
T_{out} =	Hot Fluid exiting temperature in degrees F	110.0 °F
t_{in} =	Cold Fluid entering temperature in degrees F	80.0 °F
t_{out} =	Cold Fluid exiting temperature in degrees F	86.1 °F

$$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S[\text{smaller temperature difference}]}{L\ [\text{larger temperature difference}]} = \left(\frac{S}{L}\right) \qquad \frac{110.0°F - 80.0°F}{117.3°F - 86.1°F} = \frac{30.0°F}{31.2°F} = .962$$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;
L = Larger temperature difference from step 2.
M = S/L number (LOCATED IN TABLE A). .962 = .980
$LMTD_i$ = L x M $LMTD_i$ = 31.2 x .980 (FROM TABLE A) = 30.6
To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula	Example
$R = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$	$R = \frac{117.3°F - 100°F}{86.1°F - 90°F} = \frac{17.3°F}{6.1°F} =$ **{2.82=R}**
$K = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$	$K = \frac{86.1°F - 80°F}{117.3°F - 80°F} = \frac{6.1°F}{37.3°F} =$ **{.163=K}**

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 30.6 x .996 = **30.5**

STEP 4: Calculate the area required

$$\textbf{Required Area sq.ft.} = \frac{Q\ (BTU / HR)}{LMTD_c \times U\ (\text{FROM TABLE C})} \qquad \frac{916{,}200}{30.5 \times 100} = \textbf{300.4 sq.ft.}$$

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STEP 5: Selection

a) From TABLE E choose the correct series size, baffle spacing, and number of passes that best fits your flow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 600 GPM = Series Required from Table E = **2400 Series**
Baffle Spacing from Table E = **18 baffle**
Water Flow Rate = 300 GPM = Passes required in 2000 series = **TP**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your flow rate.

Example

Required Area = 300.4 sq.ft Closest model required based upon sq.ft. & series = **CS-2472-12-6-TP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE E

Shell Dia. Code	Max. Liquid Flow - Shell Side						Liquid Flow - Tube Side					
	4	6	8	12	18	24	SP		TP		FP	
							Min.	Max.	Min.	Max.	Min.	Max.
2400	155	235	310	470	700	930	135	1080	70	535	34	265
2800	170	255	345	510	770	1030	166	1320	83	660	42	330
3200	200	295	395	590	890	1175	221	1760	110	880	55	440
3600	225	335	445	665	1000	1330	284	2275	142	1135	71	565
4000	250	375	495	745	1120	1490	355	2845	177	1420	89	710
4400	275	410	550	820	1230	1640	435	3480	218	1740	109	870
4800	300	450	600	895	1345	1790	522	4170	261	2085	130	1040

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

R

TABLE B- LMTD correction factor for Multipass Exchangers

	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

K

TABLE D- Surface Area

Model Number	Surface Area in Sq.ft.		Model Number	Surface Area in Sq.ft.		Model Number	Surface Area in Sq.ft.		Model Number	Surface Area in Sq.ft.	
	3/8" O.D Tubing	5/8 O.D Tubing		3/8" O.D Tubing	5/8 O.D Tubing		3/8" O.D Tubing	5/8 O.D Tubing		3/8" O.D Tubing	5/8 O.D Tubing
CS-2436	153.2	82.5	CS-3248	334.6	185.9	CS-4048	540.4	301.1	CS-4848	793.2	442.4
CS-2448	204.2	110.0	CS-3260	418.2	232.3	CS-4060	675.4	376.3	CS-4860	991.6	553.0
CS-2460	255.3	137.4	CS-3272	501.9	278.8	CS-4072	810.5	451.6	CS-4872	1189.9	663.7
CS-2472	306.3	164.9	CS-3284	585.5	325.3	CS-4084	945.6	526.9	CS-4884	1388.2	774.3
CS-2484	357.4	192.4	CS-3296	669.1	371.8	CS-4096	1080.7	602.1	CS-4896	1586.5	884.9
CS-2496	408.4	219.9	CS-32108	752.8	418.2	CS-40108	1215.8	677.4	CS-48108	1784.8	995.5
CS-24108	459.5	247.4	CS-32120	836.4	464.7	CS-40120	1350.9	752.7	CS-48120	1983.1	1106.1
CS-24120	510.5	274.9	CS-32132	920.1	511.2	CS-40132	1486.0	827.9	CS-48132	2181.4	1216.7
CS-2848	251.3	138.8	CS-3648	432.0	240.9	CS-4448	661.3	361.3			
CS-2860	314.2	173.4	CS-3660	540.0	301.1	CS-4460	826.6	451.6			
CS-2872	377.0	208.1	CS-3672	647.9	361.3	CS-4472	991.9	541.9			
CS-2884	439.8	242.8	CS-3684	755.9	421.5	CS-4484	1157.3	632.2			
CS-2896	502.7	277.5	CS-3696	863.9	481.7	CS-4496	1322.6	722.6			
CS-28108	565.5	312.2	CS-36108	971.9	541.9	CS-44108	1487.9	812.9			
CS-28120	628.3	346.9	CS-36120	1079.9	602.1	CS-44120	1653.2	903.2			
CS-28132	691.1	381.6	CS-36132	1187.9	662.4	CS-44132	1818.5	993.5			

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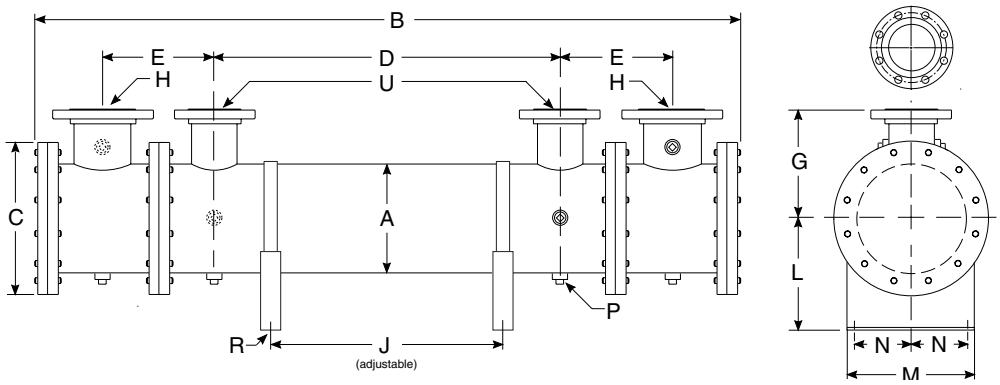
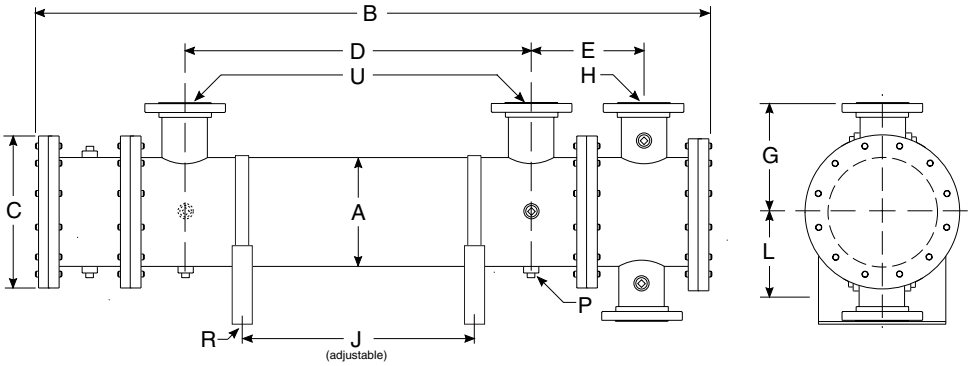
CS-2400 Series *dimensions*



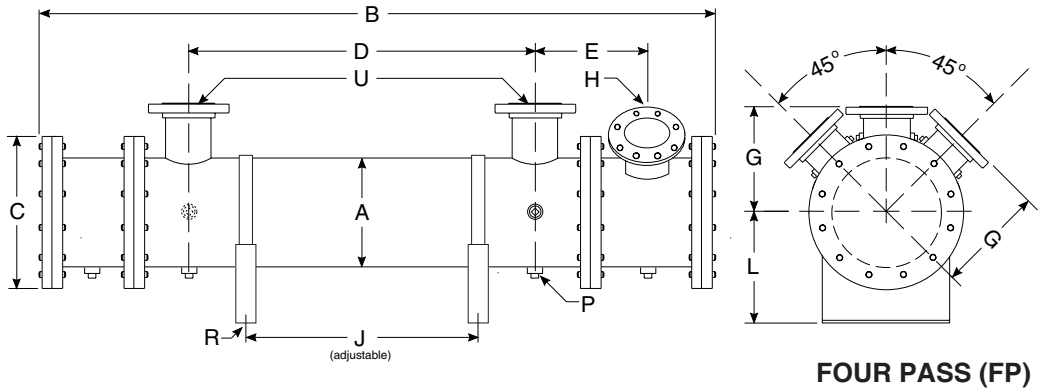
SINGLE PASS (SP)

Model	B	E	H
CS-2436	68.00	14.44	8.00" ANSI Flange 150# RF
CS-2448	80.00		
CS-2460	92.00		
CS-2472	104.00		
CS-2484	116.00		
CS-2496	128.00		
CS-24108	140.00		
CS-24120	152.00		



TWO PASS (TP)

Model	B	E	H
CS-2436	63.00	14.44	6.00" ANSI Flange 150# RF
CS-2448	75.00		
CS-2460	87.00		
CS-2472	99.00		
CS-2484	111.00		
CS-2496	123.00		
CS-24108	135.00		
CS-24120	147.00		



FOUR PASS (FP)

Model	B	E	H
CS-2436	63.00	14.44	4.00" ANSI Flange 150# RF
CS-2448	75.00		
CS-2460	87.00		
CS-2472	99.00		
CS-2484	111.00		
CS-2496	123.00		
CS-24108	135.00		
CS-24120	147.00		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-2436	12.75	16.25	24.00	11.38	13.00	12.00	14.75	5.00	(10) .50	.75"Ø x 1.00" Thru Slot	6.00" ANSI Flange 150# RF	1040	CS-2436
CS-2448			36.00		25.00							1130	CS-2448
CS-2460			48.00		37.00							1221	CS-2460
CS-2472			60.00		49.00							1312	CS-2472
CS-2484			72.00		61.00							1402	CS-2484
CS-2496			84.00		73.00							1493	CS-2496
CS-24108			96.00		85.00							1584	CS-24108
CS-24120			108.00		97.00							1675	CS-24120

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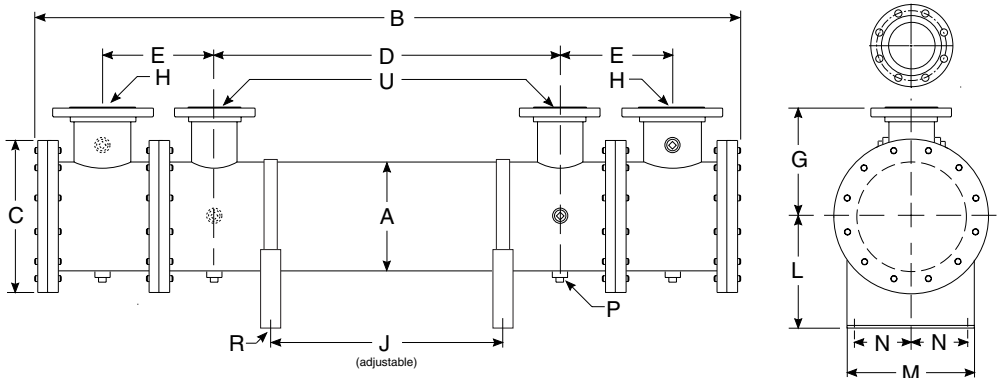
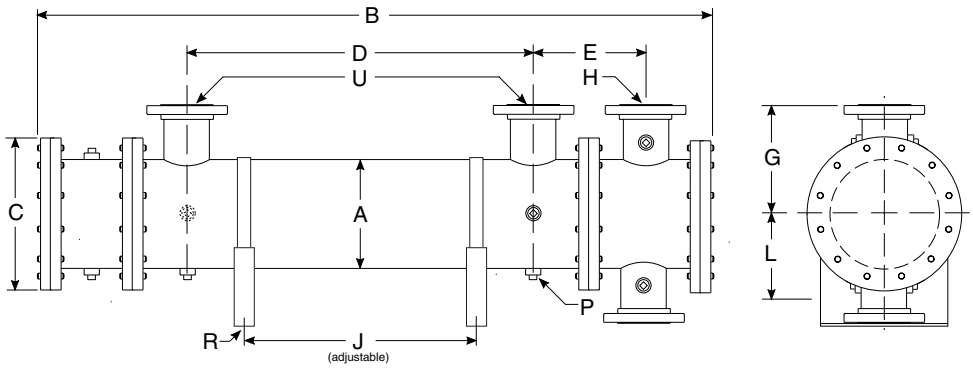


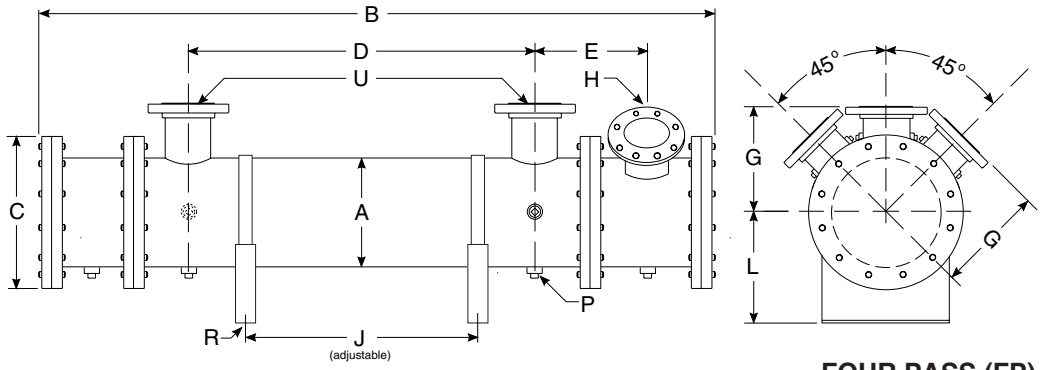
Model	B	E	H
CS-2836	68.00	15.44	8.00" ANSI Flange 150# RF
CS-2848	80.00		
CS-2860	92.00		
CS-2872	104.00		
CS-2884	116.00		
CS-2896	128.00		
CS-28108	140.00		
CS-28120	152.00		
CS-28132	164.00		

SINGLE PASS (SP)



Model	B	E	H
CS-2836	64.00	15.44	6.00" ANSI Flange 150# RF
CS-2848	76.00		
CS-2860	88.00		
CS-2872	100.00		
CS-2884	112.00		
CS-2896	124.00		
CS-28108	136.00		
CS-28120	148.00		
CS-28132	160.00		

TWO PASS (TP)



Model	B	E	H
CS-2836	64.00	15.44	4.00" ANSI Flange 150# RF
CS-2848	76.00		
CS-2860	88.00		
CS-2872	100.00		
CS-2884	112.00		
CS-2896	124.00		
CS-28108	136.00		
CS-28120	148.00		
CS-28132	160.00		

FOUR PASS (FP)

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-2836	14.00	18.00	22.00	12.00	9.00	13.00	16.00	5.00	(10) .50	.75"Ø x 1.00" Thru Slot	8.00" ANSI Flange 150# RF	1288	CS-2836
CS-2848			34.00		21.00							1400	CS-2848
CS-2860			46.00		33.00							1512	CS-2860
CS-2872			58.00		45.00							1624	CS-2872
CS-2884			70.00		57.00							1736	CS-2884
CS-2896			82.00		69.00							1848	CS-2896
CS-28108			94.00		81.00							1960	CS-28108
CS-28120			106.00		93.00							2072	CS-28120
CS-28132			118.00		105.00							2184	CS-28132

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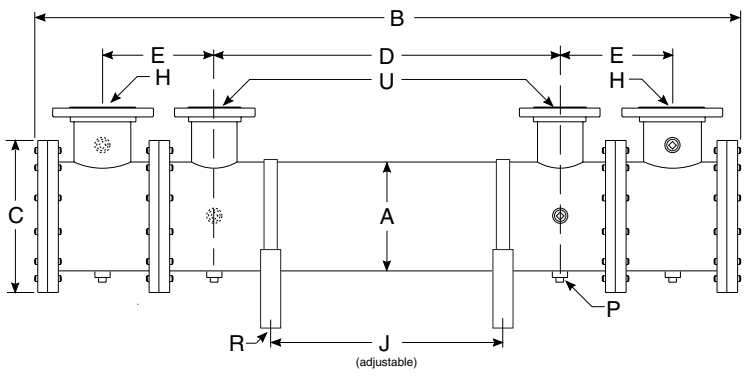
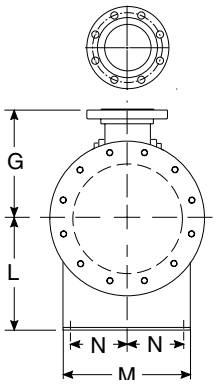
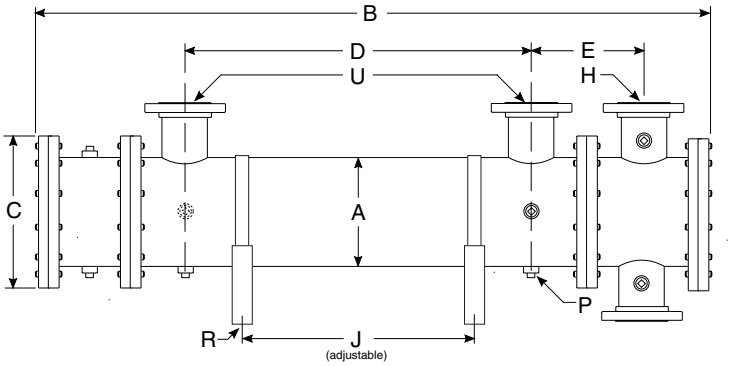
CS-3200 Series *dimensions*

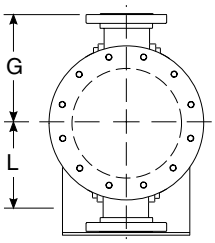




SINGLE PASS (SP)

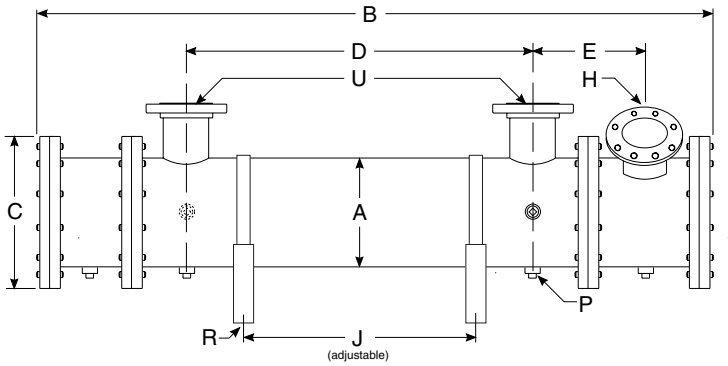
Model	B	E	H
CS-3248	85.00	17.00	10.00" ANSI Flange 150# RF
CS-3260	97.00		
CS-3272	109.00		
CS-3284	121.00		
CS-3296	133.00		
CS-32108	145.00		
CS-32120	157.00		
CS-32132	169.00		

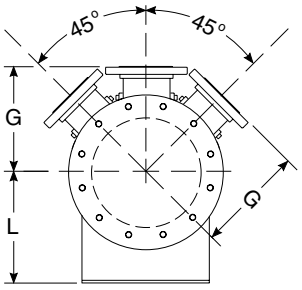




TWO PASS (TP)

Model	B	E	H
CS-3248	80.00	17.00	6.00" ANSI Flange 150# RF
CS-3260	92.00		
CS-3272	104.00		
CS-3284	116.00		
CS-3296	128.00		
CS-32108	140.00		
CS-32120	152.00		
CS-32132	164.00		





FOUR PASS (FP)

Model	B	E	H
CS-3248	80.00	17.00	5.00" ANSI Flange 150# RF
CS-3260	92.00		
CS-3272	104.00		
CS-3284	116.00		
CS-3296	128.00		
CS-32108	140.00		
CS-32120	152.00		
CS-32132	164.00		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-3248	16.00	20.00	34.00	13.00	21.00	14.00	18.00	6.00	(10) .50	.781"Ø x 1.50" Thru Slot	8.00" ANSI Flange 150# RF	2377	CS-3248
CS-3260			46.00		33.00							1975	CS-3260
CS-3272			58.00		45.00							2121	CS-3272
CS-3284			70.00		57.00							2266	CS-3284
CS-3296			82.00		69.00							2412	CS-3296
CS-32108			94.00		81.00							2558	CS-32108
CS-32120			106.00		93.00							2705	CS-32120
CS-32132			118.00		105.00							2852	CS-32132

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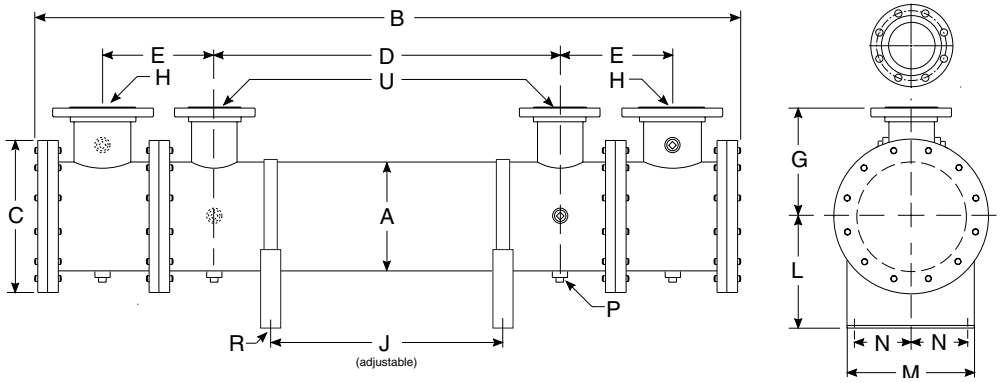
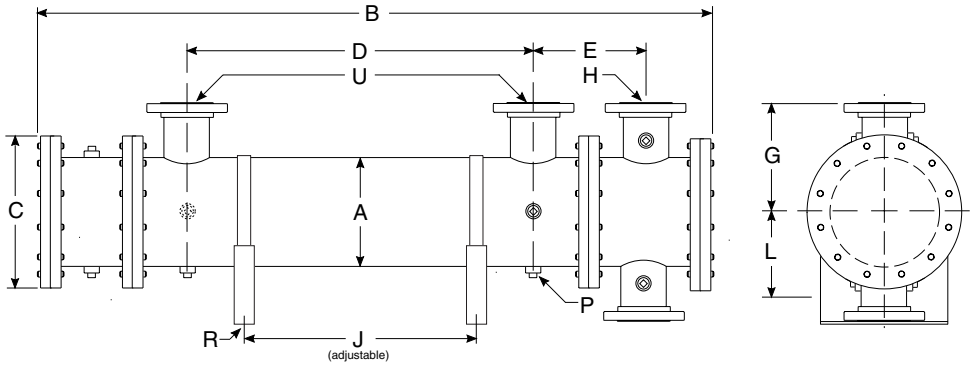


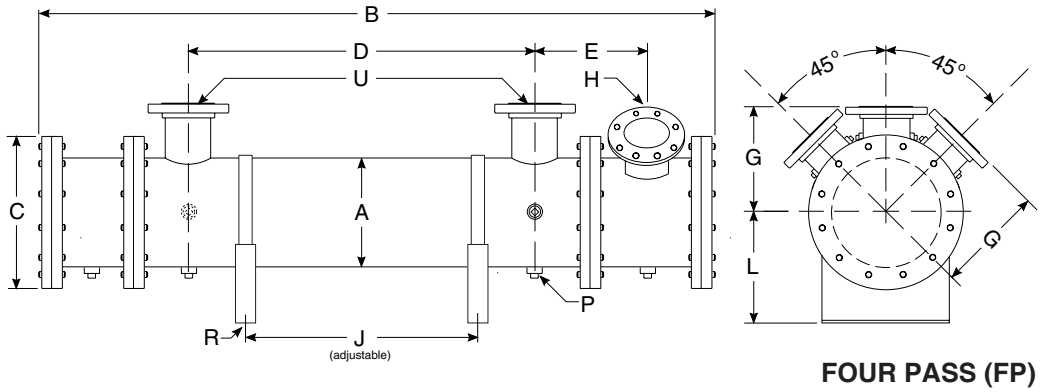
SINGLE PASS (SP)

Model	B	E	H
CS-3648	85.00	18.00	10.00" ANSI Flange 150# RF
CS-3660	97.00		
CS-3672	109.00		
CS-3684	121.00		
CS-3696	133.00		
CS-36108	145.00		
CS-36120	157.00		
CS-36132	169.00		



TWO PASS (TP)

Model	B	E	H
CS-3648	81.50	18.00	8.00" ANSI Flange 150# RF
CS-3660	93.50		
CS-3672	105.50		
CS-3684	117.50		
CS-3696	129.50		
CS-36108	141.50		
CS-36120	153.50		
CS-36132	165.50		



FOUR PASS (FP)

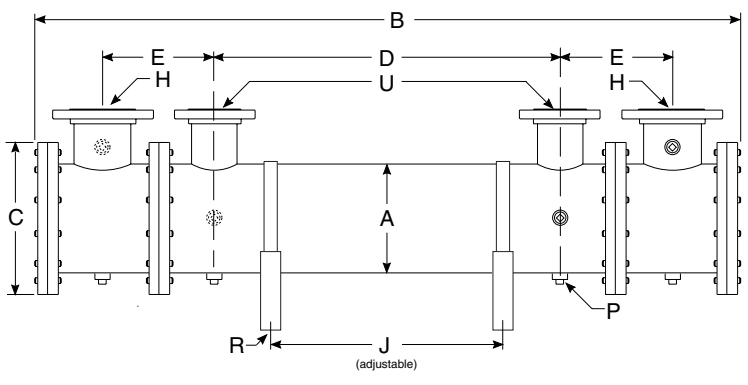
Model	B	E	H
CS-3648	81.50	18.00	5.00" ANSI Flange 150# RF
CS-3660	93.50		
CS-3672	105.50		
CS-3684	117.50		
CS-3696	129.50		
CS-36108	141.50		
CS-36120	153.50		
CS-36132	165.50		

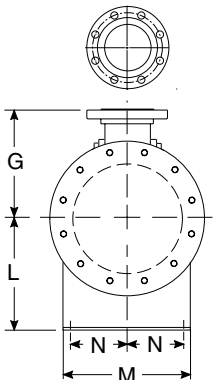
COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-3648	18.00	22.00	32.00	14.00	17.00	15.00	20.00	7.00	.50	.781"Ø x 1.50" Thru Slot	10.00" ANSI Flange 150# RF	2314	CS-3648
CS-3660			44.00		29.00							2498	CS-3660
CS-3672			56.00		41.00							2684	CS-3672
CS-3684			68.00		53.00							2869	CS-3684
CS-3696			80.00		65.00							3054	CS-3696
CS-36108			92.00		77.00							3239	CS-36108
CS-36120			104.00		89.00							3424	CS-36120
CS-36132			116.00		101.00							3609	CS-36132

note: AIHTI reserves the right to make reasonable design changes without notice.

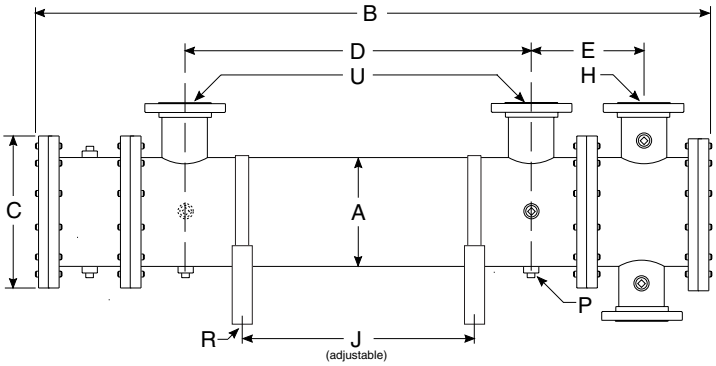
CS-4000 Series *dimensions*

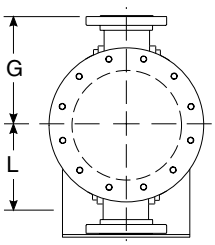




SINGLE PASS (SP)

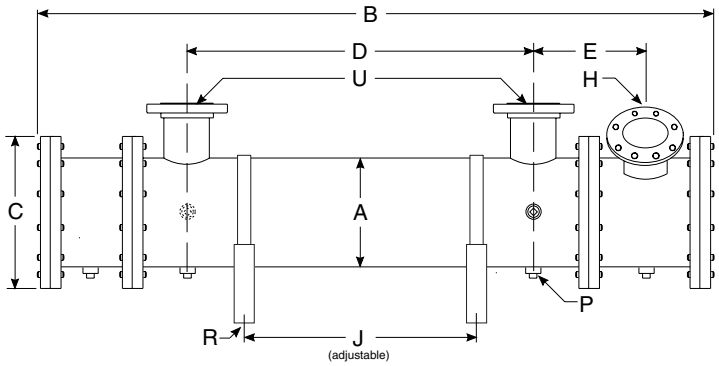
Model	B	E	H
CS-4048	91.00	19.50	12.00" ANSI Flange 150# RF
CS-4060	103.00		
CS-4072	115.00		
CS-4084	127.00		
CS-4096	139.00		
CS-40108	151.00		
CS-40120	163.00		
CS-40132	175.00		

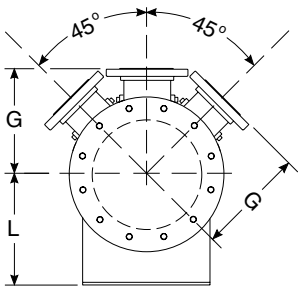




TWO PASS (TP)

Model	B	E	H
CS-4048	86.50	19.50	8.00" ANSI Flange 150# RF
CS-4060	98.50		
CS-4072	110.50		
CS-4084	122.50		
CS-4096	134.50		
CS-40108	146.50		
CS-40120	158.50		
CS-40132	170.50		





FOUR PASS (FP)

Model	B	E	H
CS-4048	86.50	19.50	6.00" ANSI Flange 150# RF
CS-4060	98.50		
CS-4072	110.50		
CS-4084	122.50		
CS-4096	134.50		
CS-40108	146.50		
CS-40120	158.50		
CS-40132	170.50		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-4048	20.00	25.00	32.00	15.00	17.00	17.00	22.00	8.00	.50	.781"Ø x 1.50" Thru Slot	10.00" ANSI Flange 150# RF	2856	CS-4048
CS-4060			44.00		29.00							3085	CS-4060
CS-4072			56.00		41.00							3313	CS-4072
CS-4084			68.00		53.00							3542	CS-4084
CS-4096			80.00		65.00							3770	CS-4096
CS-40108			92.00		77.00							3999	CS-40108
CS-40120			104.00		89.00							4227	CS-40120
CS-40132			116.00		101.00							4456	CS-40132

note: AIHTI reserves the right to make reasonable design changes without notice.

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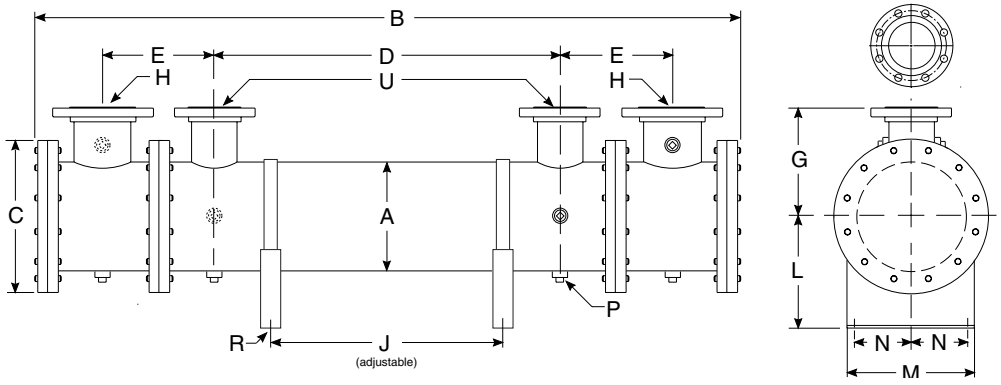
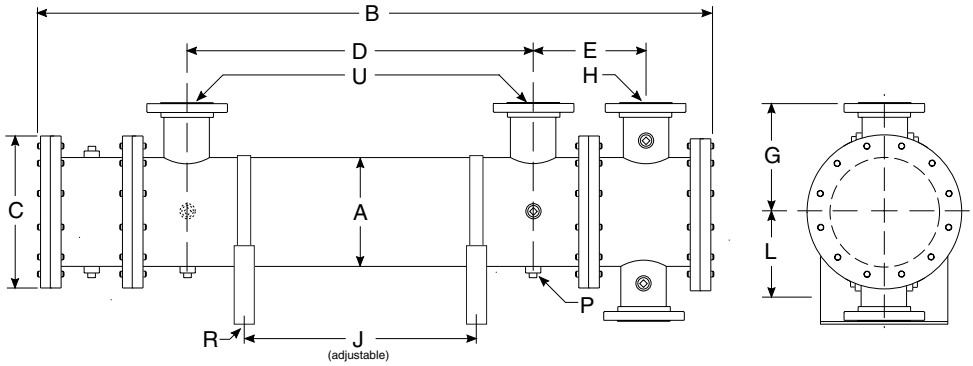


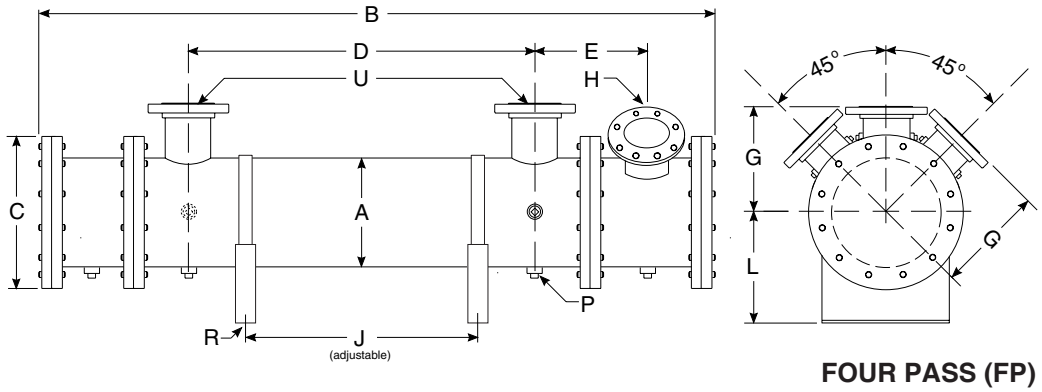
SINGLE PASS (SP)

Model	B	E	H
CS-4448	95.00	21.63	14.00" ANSI Flange 150# RF
CS-4460	107.00		
CS-4472	119.00		
CS-4484	131.00		
CS-4496	143.00		
CS-44108	155.00		
CS-44120	167.00		
CS-44132	179.00		



TWO PASS (TP)

Model	B	E	H
CS-4448	90.00	21.63	10.00" ANSI Flange 150# RF
CS-4460	102.00		
CS-4472	114.00		
CS-4484	126.00		
CS-4496	138.00		
CS-44108	150.00		
CS-44120	162.00		
CS-44132	174.00		



FOUR PASS (FP)

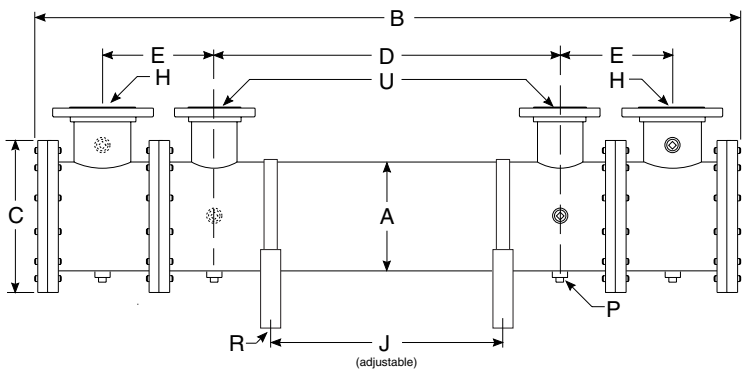
Model	B	E	H
CS-4448	90.00	21.63	6.00" ANSI Flange 150# RF
CS-4460	102.00		
CS-4472	114.00		
CS-4484	126.00		
CS-4496	138.00		
CS-44108	150.00		
CS-44120	162.00		
CS-44132	174.00		

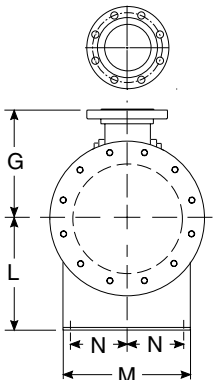
COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-4448	22.00	28.00	29.00	16.00	13.00	18.00	24.00	8.50	.50	.781"Ø x 1.50" Thru Slot	12.00" ANSI Flange 150# RF	3456	CS-4448
CS-4460			41.00		25.00							3733	CS-4460
CS-4472			53.00		37.00							4099	CS-4472
CS-4484			65.00		49.00							4285	CS-4484
CS-4496			77.00		61.00							4562	CS-4496
CS-44108			89.00		73.00							4839	CS-44108
CS-44120			101.00		85.00							5115	CS-44120
CS-44132			113.00		97.00							5391	CS-44132

note: AIHTI reserves the right to make reasonable design changes without notice.

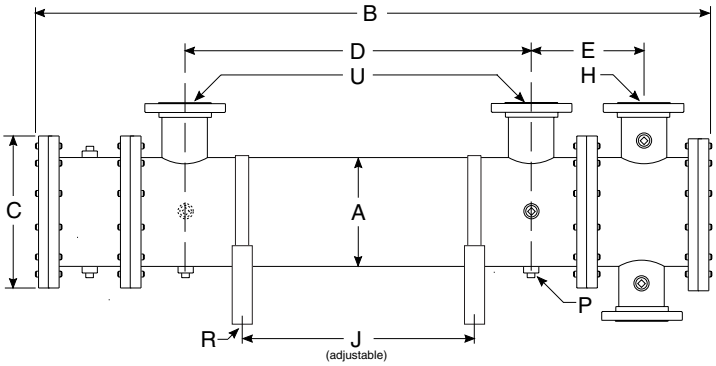
CS-4800 Series *dimensions*

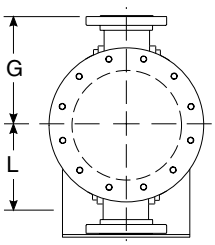




Model	B	E	H
CS-4848	95.00	21.63	14.00" ANSI Flange 150# RF
CS-4860	107.00		
CS-4872	119.00		
CS-4884	131.00		
CS-4896	143.00		
CS-48108	155.00		
CS-48120	167.00		
CS-48132	179.00		

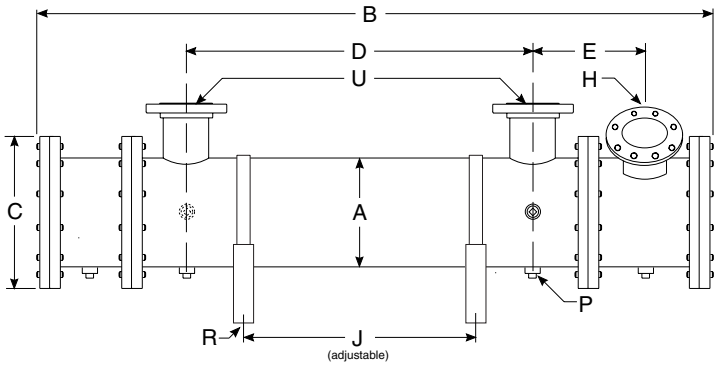
SINGLE PASS (SP)

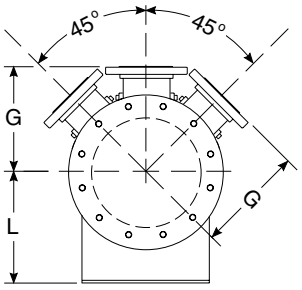




Model	B	E	H
CS-4848	91.50	21.63	10.00" ANSI Flange 150# RF
CS-4860	103.50		
CS-4872	115.50		
CS-4884	127.50		
CS-4896	139.50		
CS-48108	151.50		
CS-48120	163.50		
CS-48132	175.50		

TWO PASS (TP)





Model	B	E	H
CS-4848	91.50	21.63	8.00" ANSI Flange 150# RF
CS-4860	103.50		
CS-4872	115.50		
CS-4884	127.50		
CS-4896	139.50		
CS-48108	151.50		
CS-48120	163.50		
CS-48132	175.50		

FOUR PASS (FP)

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
CS-4848	24.00	30.00	29.00	17.00	13.00	19.00	26.00	10.00	.50	.781"Ø x 1.50" Thru Slot	12.00" ANSI Flange 150# RF	4113	CS-4848
CS-4860			41.00		25.00							4442	CS-4860
CS-4872			53.00		37.00							4771	CS-4872
CS-4884			65.00		49.00							5100	CS-4884
CS-4896			77.00		61.00							5429	CS-4896
CS-48108			89.00		73.00							5758	CS-48108
CS-48120			101.00		85.00							6087	CS-48120
CS-48132			113.00		97.00							6416	CS-48132

note: AIHTI reserves the right to make reasonable design changes without notice.

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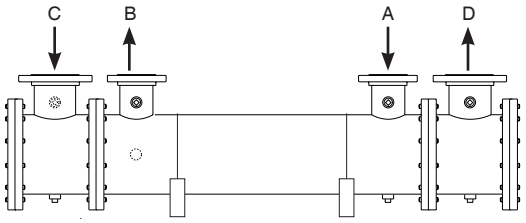
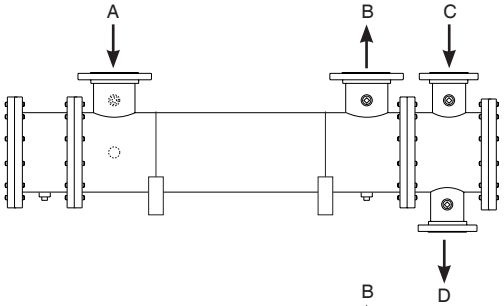
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

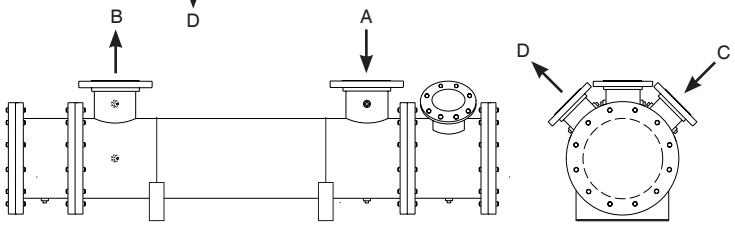
SP ..... Single Pass
TP ..... Two Pass
FP .....Four Pass



SINGLE PASS



TWO PASS



FOUR PASS

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.
Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the

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hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the channel cover and complete channel to provide sufficient clearance to permit tube rolling and cleaning. Channel covers can be removed to aid in cleaning the tubes without disassembling channel, plumbing, or mounting hardware. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

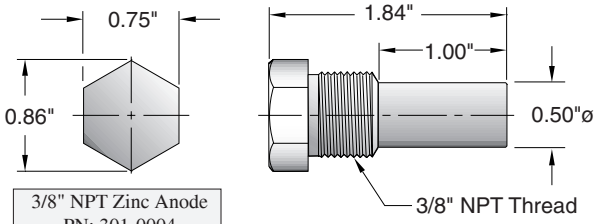
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

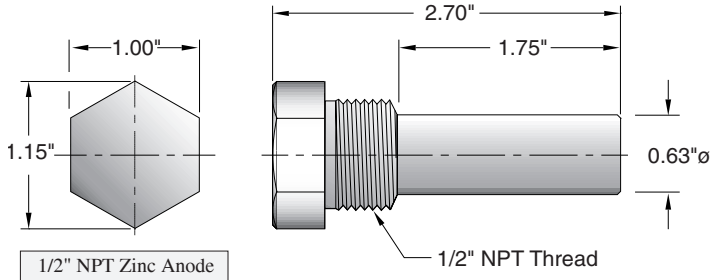
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

SRCS SERIES

SINGLE PASS

TWO PASS

Strait Tube Removable Bundle / Liquid Cooled

HEAT EXCHANGERS

- Removable strait-tube bundle
- Brass stationary and floating tube sheets.
- Brass packing and retaining rings.
- Dual Viton O-ring packing seals.
- Removable channel covers for access to tubes without disturbing existing plumbing.
- Operating pressure, 150 PSI tubes, 225 PSI shell.
- Operating temperature 400°F
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

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SRCS Series *overview*

SRCS SERIES

Strait tube heat exchangers with removeable tube bundle for fluids with high differential inlet temperatures or in applications where tube bundle requires removal. Normally applied when the differential temperature between the hot fluid entering and the cooling fluid entering is 150°F or greater. Strait tube design allows tubing to freely expand and contract independently of the shell. Welded outer shell construction made of carbon steel. Sizes from 6" to 20" diameters. Standard one and two pass units available. Optional 90/10 copper nickel, stainless steel, and carbon steel tube. Can be modified to meet your requirements.

UCS & URCS SERIES

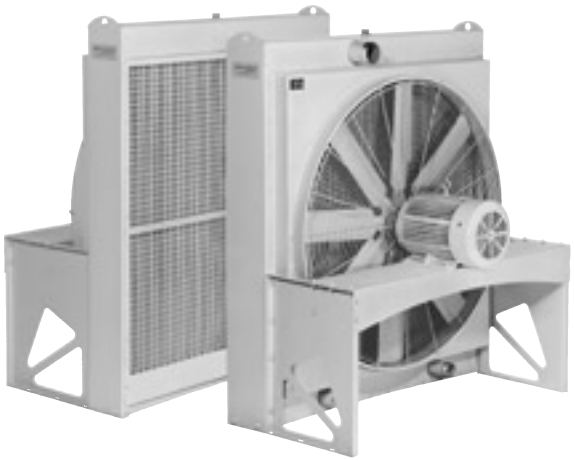
U-tube heat exchangers with removeable tube bundle for fluids with high differential inlet temperatures or where tube bundle requires removal. Normally applied when the differential temperature between the hot fluid entering and the cooling fluid entering is 150°F or greater. U-tube design allows tubing to freely expand and contract independently of the shell. Welded outer shell construction made of carbon steel. Sizes from 3" to 10" diameters. Standard two and four pass units available. Optional 90/10 copper nickel, stainless steel, and carbon steel tube. Can be modified to meet your requirements.

(See Page 89)

UCN, URCN & UCF, URCF SERIES

U-tube heat exchangers with removeable tube bundle for steam service. Normally applied when the differential temperature between the hot fluid entering and the cooling fluid entering is 150°F or greater. U-tube design allows tubing to freely expand and contract independently of the shell. Welded outer shell construction made of carbon steel. Sizes from 5" to 10" diameters. Standard two and four pass units available. Optional 90/10 copper nickel, stainless steel, and carbon steel tube. Can be modified to meet your requirements.

(See Page 105)



AOCS Series *WITH ELECTRIC DRIVE*

Severe duty air-cooled oil coolers, super capacity, rolled tube industrial series heat exchangers with direct electric drive cooling fan, OSHA guard, and heavy duty front screen. Rated operating temperature of 300ºF at 200 PSIG. Standard flow rates from 10 to 600 GPM. NPT, ANSI flange, or SAE code 61 four bolt flange port connections. Optional built-in bypass relief valve 30 PSI or 65 PSI. Can be modified to meet your requirements. Suitable for most hydraulic oils, lubrications oils, synthetic compressor oils, ethylene glycol, and many other fluids compatible with listed material.

In applications where water is not available for cooling (see page 157)

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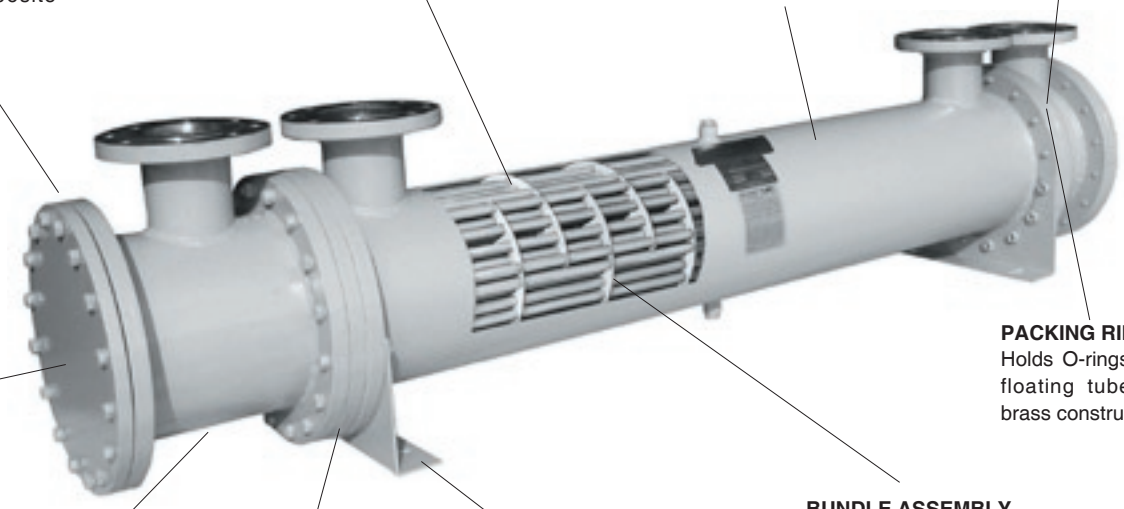
BAFFLES
CNC manufactured baffles to provide maximum turbulence and heat transfer with a minimum fluid pressure drop.

FINISH
Gray semigloss enamel. Can be used as a base for additional coats.

RETAINING RING
Holds packing O-rings in place, brass construction.

FULL FACE GASKET
Full-face composite gasket.



REMOVABLE CHANNEL COVER
For easy access to tubes for cleaning without removing the channel.

PACKING RING
Holds O-rings against floating tube sheet, brass construction.

BUNDLE ASSEMBLY
CNC precision manufactured parts to guarantee a close fit between the baffles, tubes, and shell. Clearances are minimized to provide for maximum heat transfer.

ADJUSTABLE MOUNTING CRADLE
Heavy gauge steel mounting cradles are adjustable in orientations 360° and length.

STATIONARY TUBE SHEET
Roller expanded tube joint to tube-sheet made of brass construction.

CHANNEL
Provides fluid into tubes with minimum restriction. One or two pass interchangeability.

UNIT CODING

Example Model

Options

SRCS - 2496 - 8 - 6 - TP - CNT - SB - Z

Model
SRCS

Shell Diameter
1700 = 8.00"
2000 = 10.75"
2400 = 12.75"
2800 = 14.00"
3200 = 16.00"
3600 = 18.00"
4000 = 20.00"

Effective Tube Length
(12" increments)

Baffle Spacing
4.0"
6.0"
8.0"
12.0"
18.0"
24.0"

Cooling Tube Diamenter
6 = 3/8"
10 = 5/8"

Tube Side Passes
SP = 1 pass
TP = 2 pass

Tubing
Blank = Standard

Options
CNT= 90/10 Cu Ni
STS = Stainless Steel
C = Carbon Steel

End Bonnets
Blank = Standard

Options
SB = Stainless

Zinc Anode
Z = 1 Zinc Anode
2Z = 2 Zinc Anode etc.

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	SRCS 1700 - 4000	Options	Standard Unit Ratings
Shell	Steel	Stainless Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 225 psig Operating Temperature 400 °F
Tubes	Copper	90/10 Cu. Ni. / Stainless Steel	
Baf es	Steel	Brass / Stainless Steel	
Tube Sheets	Brass	Steel / Stainless Steel	
Retaining Ring	Brass	Steel / Stainless Steel	
Packing Ring	Brass	Steel / Stainless Steel	
Gaskets / Packing	Hypalon / Viton	Viton / EPDM / EPR	
Mounting Brackets	Steel	Stainless Steel	
Bonnets / Channels	Cast Iron / Steel	Stainless Steel	

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SRCS Series *selection*

STEP 1: Calculate the heat load

The heat load in BTU/HR or (Q) can be derived by using several methods. To simplify things, we will consider general specifications for hydraulic system oils and other uids that are commonly used with shell & tube heat exchangers.

Terms					
GPM	=	Gallons Per Minute	Kw	=	Kilowatt (watts x 1000)
CN	=	Constant Number for a given uid	T_{in}	=	Hot uid entering temperature in °F
△T	=	Temperature differential across the potential	T_{out}	=	Hot uid exiting temperature in °F
PSI	=	Pounds per Square Inch (pressure) of the operating side of the system	t_{in}	=	Cold uid temperature entering in °F
MHP	=	Horsepower of the electric motor driving the hydraulic pump	t_{out}	=	Cold uid temperature exiting in °F
			Q	=	BTU / HR

For example purposes, a hydraulic system has a total input 1200 HP (894Kw) electric motor installed coupled to a pump that produces a ow of 600 GPM @ 3000 PSIG. The temperature differential of the oil entering the pump *vs* exiting the system is about 6.6°F. Even though return line pressure operates below 200 psi, calculate the system heat load potential (Q) based upon the prime movers (pump) capability, cooling uid is water @ 80ºF use one of the following equations to accomplish this:

To derive the required heat load (Q) to be removed by the heat exchanger, apply ONE of the following. Note: The calculated heat loads may differ slightly from one formula to the next. This is due to assumptions made when estimating heat removal requirements. The factor *(v)* represents the percentage of the overall input energy to be rejected by the heat exchanger. The *(v)* factor is generally about 30% for most hydraulic systems, however it can range from 20%-70% depending upon the installed system components and heat being generated (ie. servo valves, proportional valves, etc…will increase the percentage required).

Formula	Example
A) Q = GPM x CN x actual △T	A) Q =600 x 210 x 6.6°F = 831,600 BTU/HR
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545	B) Q =[(3000x600)/1714] x .30 x 2545 = 801,808 BTU/HR
C) Q = MHP x (*v*) x 2545	C) Q =1200 x .30 x 2545 = 916,200 BTU/HR
D) Q = Kw to be removed x 3415	D) Q =894 x .30 x 3415 = 915,909 BTU/HR
E) Q = HP to be removed x 2545	E) Q =300 x 2545 = 736,500 BTU/HR

Constant for a given uid (CN)

1) Oil ..... CN = 210
2) Water..... CN = 500
3) 50% E. Glycol..... CN = 450

STEP 2: Calculate the Mean Temperature Difference

When calculating the MTD you will be required to choose a liquid ow rate to derive the cold side △T. If the water ow is unknown you may need to assume a number based on what is available. As a normal rule of thumb, for oil to water cooling a 2:1 oil to water ratio is used. For applications of water to water or 50 % Ethylene Glycol to water, a 1:1 ratio is common.

	Formula	Example (from step 1,item C)
HOT FLUID Oil	$\triangle T = \frac{Q}{CN \times GPM}$	$\triangle T = \frac{916{,}200 \text{ BTU/hr}}{210 \text{ CN} \times 600\text{GPM}} = 7.37°F$ = △T Rejected
COLD FLUID Water	$\triangle t = \frac{\text{BTU / hr}}{CN \times GPM}$	$\triangle t = \frac{916{,}200 \text{ BTU/hr}}{500 \text{ CN} \times 300\text{GPM}} = 3.81°F$ = △t Absorbed

T_{in}	= Hot Fluid entering temperature in degrees F	117.3 °F
T_{out}	= Hot Fluid exiting temperature in degrees F	110.0 °F
t_{in}	= Cold Fluid entering temperature in degrees F	80.0 °F
t_{out}	= Cold Fluid exiting temperature in degrees F	86.1 °F

$$\frac{T_{out} - t_{in}}{T_{in} - t_{out}} = \frac{S[\text{smaller temperature difference}]}{L[\text{larger temperature difference}]} = \left(\frac{S}{L}\right) \qquad \frac{110.0°F - 80.0°F}{117.3°F - 86.1°F} = \frac{30.0°F}{31.2°F} = .962$$

STEP 3: Calculate Log Mean Temperature Difference (LMTD)

To calculate the LMTD please use the following method;
L = Larger temperature difference from step 2.
M = S/L number (LOCATED IN TABLE A). .962 = .980
$LMTD_i$ = L x M $LMTD_i$ = 31.2 x .980 (FROM TABLE A) = 30.6
To correct the $LMTD_i$ for a multipass heat exchangers calculate **R** & **K** as follows:

Formula	Example
$R = \frac{T_{in} - T_{out}}{t_{out} - t_{in}}$	$R = \frac{117.3°F - 100°F}{86.1°F - 90°F} = \frac{17.3°F}{6.1°F} =$ **{2.82=R}**
$K = \frac{t_{out} - t_{in}}{T_{in} - t_{in}}$	$K = \frac{86.1°F - 80°F}{117.3°F - 80°F} = \frac{6.1°F}{37.3°F} =$ **{.163=K}**

Locate the correction factor CF_B (FROM TABLE B)
$LMTD_c = LMTD_i \times CF_B$
$LMTD_c$ = 30.6 x .996 = **30.5**

STEP 4: Calculate the area required

$$\textbf{Required Area sq.ft.} = \frac{Q \text{ (BTU / HR)}}{LMTD_c \times U \text{ (FROM TABLE C)}} \qquad \frac{916{,}200}{30.5 \times 100} = \textbf{300.4 sq.ft.}$$

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STEP 5: Selection

a) From TABLE E choose the correct series size, baf e spacing, and number of passes that best fits your ow rates for both shell and tube side. Note that the tables suggest minimum and maximum information. Try to stay within the 20-80 percent range of the indicated numbers.

Example

Oil Flow Rate = 600 GPM = Series Required from Table E = **2400 Series**
Baf e Spacing from Table E = **18 baf e**
Water Flow Rate = 300 GPM = Passes required in 2000 series = **TP**

b) From TABLE D choose the heat exchanger model size based upon the sq.ft. or surface area in the series size that will accommodate your ow rate.

Example

Required Area = 300.4 sq.ft Closest model required based upon sq.ft. & series = **SRCS-2484-18-6-TP**

If you require a computer generated data sheet for the application, or if the information that you are trying to apply does not match the corresponding information, please contact our engineering services department for further assistance.

TABLE E

Shell Dia. Code	Max. Liquid Flow - Shell Side						Liquid Flow - Tube Side					
	4	6	8	12	18	24	SP		TP		FP	
							Min.	Max.	Min.	Max.	Min.	Max.
1700	140	165	190	210	220	—	52	418	26	164	13	82
2000	150	220	300	440	550	—	82	590	41	290	23	145
2400	155	235	310	470	700	930	125	980	64	486	31	240
2800	170	255	345	510	770	1030	150	1200	75	600	38	300
3200	200	295	395	590	890	1175	200	1600	100	800	50	400
3600	225	335	445	665	1000	1330	258	2068	129	1031	65	514
4000	250	375	495	745	1120	1490	322	2586	160	1290	81	645

TABLE C

U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

TABLE A- FACTOR M/LMTD = L x M

S/L	M	S/L	M	S/L	M	S/L	M
		.25	.541	.50	.721	.75	.870
.01	.215	.26	.549	.51	.728	.76	.864
.02	.251	.27	.558	.52	.734	.77	.879
.03	.277	.28	.566	.53	.740	.78	.886
.04	.298	.29	.574	.54	.746	.79	.890
.05	.317	.30	.582	.55	.753	.80	.896
.06	.334	.31	.589	.56	.759	.81	.902
.07	.350	.32	.597	.57	.765	.82	.907
.08	.364	.33	.604	.58	.771	.83	.913
.09	.378	.34	.612	.59	.777	.84	.918
.10	.391	.35	.619	.60	.783	.85	.923
.11	.403	.36	.626	.61	.789	.86	.928
.12	.415	.37	.634	.62	.795	.87	.934
.13	.427	.38	.641	.63	.801	.88	.939
.14	.438	.39	.648	.64	.806	.89	.944
.15	.448	.40	.655	.65	.813	.90	.949
.16	.458	.41	.662	.66	.818	.91	.955
.17	.469	.42	.669	.67	.823	.92	.959
.18	.478	.43	.675	.68	.829	.93	.964
.19	.488	.44	.682	.69	.836	.94	.970
.20	.497	.45	.689	.70	.840	.95	.975
.21	.506	.46	.695	.71	.848	.96	.979
.22	.515	.47	.702	.72	.852	.97	.986
.23	.524	.48	.709	.73	.658	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

R

TABLE B- LMTD correction factor for Multipass Exchangers

	.05	.1	.15	.2	.25	.3	.35	.4	.45	.5	.6	.7	.8	.9	1.0
.2	1	1	1	1	1	1	1	.999	.993	.984	.972	.942	.908	.845	.71
.4	1	1	1	1	1	1	.994	.983	.971	.959	.922	.855	.70		
.6	1	1	1	1	1	.992	.980	.965	.948	.923	.840				
.8	1	1	1	1	.995	.981	.965	.945	.916	.872					
1.0	1	1	1	1	.988	.970	.949	.918	.867	.770					
2.0	1	1	.977	.973	.940	.845	.740								
3.0	1	1	.997	.933	.835										
4.0	1	.993	.950	.850											
5.0	1	.982	.917												
6.0	1	.968	.885												
8.0	1	.930													
10.0	.996	.880													
12.0	.985	.720													
14.0	.972														
16.0	.958														
18.0	.940														
20.0	.915														

K

TABLE D- Surface Area

Model Number	Surface Area in Sq. ft.		Model Number	Surface Area in Sq. ft.		Model Number	Surface Area in Sq. ft.		Model Number	Surface Area in Sq. ft.	
	3/8" O.D. Tubing	5/8" O.D. Tubing		3/8" O.D. Tubing	5/8" O.D. Tubing		3/8" O.D. Tubing	5/8" O.D. Tubing		3/8" O.D. Tubing	5/8" O.D. Tubing
SRCS-1736	55.3	33.3	SRCS-2472	286.3	149.2	SRCS-3248	336.9	179.3	SRCS-36144	1324.0	730.0
SRCS-1748	73.8	44.5	SRCS-2484	334.0	174.1	SRCS-3260	421.1	224.1	SRCS-36156	1434.0	791.0
SRCS-1760	92.2	55.6	SRCS-2496	381.7	199.0	SRCS-3272	505.4	268.9	SRCS-36168	1544.0	852.0
SRCS-1772	110.7	66.7	SRCS-24108	429.4	223.8	SRCS-3284	589.6	313.8	SRCS-36180	1655.0	913.0
SRCS-1784	129.1	77.8	SRCS-24120	477.1	248.7	SRCS-3296	673.8	358.6			
SRCS-1796	147.6	89.0	SRCS-24132	524.8	273.6	SRCS-32108	758.1	403.4	SRCS-4048	545.8	299.7
SRCS-17108	166.1	100.1	SRCS-24144	572.5	298.5	SRCS-32120	842.3	448.3	SRCS-4060	682.3	374.7
						SRCS-32132	926.5	493.1	SRCS-4072	818.7	449.6
SRCS-2036	104.8	53.9	SRCS-2836	186.1	96.2	SRCS-32144	1010.8	537.9	SRCS-4084	955.2	524.5
SRCS-2048	139.8	72.0	SRCS-2848	248.1	128.2	SRCS-32156	1095.0	582.8	SRCS-4096	1091.7	599.5
SRCS-2060	174.7	90.0	SRCS-2860	310.2	160.5	SRCS-32168	1179.2	627.6	SRCS-40108	1228.0	674.4
SRCS-2072	209.7	108.0	SRCS-2872	372.2	192.4				SRCS-40120	1364.6	749.4
SRCS-2084	244.6	126.0	SRCS-2884	434.3	224.4	SRCS-3648	441.4	243.5	SRCS-40132	1501.0	824.3
SRCS-2096	279.6	144.0	SRCS-2896	496.3	256.5	SRCS-3660	551.7	304.3	SRCS-40144	1637.5	899.2
SRCS-20108	314.5	162.0	SRCS-28108	558.4	290.4	SRCS-3672	662.1	356.2	SRCS-40156	1774.0	974.2
SRCS-20120	349.5	180.0	SRCS-28120	620.4	320.7	SRCS-3684	772.4	426.1	SRCS-40168	1910.4	1049.1
			SRCS-28132	682.5	352.7	SRCS-3696	882.8	486.9	SRCS-40180	2046.9	1124.1
SRCS-2436	143.1	74.6	SRCS-28144	744.5	384.8	SRCS-36108	993.1	547.8			
SRCS-2448	190.9	99.5	SRCS-28156	806.6	416.9	SRCS-36120	1103.5	608.7			
SRCS-2460	238.6	124.4	SRCS-28168	868.6	448.9	SRCS-36132	1213.8	669.6			

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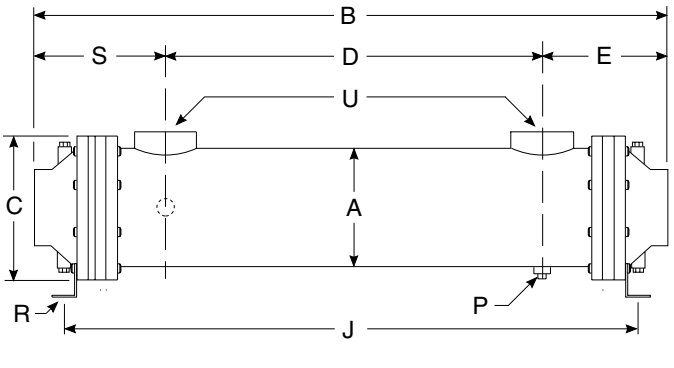
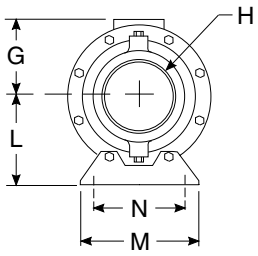
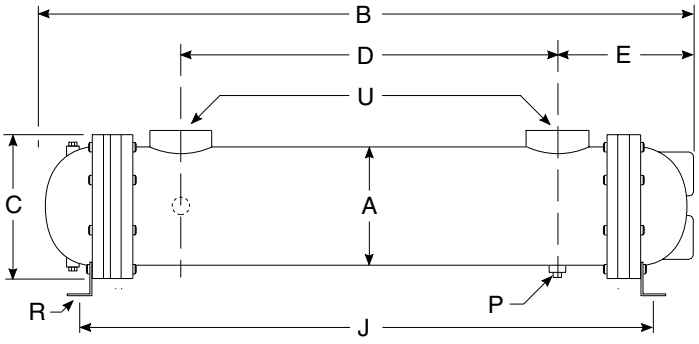
SRCS-1700 Series *dimensions*

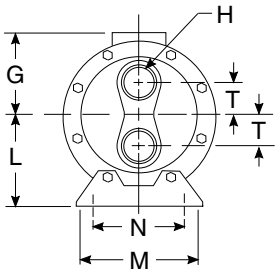




Model	B	S	E	H NPT
SRCS-1736	45.4	8.35	8.04	4.0
SRCS-1748	57.4			
SRCS-1760	69.4			
SRCS-1772	81.4			
SRCS-1784	93.4			
SRCS-1796	105.4			
SRCS-17108	117.4			

SINGLE PASS (SP)





Model	B	E	H NPT	T
SRCS-1736	44.5	7.88	2.5	1.88
SRCS-1748	56.5			
SRCS-1760	68.5			
SRCS-1772	80.5			
SRCS-1784	92.5			
SRCS-1796	104.5			
SRCS-17108	116.5			

TWO PASS (TP)

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J	L	M	N	P NPT	R	U NPT	Weight	Model
SRCS-1736	8.0	10.12	29.00	5.62	41.4	5.75	8.25	7.0	(2) .38	.44Ø x 1.00" Thru Slot	3.0	205	SRCS-1736
SRCS-1748			41.00		53.4							245	SRCS-1748
SRCS-1760			53.00		65.4							285	SRCS-1760
SRCS-1772			65.00		77.4							325	SRCS-1772
SRCS-1784			77.00		89.4							365	SRCS-1784
SRCS-1796			89.00		101.4							405	SRCS-1796
SRCS-17108			101.00		113.4							445	SRCS-17108

Notes

- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the end bonnet.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 1760 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

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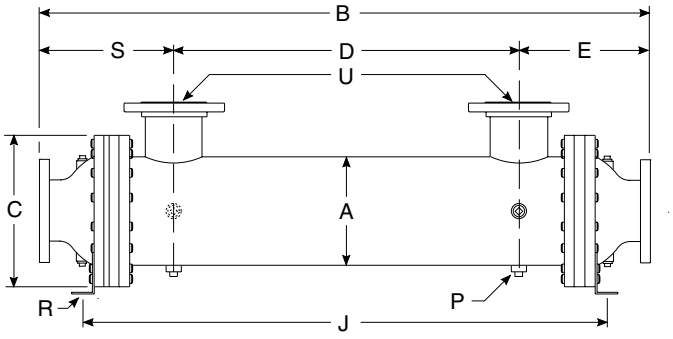
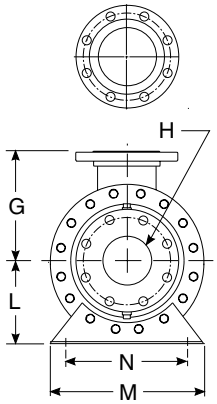
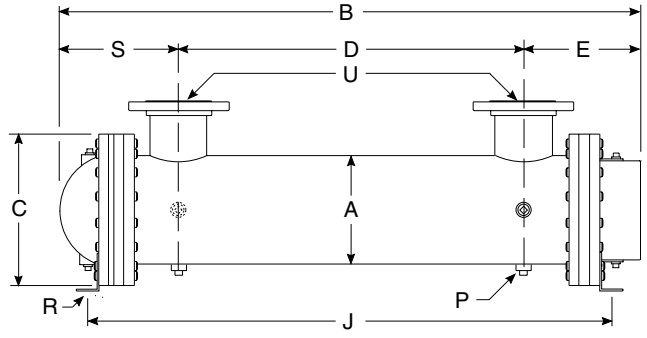
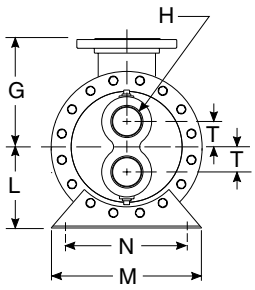




Model	B	S	E	H
SRCS-2036	53.40	14.38	13.90	5.0" ANSI Flange
SRCS-2048	65.40			
SRCS-2060	77.40			
SRCS-2072	89.40			
SRCS-2084	101.40			
SRCS-2096	113.40			
SRCS-20108	125.40			
SRCS-20120	137.40			

SINGLE PASS (SP)





Model	B	E	H NPT	T
SRCS-2036	49.2	11.94	3.00	2.50
SRCS-2048	61.2			
SRCS-2060	73.2			
SRCS-2072	85.2			
SRCS-2084	97.2			
SRCS-2096	109.2			
SRCS-20108	121.2			
SRCS-20120	133.2			

TWO PASS (TP)

COMMON DIMENSIONS & WEIGHTS

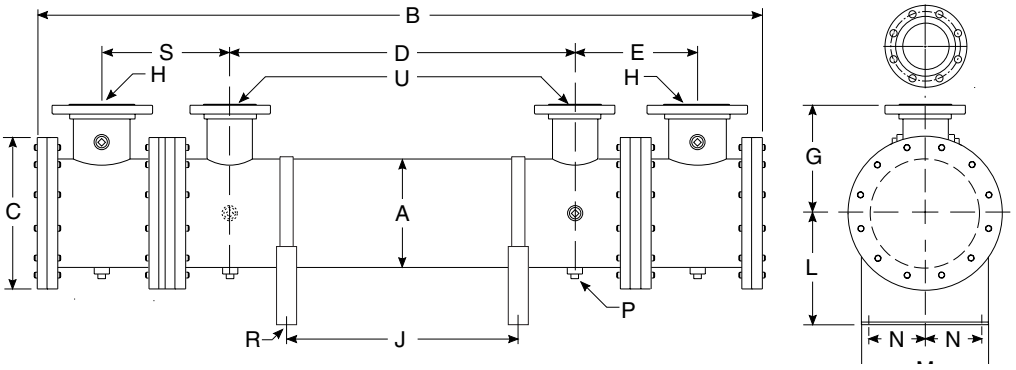
Model	A	C	D	G	J	L	M	N	P NPT	R	U	Weight	Model
SRCS-2036	10.75	15.00	26.00	10.75	44.63	8.0	12.0	5.0	(4x) .50	.75"Ø x 1.25" Thru Slot	4.00" ANSI Flange 150# RF	720	SRCS-2036
SRCS-2048			38.00		56.63							780	SRCS-2048
SRCS-2060			50.00		68.63							840	SRCS-2060
SRCS-2072			62.00		80.63							900	SRCS-2072
SRCS-2084			74.00		92.63							960	SRCS-2084
SRCS-2096			86.00		104.63							1020	SRCS-2096
SRCS-20108			98.00		116.63							1080	SRCS-20108
SRCS-20120			110.00		128.63							1150	SRCS-20120

Notes

- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the end bonnet.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 2060 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

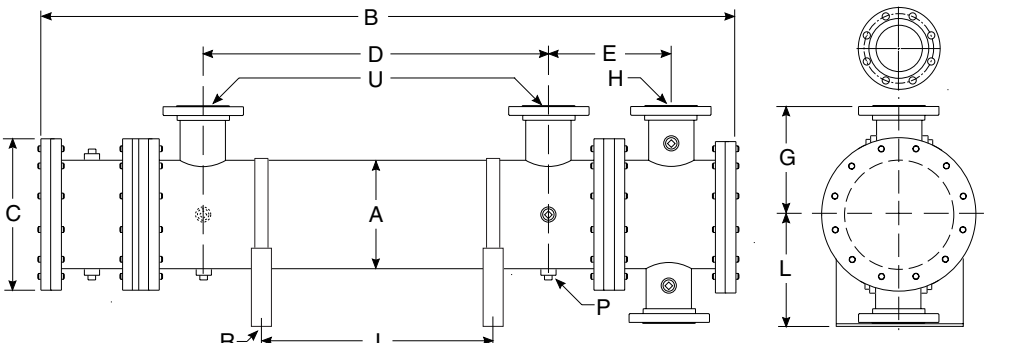
note: AIHTI reserves the right to make reasonable design changes without notice.

SRCS-2400 Series *dimensions*



SINGLE PASS (SP)

Model	B	E	H
SRCS-2436	70.63	15.56	8.0 ANSI Flange 150# RF
SRCS-2448	82.63		
SRCS-2460	94.63		
SRCS-2472	106.63		
SRCS-2484	118.63		
SRCS-2496	130.63		
SRCS-24108	142.63		
SRCS-24120	154.63		
SRCS-24132	166.63		
SRCS-24144	178.63		



TWO PASS (TP)

Model	B	E	H
SRCS-2436	70.63	15.56	6.0 ANSI Flange 150# RF
SRCS-2448	82.63		
SRCS-2460	94.63		
SRCS-2472	106.63		
SRCS-2484	118.63		
SRCS-2496	130.63		
SRCS-24108	142.63		
SRCS-24120	154.63		
SRCS-24132	166.63		
SRCS-24144	178.63		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J adjustable	L	M	N	P NPT	R	U	Weight	Model
SRCS-2436	12.75	16.25	24.00	11.38	13.00	12.00	12.75	5.00	.50 (10x)	.75"Ø x 1.00" Thru Slot	6.0 ANSI Flange 150# RF	1040	SRCS-2436
SRCS-2448			36.00		25.00							1130	SRCS-2448
SRCS-2460			48.00		37.00							1221	SRCS-2460
SRCS-2472			60.00		49.00							1312	SRCS-2472
SRCS-2484			72.00		61.00							1402	SRCS-2484
SRCS-2496			84.00		73.00							1493	SRCS-2496
SRCS-24108			96.00		85.00							1584	SRCS-24108
SRCS-24120			108.00		97.00							1675	SRCS-24120
SRCS-24132			120.00		109.00							1766	SRCS-24132
SRCS-24144			132.00		121.00							1857	SRCS-24144

Notes

- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the channel cover and channel.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 2460 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

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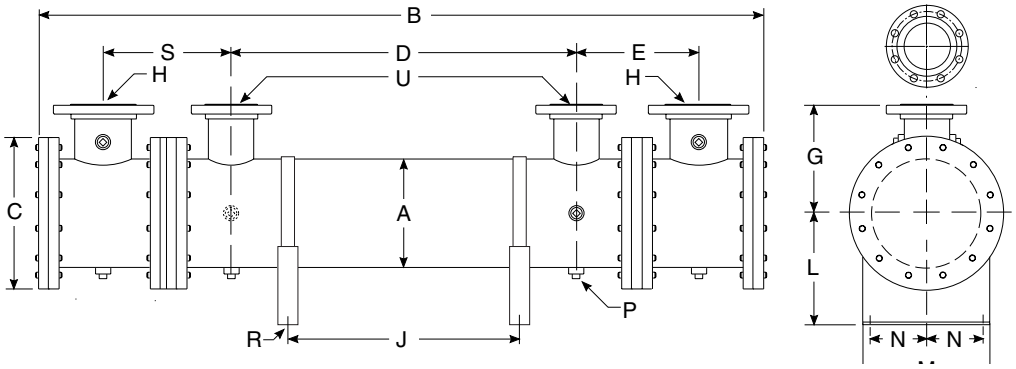
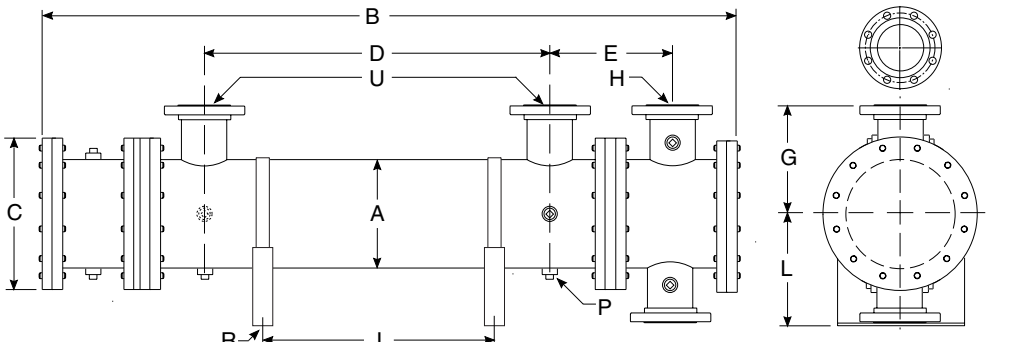


SINGLE PASS (SP)

Model	B	E	H
SRCS-2836	70.63	16.56	8.00" ANSI Flange 150# RF
SRCS-2848	82.63		
SRCS-2860	94.63		
SRCS-2872	106.63		
SRCS-2884	118.63		
SRCS-2896	130.63		
SRCS-28108	142.63		
SRCS-28120	154.63		
SRCS-28132	166.63		
SRCS-28144	178.63		
SRCS-28156	190.63		
SRCS-28168	202.63		



TWO PASS (TP)

Model	B	E	H
SRCS-2836	70.63	16.56	6.00" ANSI Flange 150# RF
SRCS-2848	82.63		
SRCS-2860	94.63		
SRCS-2872	106.63		
SRCS-2884	118.63		
SRCS-2896	130.63		
SRCS-28108	142.63		
SRCS-28120	154.63		
SRCS-28132	166.63		
SRCS-28144	178.63		
SRCS-28156	190.63		
SRCS-28168	202.63		

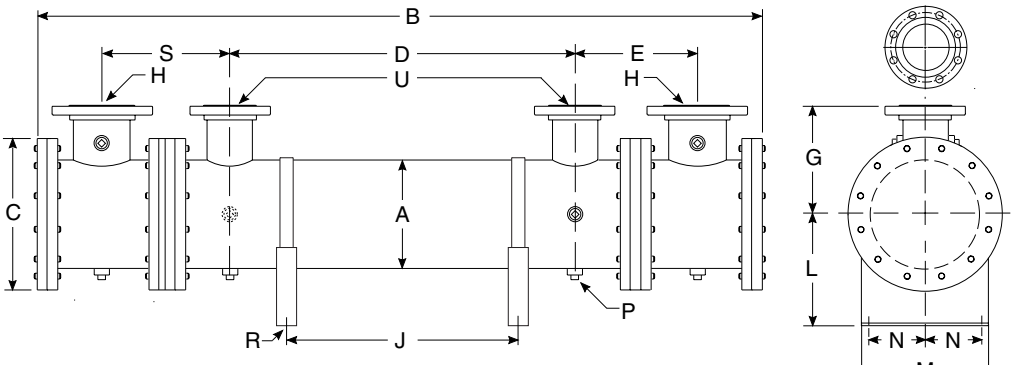
COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
SRCS-2836	14.00	18.00	22.00	12.00	9.00	13.00	14.00	5.00	.50 (10x)	.75"Ø x 1.00" Thru Slot	8.00" ANSI Flange 150# RF	1288	SRCS-2836
SRCS-2848			34.00		21.00							1400	SRCS-2848
SRCS-2860			46.00		33.00							1512	SRCS-2860
SRCS-2872			58.00		45.00							1624	SRCS-2872
SRCS-2884			70.00		57.00							1736	SRCS-2884
SRCS-2896			82.00		69.00							1848	SRCS-2896
SRCS-28108			94.00		81.00							1960	SRCS-28108
SRCS-28120			106.00		93.00							2072	SRCS-28120
SRCS-28132			112.00		105.00							2184	SRCS-28132
SRCS-28144			130.00		117.00							2296	SRCS-28144
SRCS-28156			142.00		129.00							2408	SRCS-28156
SRCS-28168			154.00		141.00							2520	SRCS-28168

Notes

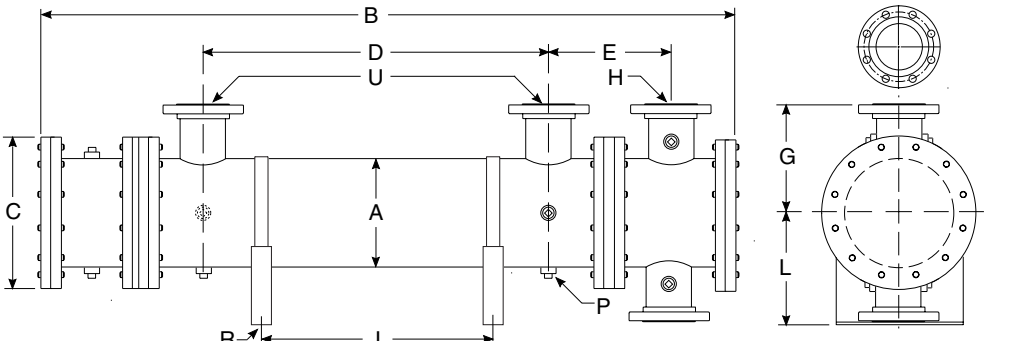
- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the channel cover and channel.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 2860 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

SRCS-3200 Series *dimensions*



SINGLE PASS (SP)

Model	B	E	H
SRCS-3248	87.63	18.13	10.00" ANSI Flange 150# RF
SRCS-3260	99.63		
SRCS-3272	111.63		
SRCS-3284	123.63		
SRCS-3296	135.63		
SRCS-32108	147.63		
SRCS-32120	159.63		
SRCS-32132	171.63		
SRCS-32144	183.63		
SRCS-32156	195.63		
SRCS-32168	207.63		



TWO PASS (TP)

Model	B	E	H
SRCS-3248	82.75	18.13	6.00" ANSI Flange 150# RF
SRCS-3260	94.75		
SRCS-3272	106.75		
SRCS-3284	118.75		
SRCS-3296	130.75		
SRCS-32108	142.75		
SRCS-32120	154.75		
SRCS-32132	166.75		
SRCS-32144	178.75		
SRCS-32156	190.75		
SRCS-32168	202.75		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
SRCS-3248	16.00	20.00	34.00	13.00	21.00	14.00	16.00	6.00	.50 (10x)	.781"Ø x 1.50" Thru Slot	8.00" ANSI Flange 150# RF	2377	SRCS-3248
SRCS-3260			46.00		33.00							1975	SRCS-3260
SRCS-3272			58.00		45.00							2121	SRCS-3272
SRCS-3284			70.00		57.00							2266	SRCS-3284
SRCS-3296			82.00		69.00							2414	SRCS-3296
SRCS-32108			94.00		81.00							2558	SRCS-32108
SRCS-32120			106.00		93.00							2705	SRCS-32120
SRCS-32132			112.00		105.00							2852	SRCS-32132
SRCS-32144			130.00		117.00							2999	SRCS-32144
SRCS-32156			142.00		129.00							3146	SRCS-32156
SRCS-32168			154.00		141.00							3293	SRCS-32168

Notes

- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the channel cover and channel.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 3260 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

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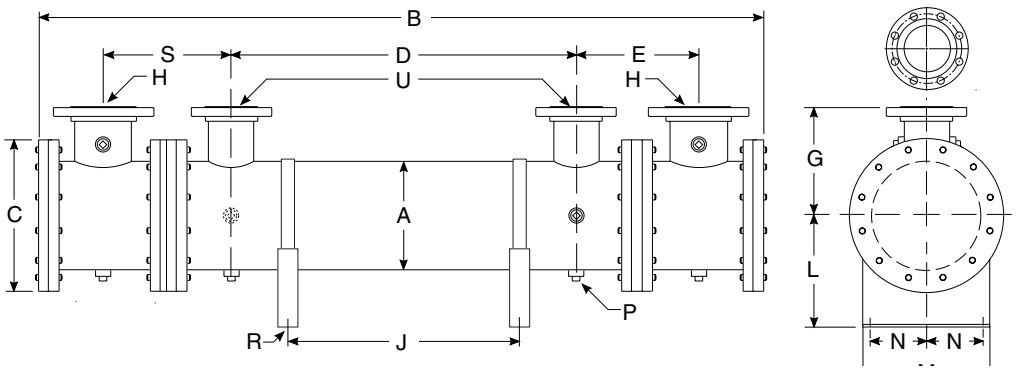
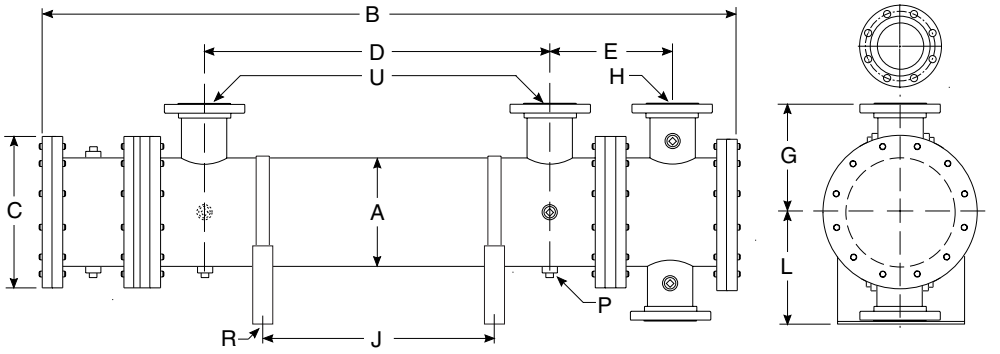


SINGLE PASS (SP)

Model	B	E	H
SRCS-3648	87.63	19.13	10.00" ANSI Flange 150# RF
SRCS-3660	99.63		
SRCS-3672	111.63		
SRCS-3684	123.63		
SRCS-3696	135.63		
SRCS-36108	147.63		
SRCS-36120	159.63		
SRCS-36132	171.63		
SRCS-36144	183.63		
SRCS-36156	195.63		
SRCS-36168	207.63		
SRCS-36180	219.63		



TWO PASS (TP)

Model	B	E	H
SRCS-3648	87.63	19.13	8.00" ANSI Flange 150# RF
SRCS-3660	99.63		
SRCS-3672	111.63		
SRCS-3684	123.63		
SRCS-3696	135.63		
SRCS-36108	147.63		
SRCS-36120	159.63		
SRCS-36132	171.63		
SRCS-36144	183.63		
SRCS-36156	195.63		
SRCS-36168	207.63		
SRCS-36180	219.63		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
SRCS-3648	18.00	22.00	32.00	14.00	17.00	15.00	16.00	7.00	.50 (6X)	.781"Ø x 1.50" Thru Slot	10.00" ANSI Flange 150# RF	2314	SRCS-3648
SRCS-3660			44.00		29.00							2498	SRCS-3660
SRCS-3672			56.00		41.00							2684	SRCS-3672
SRCS-3684			68.00		53.00							2869	SRCS-3684
SRCS-3696			80.00		65.00							3054	SRCS-3696
SRCS-36108			92.00		77.00							3239	SRCS-36108
SRCS-36120			104.00		89.00							3424	SRCS-36120
SRCS-36132			116.00		101.00							3609	SRCS-36132
SRCS-36144			128.00		113.00							3794	SRCS-36144
SRCS-36156			140.00		125.00							3979	SRCS-36156
SRCS-36168			152.00		137.00							4164	SRCS-36168
SRCS-36180			164.00		149.00							4349	SRCS-36180

Notes

- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the channel cover and channel.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 3660 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

note: AIHTI reserves the right to make reasonable design changes without notice.

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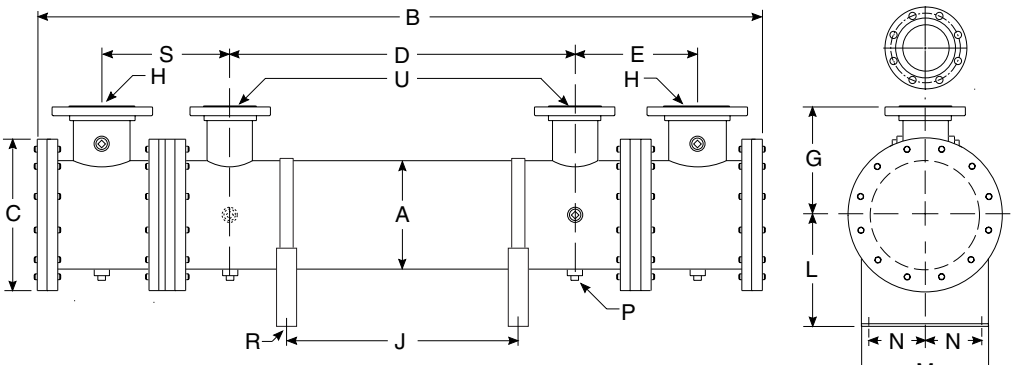
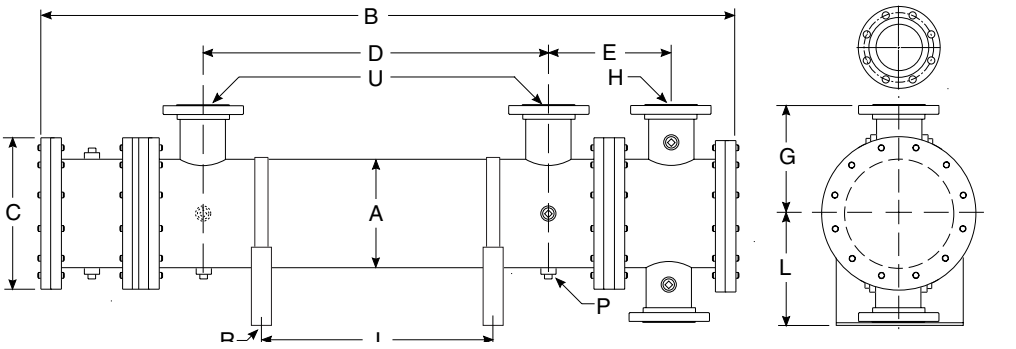
SRCS-4000 Series *dimensions*



SINGLE PASS (SP)

Model	B	E	H
SRCS-4048	93.68	20.68	12.00" ANSI Flange 150# RF
SRCS-4060	105.68		
SRCS-4072	117.68		
SRCS-4084	129.68		
SRCS-4096	141.68		
SRCS-40108	153.68		
SRCS-40120	165.68		
SRCS-40132	177.68		
SRCS-40144	189.68		
SRCS-40156	201.68		
SRCS-40168	213.68		
SRCS-40180	225.68		



TWO PASS (TP)

Model	B	E	H
SRCS-4048	93.68	20.68	8.00" ANSI Flange 150# RF
SRCS-4060	105.68		
SRCS-4072	117.68		
SRCS-4084	129.68		
SRCS-4096	141.68		
SRCS-40108	153.68		
SRCS-40120	165.68		
SRCS-40132	177.68		
SRCS-40144	189.68		
SRCS-40156	201.68		
SRCS-40168	213.68		
SRCS-40180	225.68		

COMMON DIMENSIONS & WEIGHTS

Model	A	C	D	G	J maximum	L	M	N	P NPT	R	U	Weight	Model
SRCS-4048	20.00	25.00	32.00	16.00	17.00	17.00	20.00	8.00	.50 (6X)	.781"Ø x 1.50" Thru Slot	10.00" ANSI Flange 150# RF	2856	SRCS-4048
SRCS-4060			44.00		29.00							3085	SRCS-4060
SRCS-4072			56.00		41.00							3313	SRCS-4072
SRCS-4084			68.00		53.00							3542	SRCS-4084
SRCS-4096			80.00		65.00							3770	SRCS-4096
SRCS-40108			92.00		77.00							3999	SRCS-40108
SRCS-40120			104.00		89.00							4227	SRCS-40120
SRCS-40132			116.00		101.00							4456	SRCS-40132
SRCS-40144			128.00		113.00							4686	SRCS-40144
SRCS-40156			140.00		125.00							4916	SRCS-40156
SRCS-40168			152.00		137.00							5146	SRCS-40168
SRCS-40180			164.00		149.00							5376	SRCS-40180

Notes

- Provide sufficient clearance at the stationary tube-sheet end to allow for the complete removal of the tube bundle from the shell. On the floating tube-sheet end provide space to permit removal of the channel cover and channel.
- Tube bundle removal minimum space required is the model length in inches plus six inches.
  Example: SRCS 4060 Effective Tube Length 60" + 6" + channel width = minimum clearance.
- When removing bundle from shell the weight of the tube bundle should not be supported on individual tubes. Weight should be distributed on the tube sheets, support baffle plates, or on blocks contoured to the periphery of the tube bundle.
- SRCS Series tube bundle is removable for replacement bundles (consult factory)
- It is recommended that when a heat exchanger is disassembled, new gaskets and O-rings be used in reassembly.
- Replacement gasket and O-ring seal part numbers are available, for more information (consult factory)

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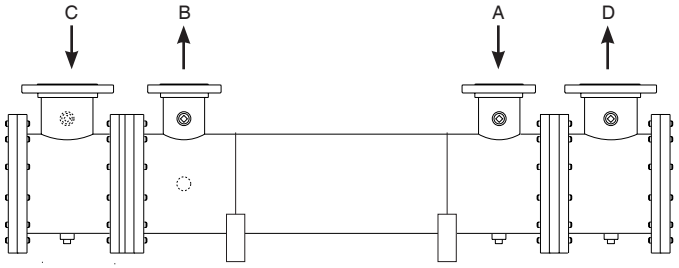
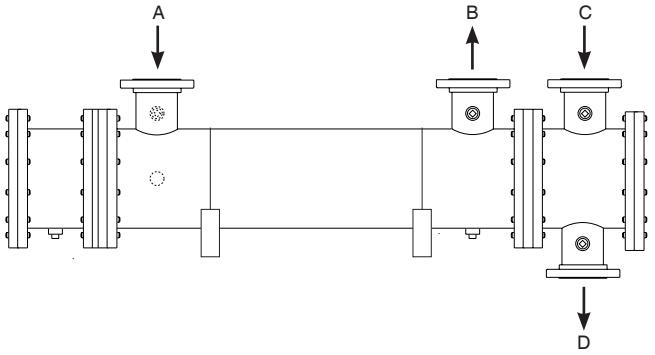
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass



SINGLE PASS



TWO PASS

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.

Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

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g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the installation diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of two pass or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For removable bundle heat exchangers, provide sufficient clearance at the stationary tube-sheet end to allow for the removal of the tube bundle from the shell. Channel cover can be removed to aid in cleaning the tubes without disassembling the tube bundle. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

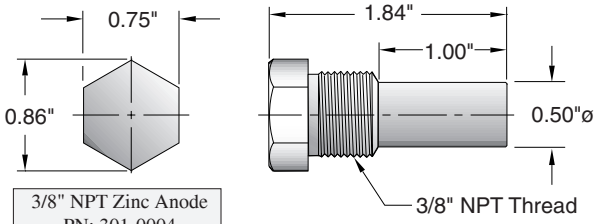
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

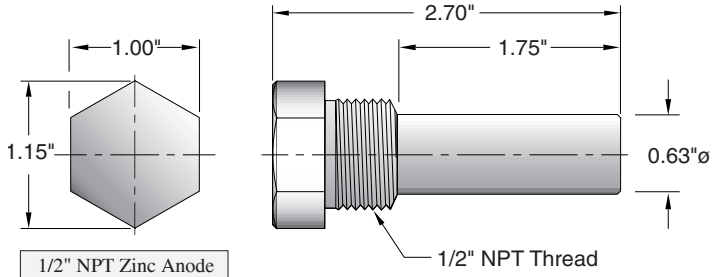
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc… .Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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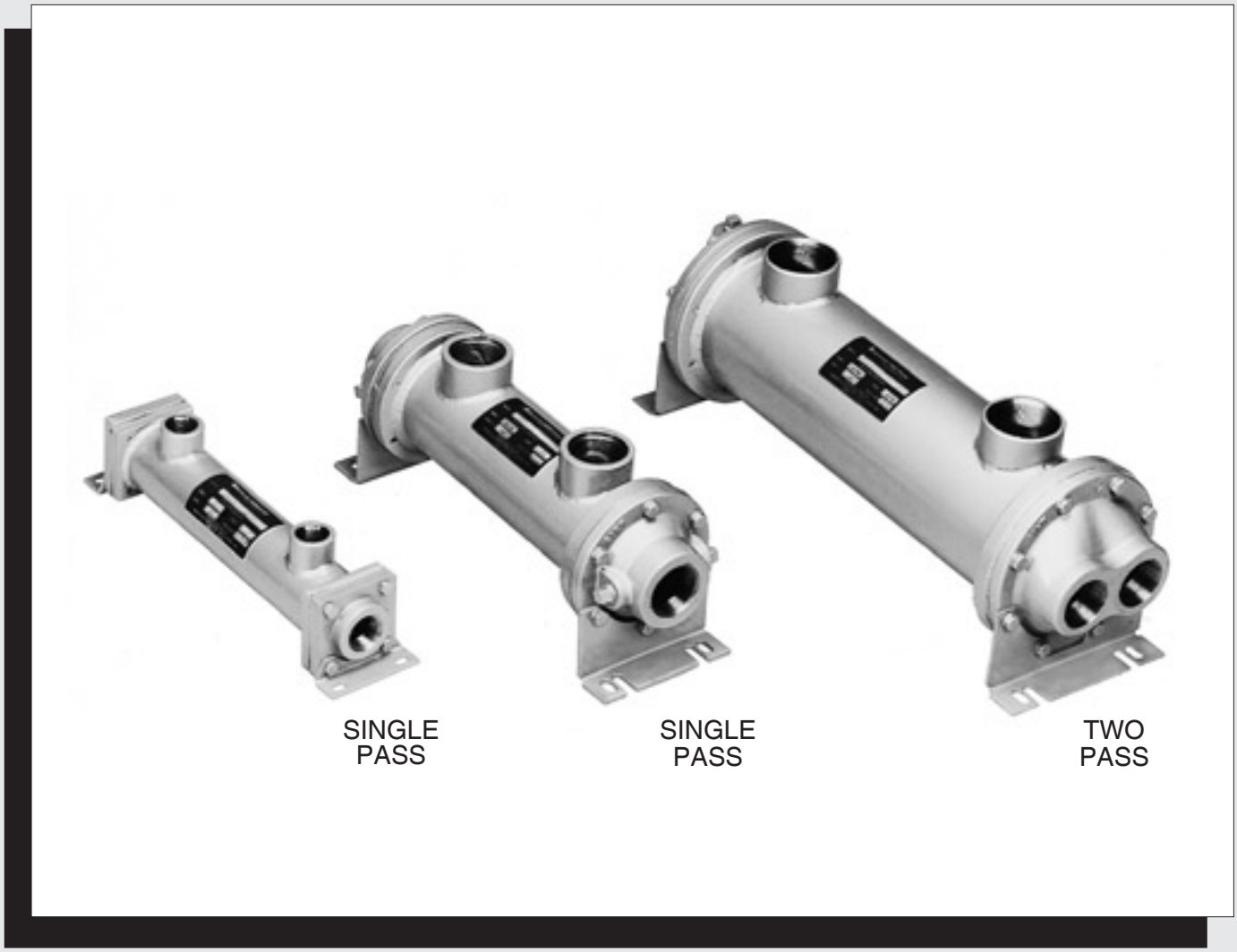

Fixed Tube Bundle / Liquid Cooled

HEAT EXCHANGERS

- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 300 PSI.
- Operating temperature 300 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

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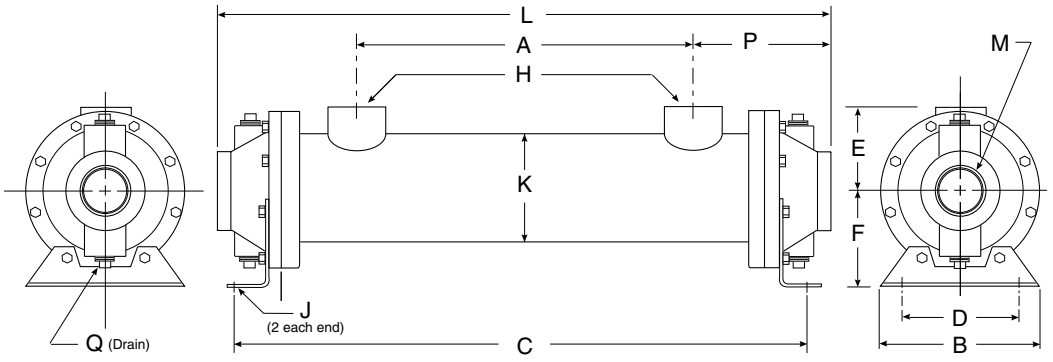
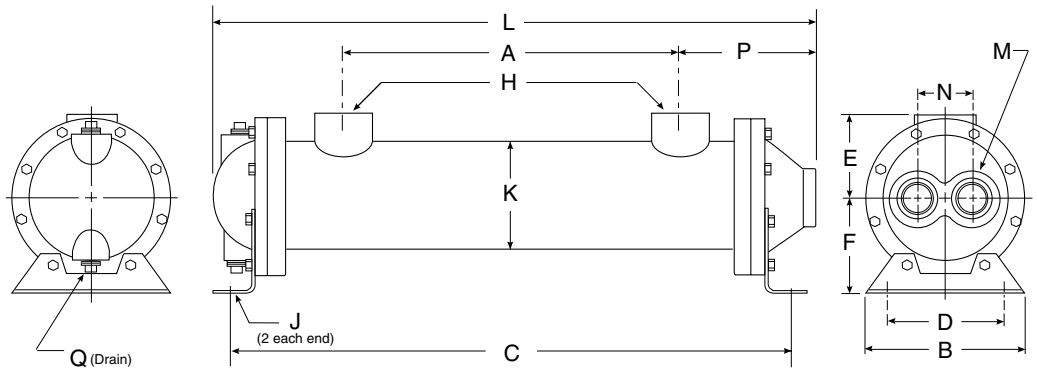
CK & CKS Series *dimensions*



Model	L	M NPT	P	S NPT
CK-505	7.38	.75	3.35	---
CK-508	10.38			
CK-510	12.38			
CK-512	14.38			
CK-514	16.38			
CK-518	20.38			
CK-524	26.38			
CK-536	38.38			
CK-708	12.57	1.25	4.78	(2) .38
CK-712	16.57			
CK-714	18.57			
CK-718	22.57			
CK-724	28.57			
CK-736	40.57			
CK-1012	17.02	2.00	5.17	(2) .38
CK-1014	19.02			
CK-1018	23.02			
CK-1024	29.03			
CK-1036	41.02			
CK-1048	53.02			

SINGLE PASS (SP)



Model	L	M NPT	N	P	Q NPT
CK-708	12.44	1.00	1.76	4.85	(2) .38
CK-714	16.44				
CK-718	18.44				
CK-724	22.44				
CK-736	40.44				
CK-1012	16.71	1.50	2.38	5.17	(2) .38
CK-1014	18.71				
CK-1018	22.71				
CK-1024	28.71				
CK-1036	40.71				
CK-1048	52.71				

TWO PASS (TP)

COMMON DIMENSIONS & WEIGHTS

Model	A	B	C	D	E	F	H NPT	H SAE	J	K	Approx. Weight	Model
CK-505	2.19	3.50	7.44	2.50	2.28	1.62	.50	#8	.34ϕ x .62	2.55	7.00	CK-505
CK-508	3.85		10.44				.75	#12 1 1/16 -12			7.50	CK-508
CK-510	5.85		12.44								8.00	CK-510
CK-512	7.85		14.44								8.50	CK-512
CK-514	9.85		16.44								9.00	CK-514
CK-518	13.85		20.44								9.50	CK-518
CK-524	19.85		26.44								10.50	CK-524
CK-536	31.85		38.44								11.50	CK-536
CK-708	3.00	5.00	10.71	3.00	2.84	2.69	1.50	#24 1 7/8 -12	.44ϕ x .75	3.75	15.00	CK-708
CK-712	7.00		14.71								17.50	CK-712
CK-714	9.00		16.71								18.50	CK-714
CK-718	13.00		20.71								20.00	CK-718
CK-724	19.00		26.71								22.00	CK-724
CK-736	31.00		38.71								24.50	CK-736
CK-1012	6.18	6.50	15.45	4.00	3.62	4.00	2.00	#32 2 1/2 -12	.44ϕ x 1.00	5.25	38.00	CK-1012
CK-1014	8.18		17.45								40.00	CK-1014
CK-1018	12.18		21.45								44.50	CK-1018
CK-1024	18.18		27.45								51.00	CK-1024
CK-1036	30.18		39.45								57.00	CK-1036
CK-1048	42.18		51.45								64.00	CK-1048

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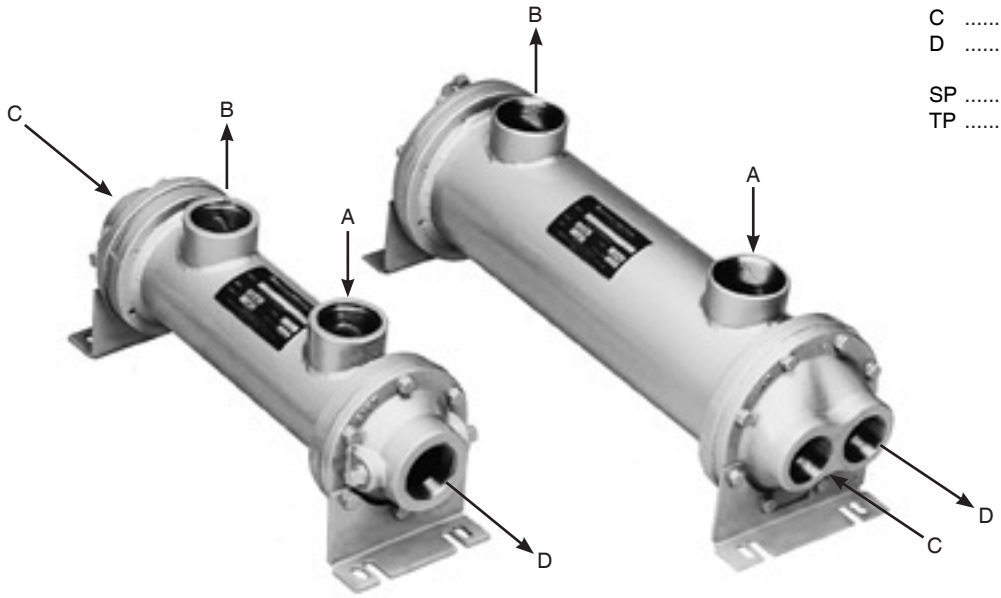
PIPING HOOK-UP

A ..... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass



ONE PASS **TWO PASS**

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.

Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the

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hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of single pass, two pass, or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

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j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

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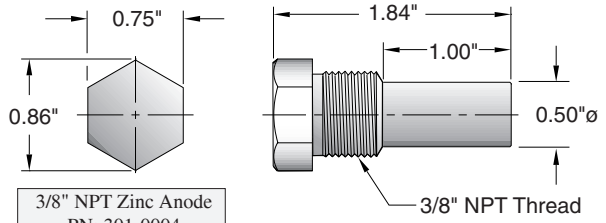
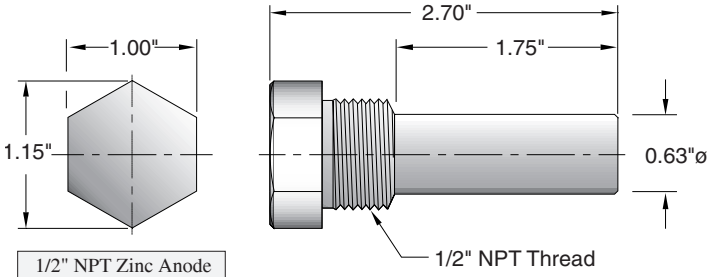


3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

URTC SERIES

U-TUBE REMOVABLE TUBE BUNDLE

HEAT EXCHANGERS

- Available in a variety of sizes.
- Operating pressure for tubes 150 PSI.
- Operating pressure for shell 150 PSI.
- Operating temperature 350 °F.
- Can be customized to fit your needs.
- Cools: Temperature controllers, high temperature lubrication equipment, etc.

note: AIHTI reserves the right to make reasonable design changes without notice.

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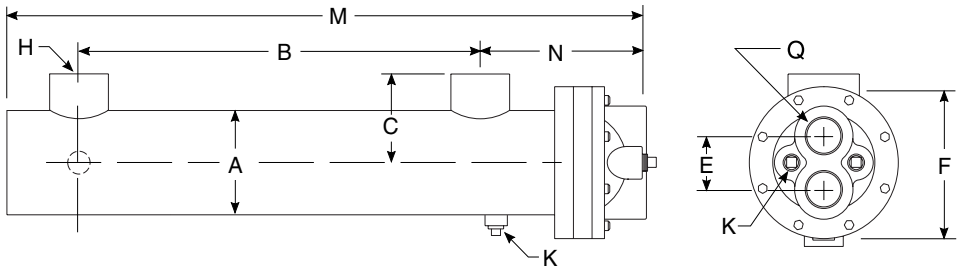
URTC Series *dimensions*

- 12 standard models available
- 500°F continuous operation
- U-Tube Removable Bundle construction
- Can be modified to fit specific needs

High temperature design heat exchangers for hot oil heating and cooling units for plastic injection molding machines. Heat exchanger allows for a large temperature differential between the hot uid and cooling uid making it ideal for high temperature liquid cool down or maintaining liquid at high temperature.



DIMENSIONS

Model	M	N	Q NPT
URTC-614	18.87		
URTC-624	28.87	5.34	1.00
URTC-630	34.87		
URTC-814	18.75		
URTC-824	28.75	5.59	1.25
URTC-830	34.75		
URTC-1014	18.86		
URTC-1024	28.86	5.71	1.50
URTC-1030	34.86		
URTC-1214	19.16		
URTC-1224	29.16	6.26	2.00
URTC-1230	35.16		

COMMON DIMENSIONS

Model	A	B	C	E	F	H NPT	K NPT	Tube Dia.	Model
URTC-614-94107 URTC-624-94108 URTC-630-94109	3.25	12.00 22.00 28.00	2.75	2.00	4.25	1.00	(2) .38	.25	URTC-614-94107 URTC-624-94108 URTC-630-94109
URTC-814-94110 URTC-824-94111 URTC-830-94112	4.25	11.25 21.25 27.25	3.25	2.12	6.00	1.50	(4) .38	.25	URTC-814-94110 URTC-824-94111 URTC-830-94112
URTC-1014-94113 URTC-1014-94114 URTC-1024-94115 URTC-1024-94116 URTC-1030-94117 URTC-1030-94118	5.25	11.25 11.25 21.25 21.25 27.25 27.25	3.75	2.38	7.00	1.50	(2) .38	.25 .375 .25 .375 .25 .375	URTC-1014-94113 URTC-1014-94114 URTC-1024-94115 URTC-1024-94116 URTC-1030-94117 URTC-1030-94118
URTC-1214-94119 URTC-1214-94120 URTC-1224-94121 URTC-1224-94122 URTC-1230-94123 URTC-1230-94124	6.25	10.75 10.75 20.75 20.75 26.75 26.75	4.25	2.88	8.00	2.00	(2) .38	.25 .375 .25 .375 .25 .375	URTC-1214-94119 URTC-1214-94120 URTC-1224-94121 URTC-1224-94122 URTC-1230-94123 URTC-1230-94124

STANDARD CONSTRUCTION MATERIALS & RATINGS

Construction Material		Optional Material	Standard Unit Ratings
Shell	Steel	Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 150 psig Operating Temperature 350 °F
Tubes	Copper	90/10 Cu. Ni. / S. Steel	
Baf e	Brass	Brass	
End Bonnet	Cast Iron	Brass / Stainless Steel	
Gasket	High Temperature Gasket		

SURFACE AREA

Model Number	Surface Area in Sq.ft.		Model Number	Surface Area in Sq.ft.	
	1 / 4" O.D. Tubing	3 / 8" O.D. Tubing		1 / 4" O.D. Tubing	3 / 8" O.D. Tubing
URTC-614	3.66	—	URTC-1014	10.99	5.95
URTC-624	6.28		URTC-1024	18.85	10.21
URTC-630	7.85		URTC-1030	23.56	12.76
URTC-814	7.02	—	URTC-1214	14.96	10.99
URTC-824	12.04		URTC-1224	25.65	18.84
URTC-830	15.05		URTC-1230	32.07	23.56

NOTE: We reserve the right to make reasonable design changes without notice.

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Manufacturer of Quality Heat Exchangers

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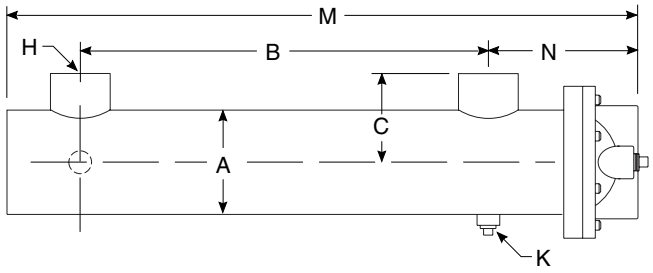

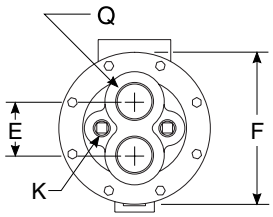

DIMENSIONS

Model	M	N	Q NPT
UTC-614	18.12	4.59	1.00
UTC-624	28.12		
UTC-630	34.12		
UTC-814	18.00	4.84	1.25
UTC-824	28.00		
UTC-830	34.00		
UTC-1014	18.11	4.96	1.50
UTC-1024	28.11		
UTC-1030	34.11		
UTC-1214	18.41	5.51	2.00
UTC-1224	28.41		
UTC-1230	34.41		

COMMON DIMENSIONS

Model	A	B	C	E	F	H NPT	K NPT	Tube Dia.	Model
UTC-614-94082 UTC-624-94083 UTC-630-94084	3.25	12.00 22.00 28.00	2.75	2.00	4.25	1.00	(2) .38	.25	UTC-614-94082 UTC-624-94083 UTC-630-94084
UTC-814-94085 UTC-824-94086 UTC-830-94087	4.25	11.25 21.25 27.25	3.25	2.12	6.00	1.50	(4) .38	.25	UTC-814-94085 UTC-824-94086 UTC-830-94087
UTC-1014-94088 UTC-1014-94089 UTC-1024-94090 UTC-1024-94091 UTC-1030-94092 UTC-1030-94093	5.25	11.25 11.25 21.25 21.25 27.25 27.25	3.75	2.38	7.00	1.50	(2) .38	.25 .375 .25 .375 .25 .375	UTC-1014-94088 UTC-1014-94089 UTC-1024-94090 UTC-1024-94091 UTC-1030-94092 UTC-1030-94093
UTC-1214-94094 UTC-1214-94095 UTC-1224-94096 UTC-1224-94097 UTC-1230-94098 UTC-1230-94099	6.25	10.75 10.75 20.75 20.75 26.75 26.75	4.25	2.88	8.00	2.00	(2) .38	.25 .375 .25 .375 .25 .375	UTC-1214-94094 UTC-1214-94095 UTC-1224-94096 UTC-1224-94097 UTC-1230-94098 UTC-1230-94099

STANDARD CONSTRUCTION MATERIALS & RATINGS

Construction Material		Optional Material	Standard Unit Ratings
Shell	Steel	Steel	Operating Pressure Tubes 150 psig Operating Pressure Shell 150 psig Operating Temperature 350 °F
Tubes	Copper	90/10 Cu. Ni. / S. Steel	
Baf e	Brass	Brass	
End Bonnet	Cast Iron	Brass / Stainless Steel	
Gasket	High Temperature Gasket		

SURFACE AREA

Model Number	Surface Area in Sq.ft. 1 / 4" O.D. Tubing	3 / 8" O.D. Tubing	Model Number	Surface Area in Sq.ft. 1 / 4" O.D. Tubing	3 / 8" O.D. Tubing
UTC-614	3.66	—	UTC-1014	10.99	5.95
UTC-624	6.28		UTC-1024	18.85	10.21
UTC-630	7.85		UTC-1030	23.56	12.76
UTC-814	7.02	—	UTC-1214	14.96	10.99
UTC-824	12.04		UTC-1224	25.65	18.84
UTC-830	15.05		UTC-1230	32.07	23.56

NOTE: We reserve the right to make reasonable design changes without notice.

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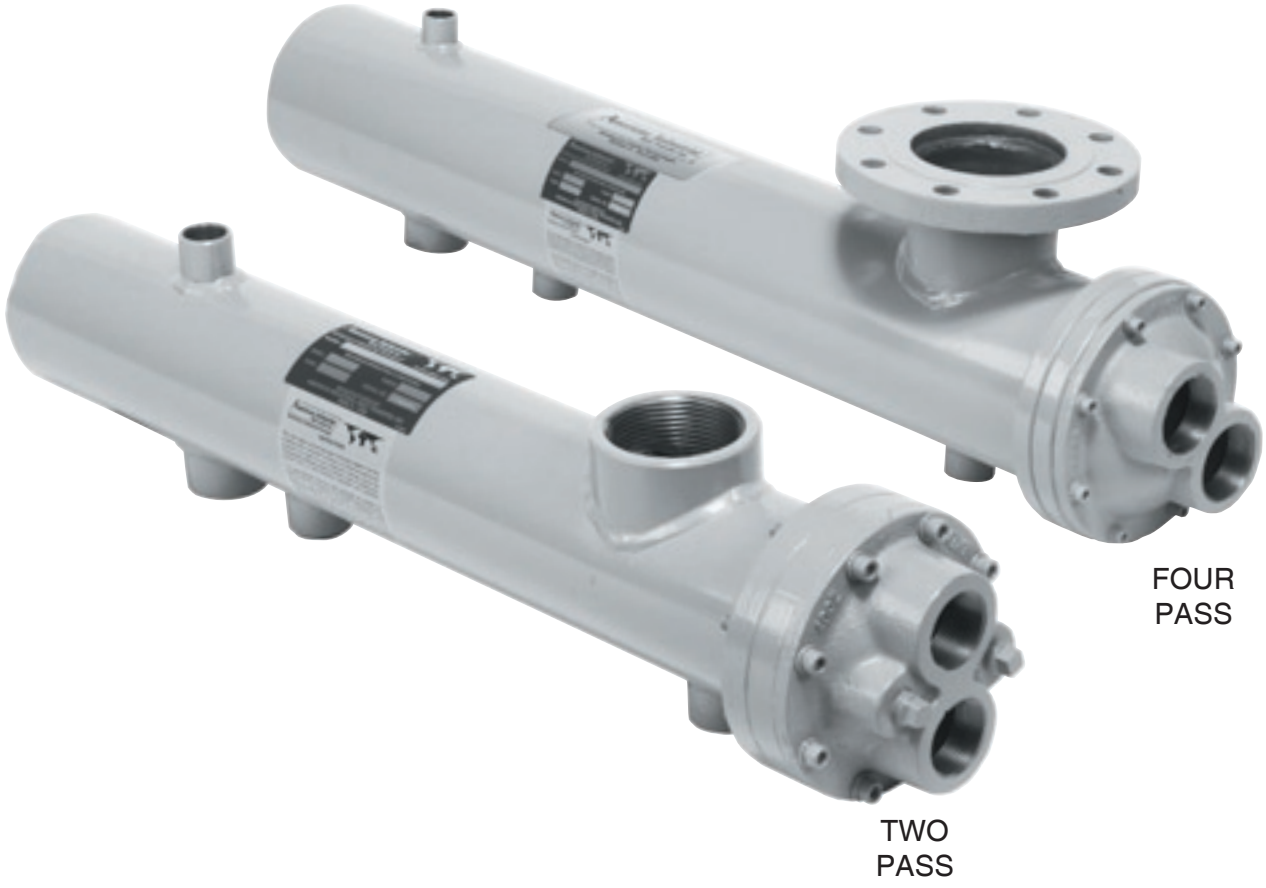
American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

URCS OEM SERIES



FOUR PASS

TWO PASS

U-TUBE REMOVABLE TUBE BUNDLE

HEAT EXCHANGERS

- Operating pressure for tubes 100 PSI.
- Operating pressure for shell 100 PSI.
- Operating temperature 400 °F.
- Can be customized to fit your needs.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.

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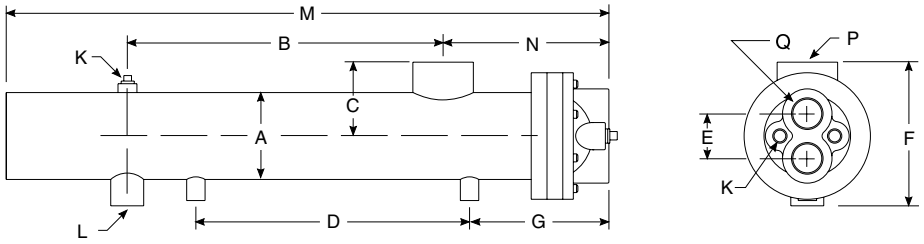
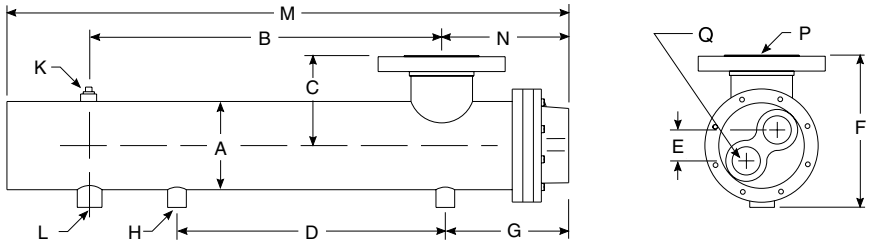
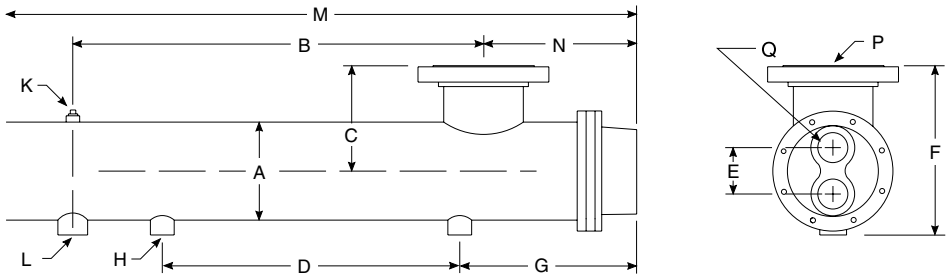
URCS OEM Series *dimensions*



URCS-830



URCS-1230, URCS-1242, URCS-1254



URCS-1754

COMMON DIMENSIONS

MODEL	A	B	C	D	E	F	G	H NPT	K NPT	L NPT	M	N	P	Q NPT	WEIGHT
URCS-830-25180	4.25	15.00	3.56	13.00	2.38	6.81	5.75	1.00	.38	1.25	28.63	7.88	2.5" NPT	1.25	35
URCS-1230-25182	6.25	13.00	6.38	13.00	3.12	10.75	5.75	1.00	—	1.50	27.75	9.00	4" ANSI	2.00	69
URCS-1242-25183	6.25	25.00	6.38	19.00	3.12	10.75	8.75	1.00	—	1.50	39.75	9.00	4" ANSI	2.00	87
URCS-1254-25184	6.25	37.00	6.38	25.00	3.12	10.75	11.75	1.00	—	1.50	51.75	9.00	4" ANSI	2.00	105
URCS-1754-25185	8.00	34.50	8.75	25.00	4.50	14.00	14.88	1.25	—	2.00	53.00	12.88	6" ANSI	2.50	187

STANDARD CONSTRUCTION MATERIALS & RATINGS

Construction Material		Optional Material	Standard Unit Ratings
Shell	Steel	Steel	Operating Pressure Tubes 100 psig Operating Pressure Shell 100 psig Operating Temperature 400 °F
Tubes	Copper	90/10 Cu. Ni. / S. Steel	
Baffle	Brass	Brass	
End Bonnet	Cast Iron	Brass / Stainless Steel	
Gasket	Viton O-Ring		

SURFACE AREA

Model Number	Surface Area in Sq.ft.	
	1 / 4" O.D. Tubing	3 / 8" O.D. Tubing
URCS-830-25180	15.0	—
URCS-1230-25182	—	21.5
URCS-1242-25183	—	30.2
URCS-1254-25184	—	88.8
URCS-1754-25185	—	72.4

note: AIHTI reserves the right to make reasonable design changes without notice.

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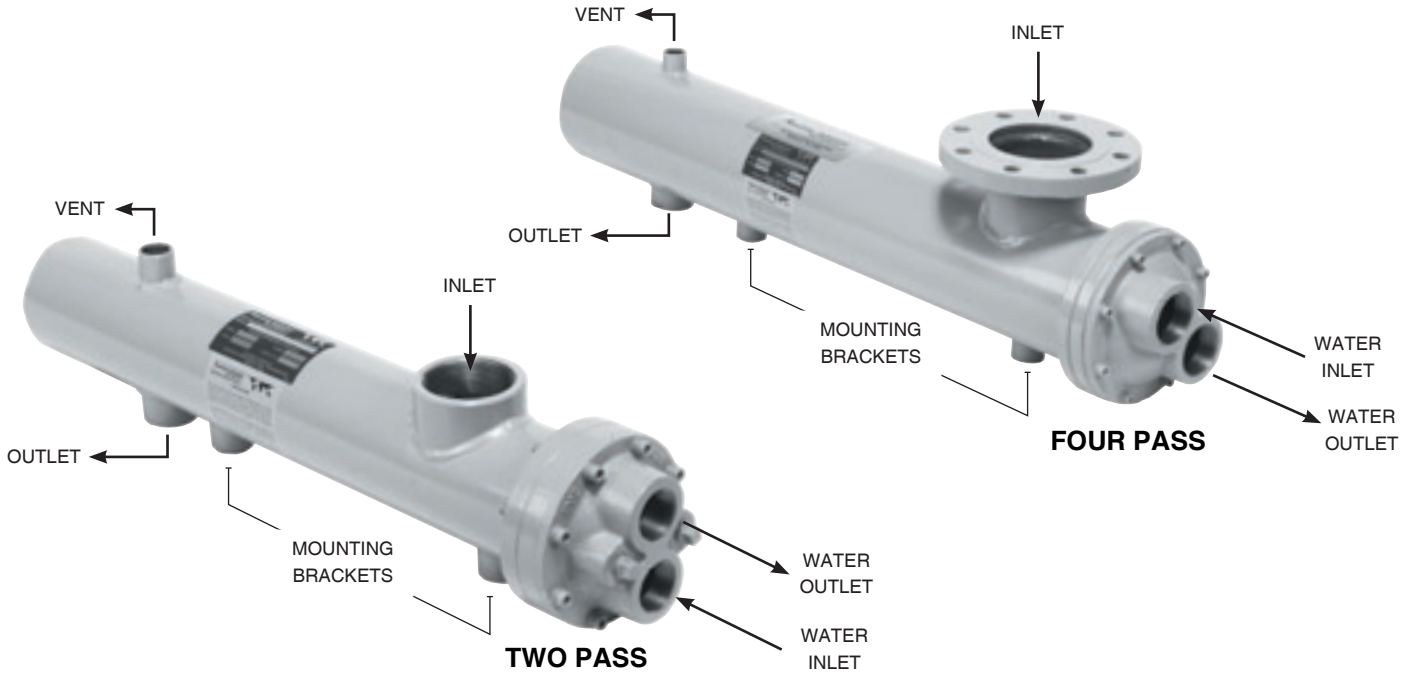
PIPING HOOK-UP



Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.

Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of ushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate grade of oil or apply a corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model

rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the hot uid to be cooled through the shell side and the cold uid through the tube side. The indicated port assembly sequence in the installation diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the uids are required to be reversed, *hot uid in the tubes and cold uid in the shell* the heat exchanger will work with reduced performance. Installation may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of two pass or four pass construction. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a uid, or mineral deposit buildup.
For removable bundle heat exchangers, provide sufficient clearance at the stationary tube-sheet end to allow for the removal of the tube bundle from the shell. Bonnet can be removed to aid in cleaning the tubes without disassembling the tube bundle. For more information please contact American Industrial.

h) It is recommended to use exible hose wherever possible to reduce vibration and allow slight movement. However, hoses are not required. Hydraulic carrying lines should be sized to handle the appropriate ow and to meet system pressure drop requirements based upon the systems parameters, and not based upon the units supply and return connection size. We recommend that a low cracking pressure direct acting relief valve be installed at the heat exchanger inlet to protect it from pressure spikes by bypassing oil in the event the system experiences a high ow surge. If preventative filtration is used it should be located ahead of the cooler on both shell and tube side to catch any scale or sludge from the system before it enters the cooler. Failure to install filters ahead of the heat exchanger could lead to possible heat exchanger failure due to high pressure if the system filters plug.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side uid and the entering tube side uid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the uids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a oating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the ow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water ow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance
a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external uid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to ush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic uid is in question, the shell side should be disconnected and ushed on a yearly basis with a clean ushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be ushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor uid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, ush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

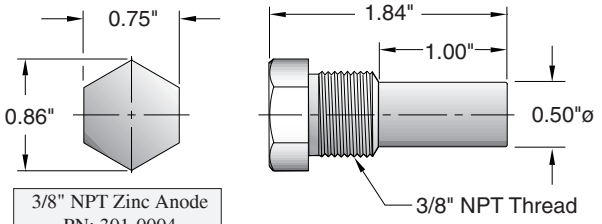
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, ow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

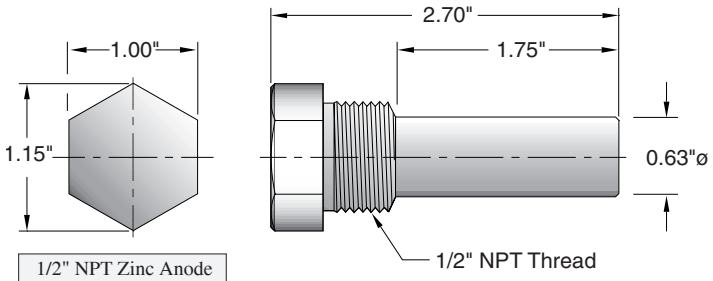
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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American Industrial Heat Transfer Inc.®

Manufacturer of Quality Heat Exchangers

ABR SERIES

FIXED TUBE BUNDLE / LIQUID COOLED

AFTER COOLERS

FOR COMPRESSED AIR AND GAS APPLICATIONS

- Copper, 90/10 Copper/Nickel, or Stainless Steel Tubing.
- Optional Bronze Bonnets.
- Operating Pressure for Tubes 150 PSI.
- Operating Pressure for Shell 250 PSI.
- Operating Temperatures of 350° F.
- Can Be Customized to Fit Your Needs.

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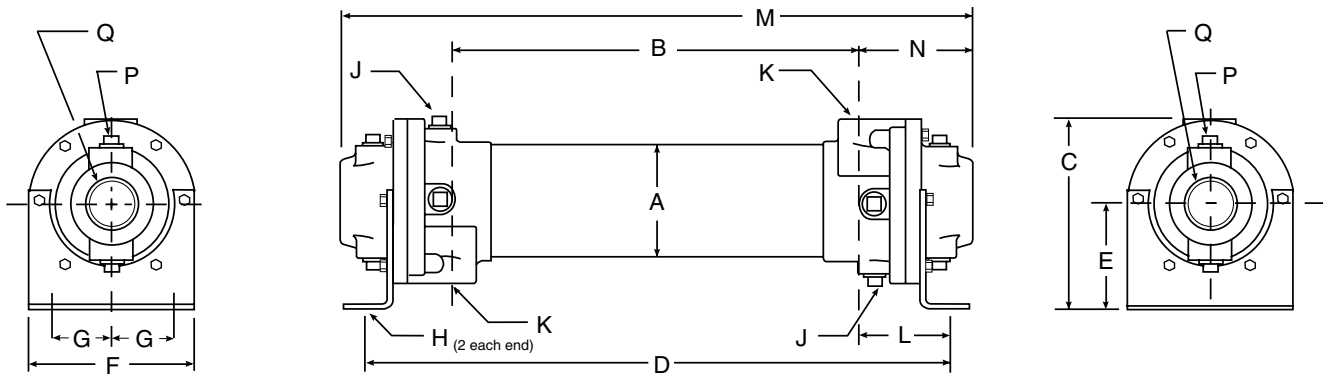
ABR Series *performance*



COMMON DIMENSIONS

Model	A	B	C	D	E	F	G	H	J NPT	K NPT	L	M	N	P NPT	Q NPT	Weights (lbs.)
ABR-403-A4-SP	2.13	25.62	3.50	29.06	1.94	2.62	0.88	0.41 DIA.	N/A	0.50	1.72	33.36	3.87	N/A	1.50	13
ABR-404-A4-SP	2.13	34.62	3.50	38.06	1.94	2.62	0.88			0.50	1.72	42.36	3.87		1.50	16
ABR-405-B4-SP	2.13	43.62	3.50	47.06	1.94	2.62	0.88			0.50	1.72	51.36	3.87		1.50	18
ABR-705-B4-SP	3.66	43.00	6.25	48.38	3.62	5.25	1.50	0.44x 1.00	(2) 0.38	1.00	2.89	50.40	3.70		2.50	40
ABR-1006-B6-SP	5.13	51.50	7.38	57.62	4.00	6.75	2.00		(6) 0.38	1.50	3.06	59.60	4.05		3.00	80
ABR-1206-C6-SP	6.13	50.50	8.81	57.38	4.75	7.50	2.50	0.44x .88		2.00	3.44	60.25	4.88	(4) 0.50	3.00	130
ABR-1207-C6-SP	6.13	59.60	8.81	66.38	4.75	7.50	2.50			2.00	3.44	69.25	4.88		3.00	150
ABR-1606-C6-SP	8.00	49.60	12.13	58.38	6.50	8.62	3.50	0.44x 1.00		3.00	4.39	62.62	6.52		5.00	259
ABR-1607-D6-SP	8.00	58.60	12.13	67.38	6.50	8.62	3.50			3.00	4.39	71.62	6.52		5.00	270
ABR-1608-D6-SP	8.00	67.60	12.13	76.38	6.50	8.62	3.50			3.00	4.39	80.62	6.52		5.00	315

CAPACITY SELECTION CHART

MODEL	2-Stage 250 ^{0}F Inlet Air		Rotary 200 ^{0}F Inlet Air	
	SCFM Capacity In Tubes	△P, PSI, In Rated Capacity	SCFM Capacity In Tubes	△P, PSI, In Rated Capacity
ABR-403-A4-SP	45	0.15	56	0.15
ABR-404-A4-SP	85	0.35	115	0.65
ABR-405-B4-SP	155	1.25	200	2.01
ABR-705-B4-SP	315	1.10	435	1.65
ABR-1006-B6-SP	445	0.35	650	0.55
ABR-1206-C6-SP	645	0.35	950	0.65
ABR-1207-C6-SP	1245	1.15	1680	1.95
ABR-1606-C6-SP	1605	0.60	2270	0.95
ABR-1607-D6-SP	2105	1.10	3075	1.75
ABR-1608-D6-SP	2810	1.65	3165	2.10

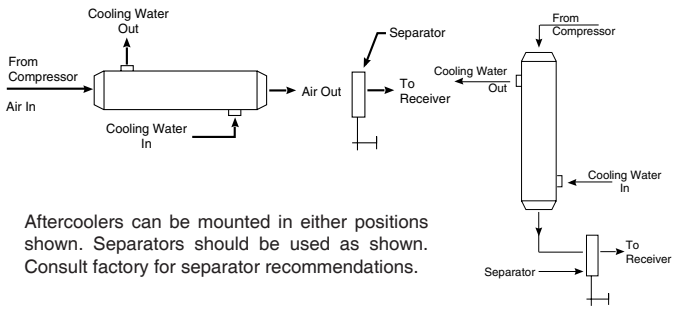
EXAMPLE

A two stage compressor with a 340 SCFM air delivery at 100psi and a 250^o F discharge temperature. Two psi is the maximum allowable pressure loss. Rate of water flow, to be determined.

SELECTION

To find a solution, select ABR-1006-B6-SP from the 2-stage column in the above chart. It has a capacity of 445 SCFM.
Next, identify the value for △P by reading the sub-column within the 2-stage column. The information in that column should be △P= 0.35 psi.
Data for water flow is 340 SCFM x .035 = 11.9 gpm.

PIPING HOOK-UP DIAGRAMS



Aftercoolers can be mounted in either positions shown. Separators should be used as shown. Consult factory for separator recommendations.

note: AIHTI reserves the right to make reasonable design changes without notice.

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PIPING HOOK-UP

Receiving / Installation

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person, and mark it on the receiving bill before accepting the freight. Make sure that there is no visible damage to the outside surface of the heat exchanger. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. Since the warranty is based upon the unit date code located on the model identification tags, removal or manipulation of the identification tags will void the manufacturers warranty.

b) When handling the shell & tube heat exchanger, special care should be taken to avoid dropping the unit since mishandling could cause the heat exchanger to crack and leak externally. Mishandling of the unit is not covered under the manufacturers warranty. All units are shipped with partial wood/corrugated cardboard containers for safe handling.

c) Storage: American Industrial heat exchangers are protected against the elements during shipment. If the heat exchanger cannot be installed and put into operation immediately upon receipt, certain precautions are required to prevent deterioration during storage. The responsibility for integrity of the heat exchanger(s) is assumed by the user. American Industrial will not be responsible for damage, corrosion, or other deterioration of the heat exchanger during transit or storage.

Proper storage practices are important when considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following listed practices are provided solely as a convenience to the user, who shall make their own decision on whether to use all or any of them.

1) Heat exchangers not to be placed in immediate service, require precautionary measures to prevent corrosion or contamination.
2) Heat exchangers made of ferrous materials, may be pressure-tested using compressed air at the factory. Residual oil coating on the inside surfaces of the heat exchanger(s) as a result of flushing does not discount the possibility of internal corrosion. Upon receipt, fill the heat exchanger(s) with the appropriate corrosion preventing inhibitor for storage.
3) Corrosion protection compounds for interior surfaces for long term storage or other applications are applied solely at the request of customers. Upon request, American Industrial can provide a customer approved corrosion preventative if available when included in the original purchase order specifications.
4) Remove all dirt, water, ice, or snow and wipe dry before moving heat exchanger(s) into storage. Heat exchangers are generally shipped empty, open drain plugs to remove any accumulated condensation moisture, then reseal. Accumulation of moisture usually indicates corrosion has already started and remedial action should be taken.
5) Store in a covered, environmentally stable area. The ideal storage environment for heat exchangers is in a dry, low-humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Maintain in atmospheric temperatures between 70°F and 105°F (Large temperature swings may cause condensation and moisture to form on steel components, threads, shell, etc...) Use thermometers and humidity indicators and maintain the atmosphere at 40% relative humidity, or lower.

d) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warranty it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

e) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warranty coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

f) American Industrial recommends that the equipment supplied should be installed by qualified personnel who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any shell & tube heat exchanger. If the system pressure or temperature does not fall within the parameters on model rating tag located on the heat exchanger, contact our factory prior to installation or operation.

g) Plan the installation to meet the requirements indicated on the piping installation diagram as illustrated above. It is recommended to put the

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compressed air to be cooled through the tube side and the cold fluid through the shell side. The indicated port assembly sequence in the diagram maximizes the performance, and minimizes the possibility of thermal shock. In instances where the fluids are required to be reversed, *compressed air in the shell side and cold fluid in the tube side* the heat exchanger will work, however it may not meet the performance requirements of the application. Installations may be vertical or horizontal or a combination thereof. However, the installation must allow for complete draining of the heat exchanger regardless of orientation. Complete drainage is important to prevent the heat exchanger from freezing, over-heating of a fluid, or mineral deposit buildup.

h) For fixed bundle heat exchangers, provide sufficient clearance at one end to allow for the removal or replacement of tubes. On the opposite end, provide enough space to allow removal of the bonnet to provide sufficient clearance to permit tube rolling and cleaning. Allow accessible room for scheduled cleaning as needed. Include thermometer wells and pressure gauge pipe ports in piping to and from the heat exchanger located as close to the heat exchanger as possible. For more information please contact American Industrial.

i) Standard shell & tube coolers are built with a rolled tube-sheet construction. However, the differential operating temperature between the entering shell side fluid and the entering tube side fluid should not exceed 150°F. If this condition exists, a severe thermal shock could occur leading to product failure and mixing of the fluids. For applications with a differential temperatures of 150°F or more, we recommend using a series with a floating tube-sheet, u-tube, or expansion joint to reduce the potential for the effects of thermal shock.

j) Water requirements vary from location to location. If the source of cooling water is from other than a municipal water supply, it is recommended that a water strainer be installed ahead of the heat exchanger to prevent dirt and debris from entering and clogging the flow passages. If a water modulating valve is used it is recommended to be installed at the inlet to the cooler to regulate the water flow.

k) For steam service, or other related applications, please consult our engineering department for additional information.

Maintenance

a) Inspect the heat exchanger for loosened bolts, connections, rust spots, corrosion, and for internal or external fluid leakage. Any corroded surfaces should be cleaned and recoated with paint.

b) Shell side: In many cases with clean hydraulic system oils it will not be necessary to flush the interior of the shell side of the cooler. In circumstances where the quality of hydraulic fluid is in question, the shell side should be disconnected and flushed on a yearly basis with a clean flushing oil/solvent to remove any sludge that has been deposited. For severe cases where the unit is plugged and cannot be flushed clean with solvent, the heat exchanger should be replaced to maintain the proper cooling performance.

c) Tube side: In many cases it will be necessary to clean the tube side of the heat exchanger due to poor fluid quality, debris, calcium deposits, corrosion, mud, sludge, seaweed, etc.... To clean the tube side, flush with clean water or any good quality commercial cleaner that does not attack the particular material of construction. With straight tube heat exchangers you can use a rod to carefully push any debris out of the tubes.

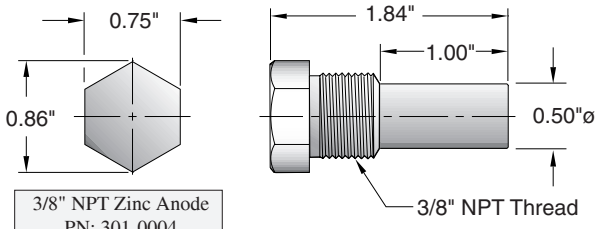
d) Zinc anodes are normally used to reduce the risk of failure due to electrolysis. Zinc anodes are a sacrificial component designed to wear and dissolve through normal use. Normally, zinc anodes are applied to the water supply side of the heat exchanger. Depending upon the amount of corrosive action, one, two, three, or more anodes can be applied to help further reduce the risk of failure. American Industrial Heat Transfer, Inc. offers zinc anodes as an option, to be specified and installed at the request our customers. It is the responsibility of the customer to periodically check and verify the condition of the zinc anode and replace it as needed.

Applications vary due to water chemical makeup and quality, material differences, temperature, flow rate, piping arrangements, and machine grounding. For those reasons, zinc anodes do not follow any scheduled factory predetermined maintenance plan moreover they must be checked routinely by the customer, and a maintenance plan developed based upon the actual wear rate.

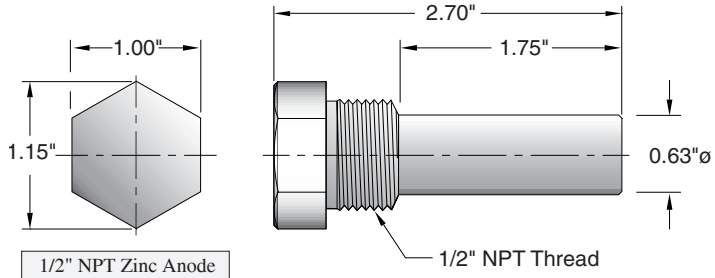
If substantial wear occurs or zinc dissolves without replacement, premature failure or permanent damage may occur to the heat exchanger. American Industrial does not warranty customer applications. It is the responsibility of the customer to verify and apply the proper system materials of construction and overall system requirements. Failures resulting from properly applied or misapplied use of zinc anode(s) into non-specified or specified applications will be the sole responsibility of the customer.

e) A routine maintenance schedule should be developed and adjusted to meet your systems requirements based upon water quality, etc….Failure to regularly maintain and clean your heat exchanger can result in a reduction in operational performance and life expectancy.

Note: *Since applications can vary substantially, the installation and maintenance information contained in this catalog should be used as a basic guideline. The safe installation, maintenance, and use of any American Industrial Heat Transfer, Inc. heat exchanger are solely the responsibility of the user.*



3/8" NPT Zinc Anode PN: 301-0004
AB-400 thru AB-1000 AA-400 thru AA-1000 CS-600 thru CS-1000



1/2" NPT Zinc Anode PN: 301-0003
AB-1200 thru AB-2000 AA-1200 thru AA-1600 CS-1200 thru CS-1700

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