American Industrial
Heat Transfer Inc.
Manufacturer of Quality Heat Exchangers

website : www.aihti.com
general email : sales@aihti.com
technical email : engineering@aihti.com

Shell & Tube Application Request: *(For liquid to liquid heat exchangers)*

Please fill out form as completely as possible.

Email form to: sales@aihti.com   or   engineering@aihti.com   or   fax to 434-757-1810

Contact Name _____

Telephone _____   Date _____

Company Name _____

Email _____

Address: _____

Fax _____

_____

Hot Side

Fluid Type   _____

If available:

Density	_____	lb/ft3
Viscosity	_____	cP
Conductivity	_____	Btu/hr.ft.°F
Specific Heat	_____	Btu/lb.°F

1. Flow Rate _____

2. Temperature In _____

3. Desired Temperature Out _____

4. Heat Load _____

Cold Side

Fluid Type   _____

If available:

Density	_____	lb/ft3
Viscosity	_____	cP
Conductivity	_____	Btu/hr.ft.°F
Specific Heat	_____	Btu/lb.°F

1. Flow Rate _____

2. Temperature In _____

Maximum Allowable Pressure Drop:

Hot Side _____   Cold Side _____

To properly size the heat exchanger we need 3 of the 4 parameter on the Hot Side and 2 on the Cold Side.

Shell Material Construction:

Brass ☐   Steel ☐   Stainless Steel ☐

ASME Code and Certified   Yes ☐   No ☐

Tube Material Construction:

Copper ☐   90/10 Copper Nickel ☐   Stainless Steel ☐

Require All Stainless Steel Heat Exchanger   Yes ☐   No ☐

Comment: _____

_____

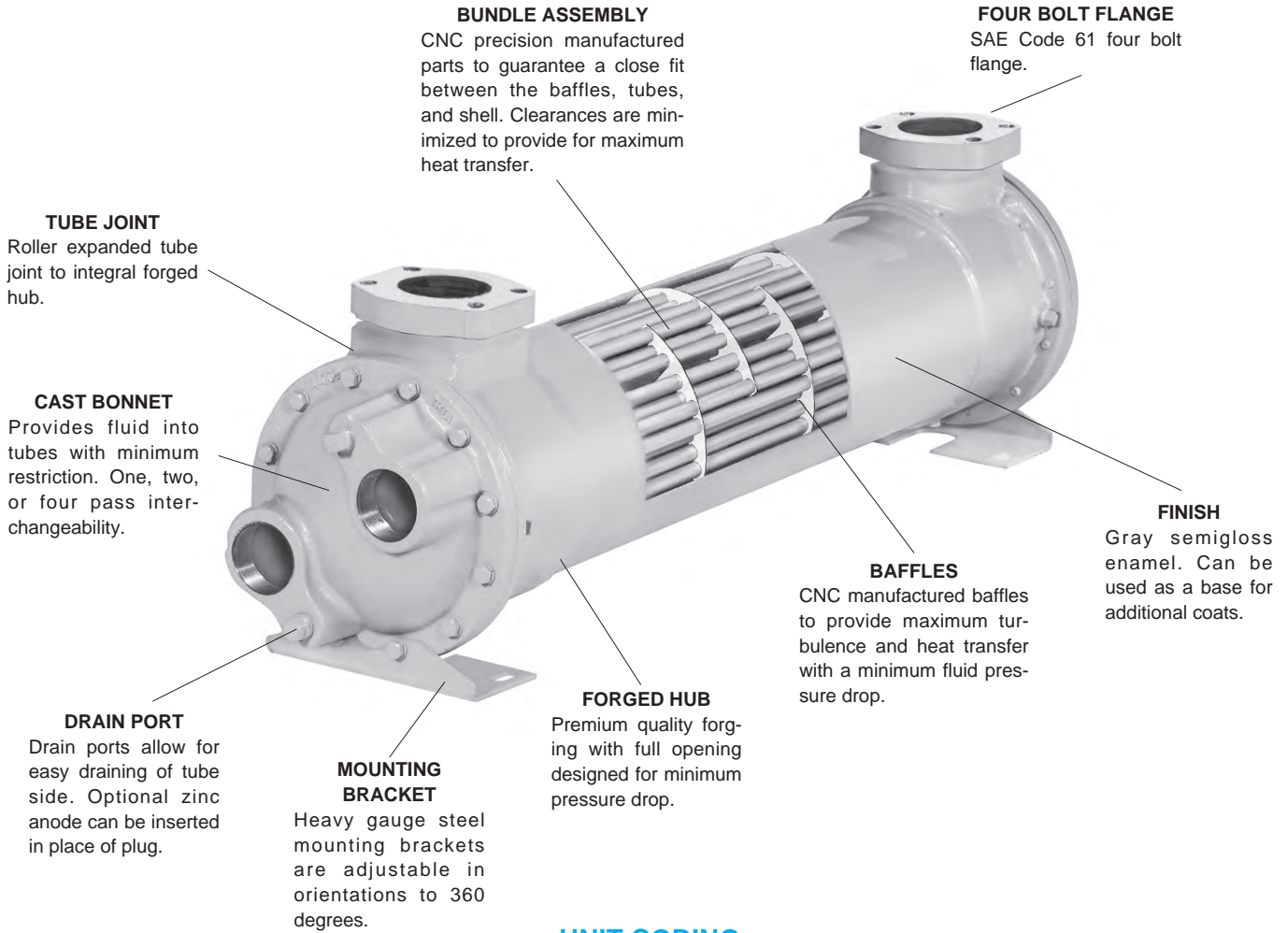FOUR
PASS

Fixed Tube Bundle Liquid Cooled

HEAT EXCHANGERS

with code 61 four bolt flange

- Computer generated data sheet available for any application
- 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 any applications.
- Cools: Fluid power systems, rock crushers, presses, shears, lubrication equipment for paper machinery, gear drives, marine transmissions, etc.
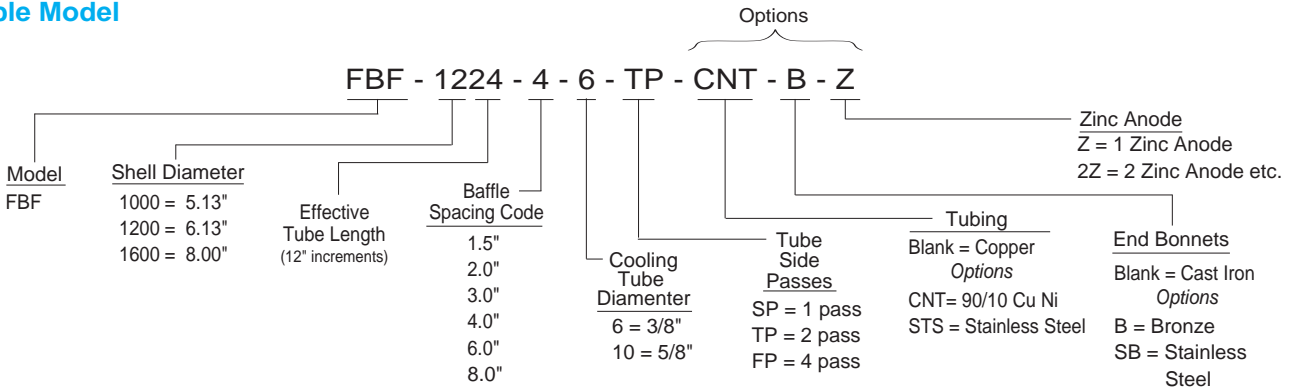
FBF Series *construction*

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.

FOUR BOLT FLANGE
SAE Code 61 four bolt flange.

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.

Example Model

UNIT CODING

Options

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

Model
FBF

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"
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

End Bonnets
Blank = Cast Iron
Options
B = Bronze
SB = Stainless Steel

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

STANDARD CONSTRUCTION MATERIALS & RATINGS

Standard Model	FBF Series	SFBF Series★	
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.

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
$\triangle$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

A) Q = GPM x CN x actual $\triangle$T
B) Q = [(PSI x GPM) / 1714] x (*v*) x 2545
C) Q = MHP x (*v*) x 2545
D) Q = Kw to be removed x 3415
E) Q = HP to be removed x 2545

EXAMPLE

A) Q = 80 x 210 x 5.3°F = 89,040 BTU/HR
B) Q = [(2500x80)/1714] x .30 x 2545 = 89,090 BTU/HR
C) Q = 125 x .30 x 2545 = 95,347 BTU/HR
D) Q = 28 x 3415 = 95,620 BTU/HR
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 $\triangle$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

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

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

EXAMPLE

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

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

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

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

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

EXAMPLE

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

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

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

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

STEP 4: Calculate the area required

$$\text{Required Area sq.ft.} = \frac{Q\,(\text{BTU}/\text{HR})}{\text{LMTD}_c \times U\,(\text{from table C})} \qquad \frac{89{,}090}{50.39 \times 100} = \textbf{17.68 sq.ft.}$$

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	.874
.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	.858	.98	.991
.24	.533	.49	.715	.74	.864	.99	.995

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 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														

R (left axis label) K (bottom axis label)

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

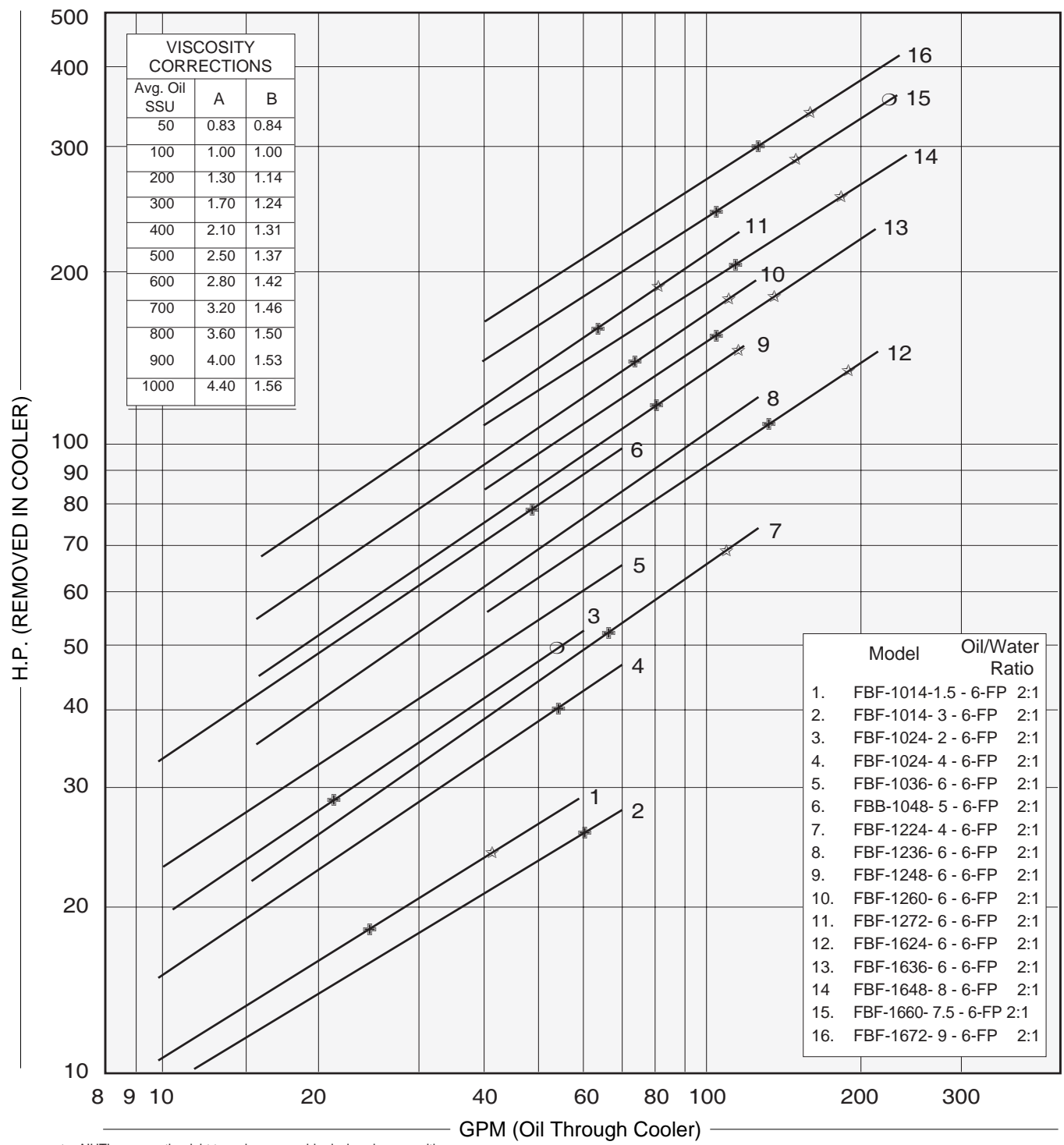| U	TUBE FLUID	SHELL FLUID
400	Water	Water
350	Water	50% E. Glycol
100	Water	Oil
300	50% E. Glycol	50% E. Glycol
90	50% E. Glycol	Oil

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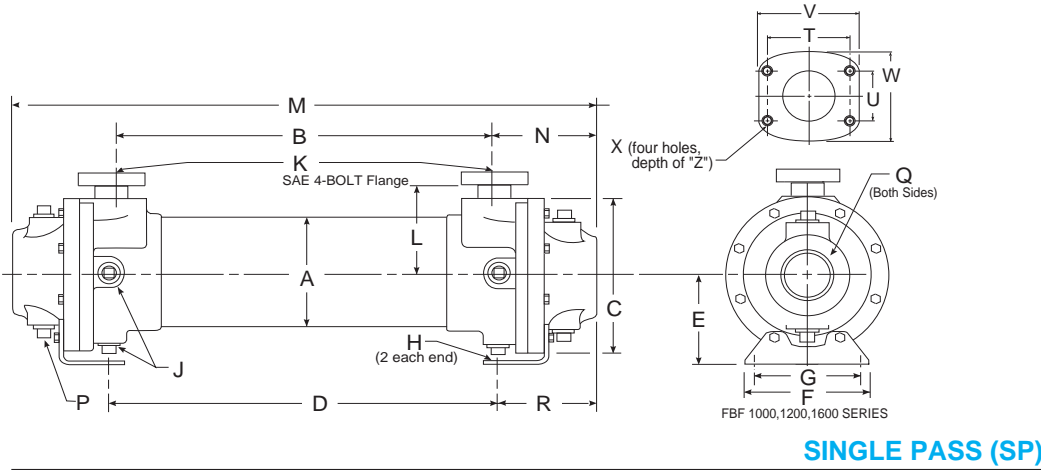
3) OIL PRESSURE DROP CODING: ✚ = 5 psi; ☆= 10 psi; ◯ = 20 psi; △ = 50psi. Curves that have no pressure drop code symbols indicate that the oil pressure drop is less than 5 psi for the flow rate shown.

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:

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

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.	FBF-1014-1.5 - 6-FP	2:1
2.	FBF-1014- 3 - 6-FP	2:1
3.	FBF-1024- 2 - 6-FP	2:1
4.	FBF-1024- 4 - 6-FP	2:1
5.	FBF-1036- 6 - 6-FP	2:1
6.	FBB-1048- 5 - 6-FP	2:1
7.	FBF-1224- 4 - 6-FP	2:1
8.	FBF-1236- 6 - 6-FP	2:1
9.	FBF-1248- 6 - 6-FP	2:1
10.	FBF-1260- 6 - 6-FP	2:1
11.	FBF-1272- 6 - 6-FP	2:1
12.	FBF-1624- 6 - 6-FP	2:1
13.	FBF-1636- 6 - 6-FP	2:1
14	FBF-1648- 8 - 6-FP	2:1
15.	FBF-1660- 7.5 - 6-FP	2:1
16.	FBF-1672- 9 - 6-FP	2:1

FBF Series *dimensions*

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	6.52	(4) .50	4.00	5.25	-
1660	67.25					
1672	79.25					
1684	91.25					

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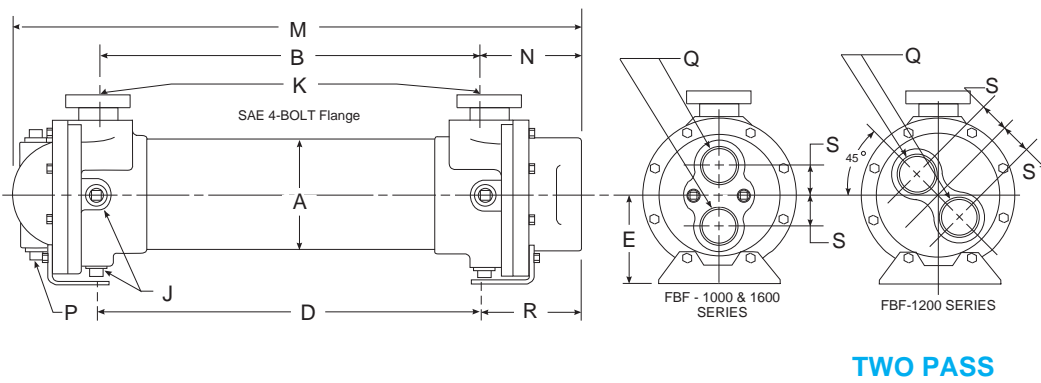
Model	M	N	P NPT	Q NPT	R	S
1014	18.50					
1024	28.50					
1036	40.50	3.69	(2) .38	1.50	3.50	1.50
1048	52.50					
1224	28.75					
1236	40.75					
1248	52.75	4.25	(2) .38	2.00	3.75	1.56
1260	64.75					
1272	76.75					
1624	30.50					
1636	42.50					
1648	54.50	6.00	(2) .50	2.50	5.25	2.25
1660	66.50			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

FOUR PASS (FP)
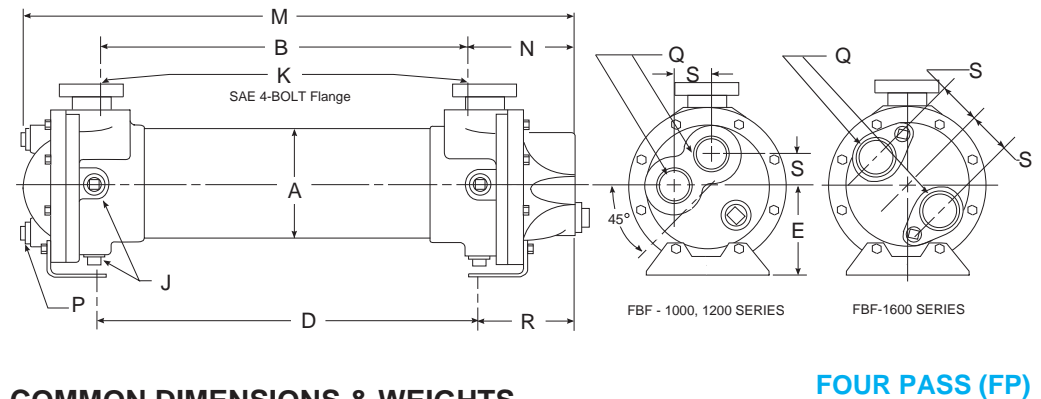
Model	M	N	P NPT	Q NPT	R	S
1014	18.50					
1024	28.50					
1036	40.50	3.80	(3) .38	1.00	3.25	1.69
1048	52.50					
1224	29.50					
1236	41.50					
1248	53.50	4.56	(3) .50	1.50	3.75	2.00
1260	65.50					
1272	77.50					
1624	30.75					
1636	42.75					
1648	54.75	6.08	(4) .50	2.00	5.25	2.62
1660	66.75					
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	5.13	11.12	6.50	11.75	3.75	5.00	4.00	.50øx.88	(6) .38	1.50 SAE Four Bolt Flange	4.62	2.75	1.41	3.68	2.75	1/2-13	.75	45
FBF-1024		21.12		21.75														60
FBF-1036		33.12		33.75														82
FBF-1048		45.12		45.75														94
FBF-1224	6.13	20.50	7.50	21.50	4.12	6.00	5.00	.50øx.88	(6) .38	2.00 SAE Four Bolt Flange	5.25	3.06	1.69	4.00	3.31	1/2-13	.75	90
FBF-1236		32.50		33.50														110
FBF-1248		44.50		45.50														130
FBF-1260		56.50		57.50														150
FBF-1272		68.50		69.50														170
FBF-1624	8.00	19.00	9.75	20.50	5.38	8.25	7.00	.62øx1.12	(6) .38	3.00 SAE Four Bolt Flange	6.62	4.19	2.44	5.31	4.69	5/8-11	.88	160
FBF-1636		31.00		32.50														185
FBF-1648		43.00		44.50														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

ONE PASS

TWO PASS

FOUR PASS
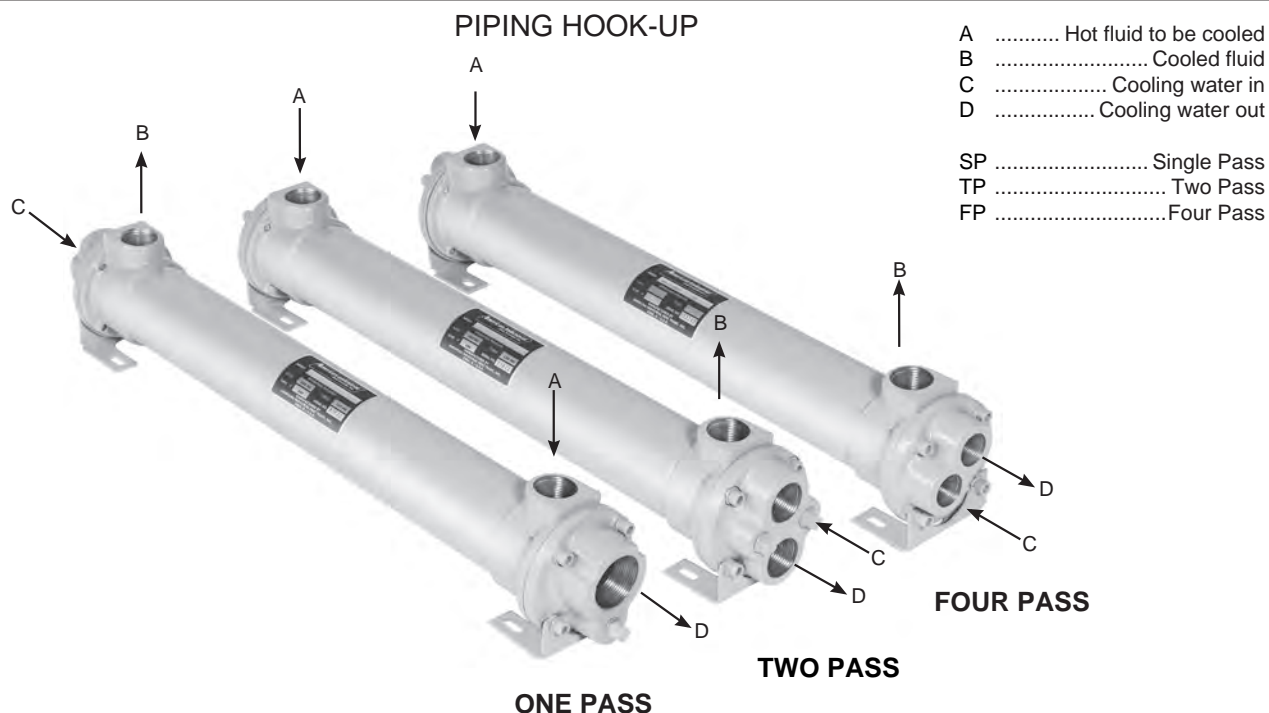
Receiving / Installation

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

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.*

0.75"
0.86"
1.84"
1.00"
0.50"ø
3/8" NPT Thread

3/8" NPT Zinc Anode
PN: 301-0004

AB-400 thru AB-1000
AA-400 thru AA-1000
CS-600 thru CS-1000

1.00"
1.15"
2.70"
1.75"
0.63"ø
1/2" NPT Thread

1/2" NPT Zinc Anode
PN: 301-0003

AB-1200 thru AB-2000
AA-1200 thru AA-1600
CS-1200 thru CS-1700