



**BASCO®  
TYPE 500  
HEAT  
EXCHANGERS**

**API Heat Transfer**

*...world leaders in heat transfer technology*

## Quality, Value and Performance. An API Heat Transfer tradition.

*For over 75 years, original equipment manufacturers and aftermarket providers have looked to API for a wide variety of heat transfer products.*

*The Basco® Type 500 remains the industry standard in ultimate value and long term reliability.*

API BASCO  
ISO-9001  
CERTIFIED



## Cost Effective, Reliable and Fast

### **Standard Heat Exchangers Deliver Cost Effective Performance.**

The Basco Type 500 Shell & Tube Heat Exchanger offers the cost effectiveness that comes with having a standard design, while easily providing for various options to meet specific customer requirements. Units are available as Commercial Standard, ASME or ASME/TEMA-C. The Type 500 line is intended to provide maximum service performance at minimum cost.



### **Proven Reliability in Tens of Thousands of Installations.**

Reliability comes from using quality materials in a well-conceived design that is properly applied by knowledgeable engineers and manufactured by skilled personnel. The Basco Type 500 features:

- High strength Carbon Steel or Stainless Steel **Shells**.
- Precision punched **Baffles** to minimize fluid by-pass and insure maximum heat transfer.
- **Tubesheets** in Carbon Steel, Stainless Steel, or 90/10 CuNi that are welded to the shell, and whose holes are precision drilled for proper fit.
- **Tubes** in Copper, Admiralty, 90/10 CuNi, Stainless Steel, and Carbon Steel are available depending on the application, and roller expanded using controlled pressure methods to ensure a proper bond.
- High grade Cast Iron or Carbon Steel **Bonnets** are available in one, two and four-pass designs. Zinc anodes to neutralize the effects of galvanic action can be furnished on special order.
- Heavy duty **Mounting Brackets** that can be reversed or rotated, and feature slotted holes to permit quick installation. Installations other than horizontal with the brackets underneath should be checked for weight.

### **Rugged and versatile enough to meet your most demanding needs.**

Type 500 Heat Exchangers are used in these and other applications:

- **Compressor Systems**
- **Hydraulic Systems**
- **Stationary Engines**
- **Marine Applications**
- **Turbines**
- **Paint Systems**
- **Air Dryers**
- **Vapor Recovery Systems**
- **Sterilizing Systems**
- **Lube Oil Consoles**

# State-of-the-Art Heat Exchanger Manufacturing Expertise for a Wide Range of Duties

## Certified Demand Flow Production Methods and ISO Quality.

API Heat Transfer has fully embraced the superior quality, improved work-flow and cost controls inherent in Demand Flow Technology (DFT) manufacturing. Products are made “on-demand” from components and in-line support machining centers. With DFT, non-value procedures are eliminated, inventory costs are reduced, and quality is maintained and verified at every phase of the assembly. API also has ISO 9001 certification assuring world-class manufacturing methods and full accountability to our customers.

DFT and ISO 9001 result in reduced cycle times, increased flexibility, higher efficiencies, consistently high quality, and ... **MORE VALUE FOR OUR CUSTOMERS!**



Robotic CNC Machining Center assures precision drilled tubesheets, twenty-four hours a day.



Use of rolled coil tubing supports the flexibility inherent in DFT manufacturing. Special straightening equipment and unique burr-free cutting process for superior rolled joints.

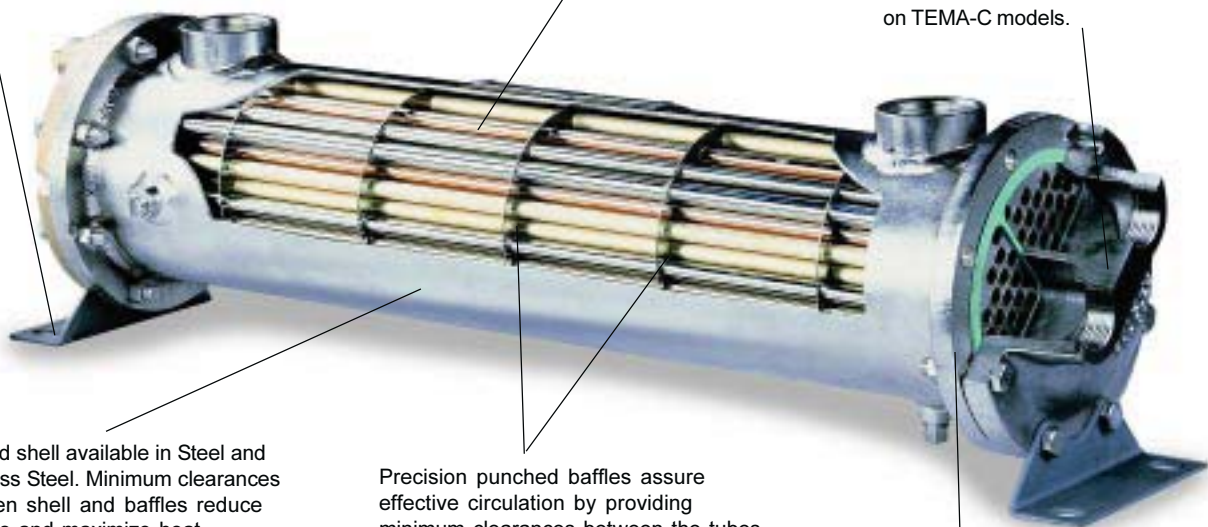


API's additional grinding process flattens tube ends and tubesheets which reduces risk of crevice corrosion, ensures even gasket compression and eliminates cracking of casting during manufacturing and servicing of units.

Heavy stamped steel brackets are standard and can be rotated and reversed for a variety of mounting needs. Cradle mounting is available on all models.

Tubes are available in Copper, 90/10 CuNi, Stainless Steel, Admiralty or Titanium. Tubes are roller expanded. Seal welding and grooving available in some cases.

End bonnets are of high quality cast Iron, Bronze or Stainless Steel in 1, 2 or 4-pass configurations. Fabricated heads are available and are standard on TEMA-C models.



Rugged shell available in Steel and Stainless Steel. Minimum clearances between shell and baffles reduce by-pass and maximize heat transfer.

Precision punched baffles assure effective circulation by providing minimum clearances between the tubes and tube holes. Baffle cuts and spacing for each diameter are consistent with best practices.

Thick Carbon Steel, Stainless Steel or 90/10 CuNi tubesheets are welded to the shell.

# Basco Type 500

# API Heat Transfer

## Type 500 Commercial Standard Models 3" – 8" Diameters, Straight and U-Tubes

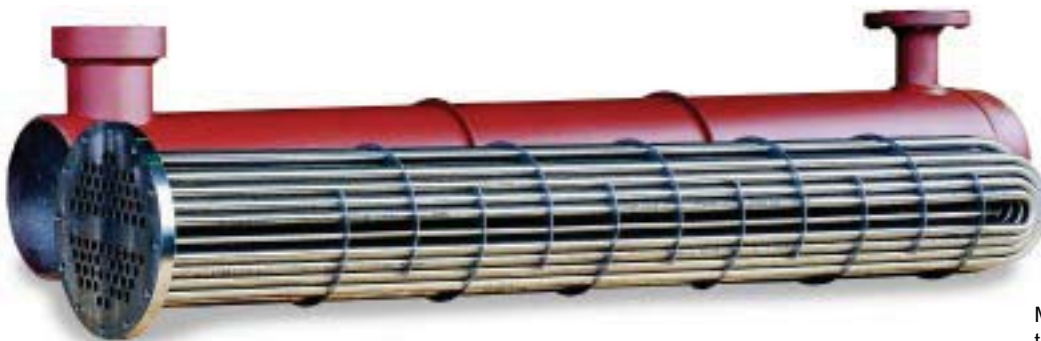


### Type 500 Standard Materials

Shell .....	Steel Pipe or Tubing
Tubes .....	Copper, Admiralty or 90/10 CuNi
Tubesheets .....	Steel, Stainless or 90/10 CuNi
Bonnets .....	Cast Iron
Baffles .....	Carbon Steel
Gaskets .....	Compressed Fiber

Commercial standard model and modified model with special shellside flanges shown. Several modifications are available without adding manufacturing delays.

## Type 500 Stainless Steel Models 3" – 8" Diameters, Straight and U-Tubes



### Type 500 S Materials

Shell .....	Welded 304 Stainless
Tubes .....	304 Stainless Steel
Tubesheets .....	304 Stainless Steel
Bonnets .....	Cast 304 Stainless
Baffles .....	304 Stainless Steel
Gaskets .....	Compressed Fiber

Model shown is removable tubesheet U-tube with type 304 Stainless Steel tubing. Fixed bundle models also available.

## Type 500 ASME and TEMA-C Models 5" - 12" Diameters, Straight and U-Tubes



### ASME and TEMA-C Materials

Shell .....	Carbon Steel
Tubes .....	Copper, Admiralty, 90/10 CuNi, SS
Tubesheets .....	Carbon Steel, 90/10, SS
Bonnets .....	Carbon Steel, Cast Ductile Iron
Baffles .....	Carbon Steel, SS
Gaskets .....	Compressed Fiber

ASME Code models are available from 5" diameter and up. TEMA-C models are available in straight and U-tube designs through 12" diameter.

### Product Nomenclature

Size (Inches)

**05 024**

Shell Tube  
Dia. Length

Overall length, shell port center distance and mounting hole locations can be adjusted by adding or subtracting the actual tube length differential.

### Standard Ratings

<b>Design Pressure</b>	<b>Std Units</b>	<b>TEMA-C/ASME</b>
Shellside .....	300 psi	150 psi
Tubeside .....	150 psi	150 psi

**Design Temp** ..... 300°F, Stainless higher

**Test Pressure**

All units are either pneumatically or hydrostatically tested.

**Shells** - Steel or 304 Stainless pipe to ASME specification. Shells are cleaned prior to assembly.

**Tubes** - Copper, roller expanded into tubesheet in 1/4", 3/8" or 5/8" OD. Also available in Admiralty, 304, 316 Stainless Steel or 90/10 CuNi.

**Tubesheets** - Quality steel to ASME specifications. Precision machined for excellent sealing. Stainless Steel and 90/10 CuNi also available in all sizes.

**Baffles** - Hot-rolled punched steel for enhanced strength and reliability. Engineered for correct fit to reduce tube wall damage from high velocity fluids. Also available in Brass and 304 Stainless Steel.

**Heads** - Cast or fabricated construction. Available in 1, 2, or 4-pass designs to meet ASME specifications. Designed to provide excellent gasket sealing. Options include fabricated heads from Steel, 304 Stainless, and 90/10 CuNi. Cast heads are available in Iron, cast 304 Stainless, or cast Bronze. Zinc anodes can be supplied for added protection.

**Connections** - Tubeside or shellside threaded or flanged in sizes 3", 4", 5", 6" and 8". Additional connections can be provided as option on all models.

**Codes** - ASME, ASME/TEMA-C are available and stamped accordingly. Code Version 1 has ductile iron bonnets and tubing for shell. Code Version 2 has fabricated heads and pipe for shell.

**Finish** - Exterior surfaces are cleaned and painted with a high quality red oxide primer.

## Common Specifications...

### Standard Straight-Tube Type 500 Heat Exchangers

Model	Shell Dia.	No. Tubes			Surface			Connection Size - (Max Flow)			
		1/4"	3/8"	5/8"	1/4"	3/8"	5/8"	Shell	1-Pass	2-Pass	4-Pass
<b>03014</b> <b>03024</b>	3-1/4"	60	24	NA	4.6	2.7	-	1	1-1/2 (47)	1 (23)	1 (12)
<b>04014</b> <b>04024</b> <b>04036</b>	4-1/2"	104	44	NA	7.9	5.0	-	1-1/2	2 (86)	1-1/4 (43)	3/4 (22)
<b>05014</b> <b>05024</b> <b>05036</b>	5-1/4"	180	80	28	13.7	9.1	5.3	1-1/2	2-1/2 (160)	1-1/2 (80)	1 (40)
<b>06024</b> <b>06036</b> <b>06048</b> <b>06060</b>	6-1/4"	264	116	40	34.5	22.8	13.0	2	3 (230)	2 (115)	2 (57)
<b>08024</b> <b>08036</b> <b>08048</b> <b>08060</b> <b>08072</b>	8-5/8"	NA	232	76	-	45.6	24.9	3	3 (461)	2-1/2 (231)	2 (115)

### ASME Code Straight-Tube Type 500 Heat Exchangers

Model	Shell Dia.	No. Tubes		Surface			Connection Size - (Max Flow)			
		3/8"	5/8"	1/4"	3/8"	5/8"	Shell	1-Pass	2-Pass	4-Pass
<b>05024</b> <i>per foot</i>	5-1/4"	80	28	-	15.7	28	1-1/2	2-1/2 (160)	1-1/2 (80)	1 (40)
<b>06024</b> <i>per foot</i>	6-1/4"	116	40	-	22.8	13	2	3 (230)	2 (115)	1-1/2 (57)
<b>08024</b> <i>per foot</i>	8-5/8"	232	76	-	45.6	24.9	3	3 (461)	2-1/2 (231)	2 (115)

### ASME/TEMA-C Straight-Tube Heat Exchangers

Model	Shell Dia.	No. Tubes		Surface			Connection Size - (Max Flow)			
		3/8"	5/8"	1/4"	3/8"	5/8"	Shell	1-Pass	2-Pass	4-Pass
<b>05024</b> <i>per foot</i>	5-1/4"	72	20	-	14	6.5	1-1/2	2-1/2 (160)	1-1/2 (80)	1 (40)
<b>06024</b> <i>per foot</i>	6-1/4"	104	36	-	20.4	11	2	3 (230)	2 (115)	1-1/2 (57)
<b>08024</b> <i>per foot</i>	8-5/8"	208	68	-	40.9	22.2	3	3 (461)	2-1/2 (231)	2 (115)
<b>10120</b> <i>per foot</i>	10-3/4"	344	116	-	338	190	4 FL	6 FL (630)	4 FL (315)	2-1/2 (158)
<b>12120</b> <i>per foot</i>	12-3/4"	516	172	-	507	281	6 FL	6 FL (935)	4 FL (465)	3 (234)

### Standard Type 500 U-Tube Heat Exchangers

Model	Shell Dia.	No. Tubes		Surface			Connection Size - (Max Flow)			
		3/8"	5/8"	1/4"	3/8"	5/8"	Shell	1-Pass	2-Pass	4-Pass
<b>05048</b> <i>per foot</i>	5-1/4"	34	8	-	27	11	1-1/2	-	1-1/2 (44)	1 (22)
<b>06048</b> <i>per foot</i>	6-1/4"	52	14	-	51	18.5	2	-	2 (77)	1-1/2 (38)
<b>08048</b> <i>per foot</i>	8-5/8"	104	34	-	82	44.5	3	-	2-1/2 (185)	2 (93)

### ASME/TEMA-C U-Tube Heat Exchangers\*

Model	Shell Dia.	No. Tubes		Surface			Connection Size - (Max Flow)			
		3/8"	5/8"	1/4"	3/8"	5/8"	Shell	1-Pass	2-Pass	4-Pass
<b>10120</b> <i>per foot</i>	10-3/4"	174	58	-	350	195	4 FL	-	4 FL (316)	2-1/2 (158)
<b>12120</b> <i>per foot</i>	12-3/4"	260	88	-	527	297	6 FL	-	4 FL (480)	3 (240)

\* Max tube length: 3/8" OD - 12 feet; 5/8" OD - 20 feet. Max flow based on 8 fps. Corrosion allowance: 1/16" both sides on TEMA-C models. Flanges are 150# ANSI Raised-Face

# Basco Type 500 Straight-Tube Heat Exchangers

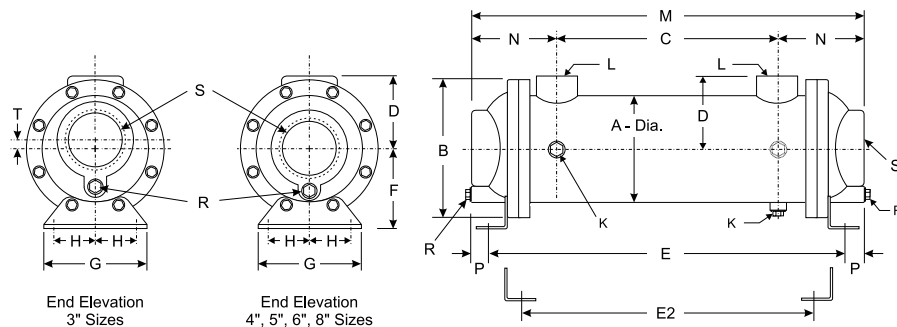
COMMERCIAL STANDARD - COMMON DIMENSIONS												SINGLE-PASS					
Model	A	B	C	D	E	F	G	H	J	K-NPT	L-NPT	M	N	P	R-NPT	S-NPT	T
03014 03024	3-1/4	4-1/2	10 20	2-5/16	16-3/8 26-3/8	2-3/4	4-1/2	1-5/8	7/16	1/4	1	17-3/8 27-3/8	3-11/16	1/2	3/8	1-1/2	3/8
04014 04024 04036	4-1/4	6	9 19 31	3-1/8	16-5/8 29-5/8 38-5/8	3-1/2	4-1/4	1-3/4	7/16	1/4	1-1/2	17-7/8 27-7/8 39-7/8	4-7/16	5/8	3/8	2	-
05014 05024 05036	5-1/4	6-3/4	9 19 31	3-7/16	17-1/8 27-1/8 39-1/8	4	5-1/4	2	1/2 x 3/4	1/4	1-1/2	19 29 41	5	15/16	3/8	2-1/2	-
06024 06036 06048 06060	6-1/4	7-3/4	18-1/4 30-1/4 42-1/4 54-1/4	4-1/16	27-1/8 39-1/8 51-1/8 63-1/8	4-1/2	6-1/4	2-1/2	1/2 x 3/4	3/8	2	29-1/8 41-1/8 53-1/8 65-1/8	5-7/16	1	1/2	3	-
08024 08036 08048 08060 08072	8-5/8	10-1/2	17 29 41 53 65	5-7/16	27-1/2 39-1/2 51-1/2 63-1/2 75-1/2	5-3/4	8-1/4	3-1/2	5/8 x 7/8	3/8	3	31-1/8 43-1/8 55-1/8 67-1/8 79-1/8	7-1/16	1-13/16	1/2	3	-

5", 6" & 8" ASME CODE - COMMON DIMENSIONS												SINGLE-PASS					
Model	A	B	C	D	E	F	G	H	J	K-NPT	L-NPT	M	N	P	R-NPT	S-NPT	T
05048 06048 08048	5-1/4	6-3/4	42 41-1/2 40	3-7/8	51-5/8 51-3/4 52-3/8	4	5-1/4	2	1/2 x 3/4	1/4 3/8 3/8	1-1/2 2 3	53-1/2 53-3/4 56	5-3/4 6-1/8 8	15/16 1 1-13/16	3/8 1/2 1/2	2-1/2 3 3	- - -

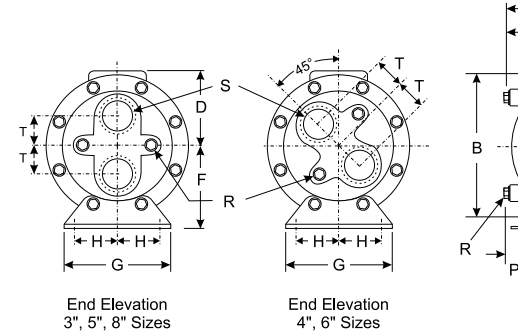
10" & 12" ASME TEMA C - COMMON DIMENSIONS												SINGLE-PASS					
Model	A	B	C	D	E	F	G	H	J	K-NPT	L-NPT	M	N	P	R-NPT	S-NPT	T
10120 12120	10-3/4	145-3/8	109-1/2 107-1/2	11-1/8	11-1/8 12-7/16	6-13/16 6-15/16	10 11	13-3/4 15-3/4	96 94	2-1/4 2-1/4	12-1/2 14-1/2	4 5	1-3/8 1-3/8	7 8-1/4	4FL 6FL	6FL 6FL	- -

All models are available in other lengths. Apply the appropriate dimension changes to all length measurements along the centerline. Maximum tube length for 3/8" tubing is 12 feet. Maximum tube length for 5/8" tubing is 20 feet. FL indicates ANSI 150 lb. RF flange. Code design models are equipped with bottom drain only on the shell side. Bonnet vents may not be tapped unless required or if equipped with zinc anodes.

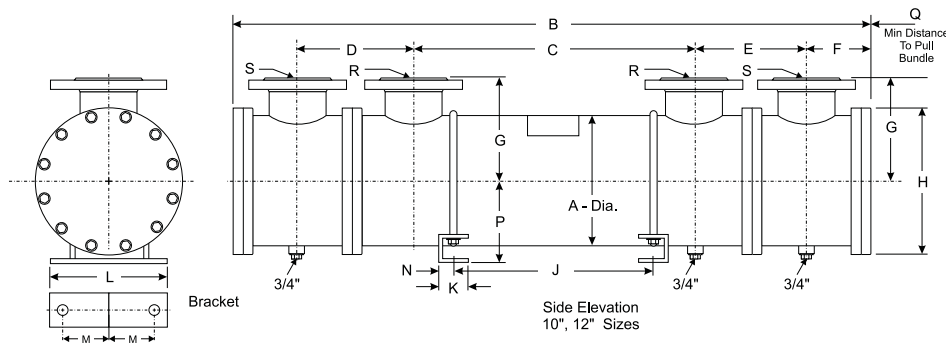
## TWO-PASS STANDARDS



**SINGLE-PASS ASME TEMA-C**



**TWO-PASS ASME**



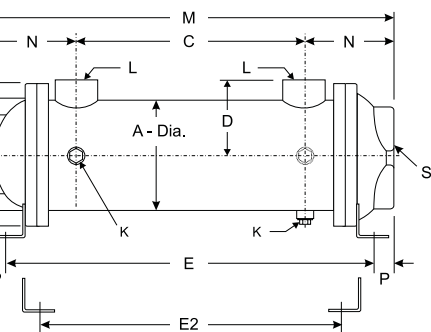
TWO-PASS							FOUR-PASS						Weight	E2	Model
Model	M	N	P	R-NPT	S-NPT	T	M	N	P	R-NPT	S-NPT	T			
03014	17-1/8	3-9/16	3/8	3/8	1	1	17-1/8	3-9/16	3/8	3/8	3/4	1	18	13-5/8	03014
03024	27-1/8						27-1/8						23	23-5/8	03024
04014	17-7/8						17-7/8						32	13-7/8	04014
04024	27-7/8	4-7/16	5/8	3/8	1-1/4	1-1/16	27-7/8	4-7/16	5/8	3/8	3/4	1-1/4	41	23-7/8	04024
04036	39-7/8						39-7/8						52	35-7/8	04036
05014	19						18-13/16						45	13-3/8	05014
05024	29	5	15/16	3/8	1-1/2	1-1/2	28-13/16	4-13/16	3/4	3/8	1	1-11/16	55	23-3/8	05024
05036	41						40-13/16						75	35-3/8	05036
06024	29-1/8						29-1/8						75	23-1/2	06024
06036	41-1/8	5-7/16	1	1/2	2	1-9/16	41-1/8	5-7/16	1	1/2	1-1/2	2	100	35-1/2	06036
06048	53-1/8			See Note			53-1/8			See Note			125	47-1/2	06048
06060	65-1/8			Note			65-1/8			Note			150	59-1/2	06060
08024	30-5/8						30-5/8						165	23-5/8	08024
08036	42-5/8						42-5/8						215	35-5/8	08036
08048	54-5/8	7-1/16	1-13/16	1/2	2-1/2	2-1/4	54-5/8	7-1/16	1-13/16	1/2	2	2-1/2	285	47-5/8	08048
08060	66-5/8			See Note			66-5/8			See Note			325	59-5/8	08060
08072	78-5/8			Note			78-5/8			Note			390	71-5/8	08072

TWO-PASS							FOUR-PASS						Weight	E2	Model
Model	M	N	P	R-NPT	S-NPT	T	M	N	P	R-NPT	S-NPT	T			
05048	53-1/2	5-3/4	15/16	3/8	1-1/2	1-1/2	53-5/16	5-9/16	3/4	3/8	1	1-11/16		47-7/8	05048
06048	53-3/4	6-1/8	1	1/2	2	1-9/16	53-3/4	6-1/8	1	1/2	1-1/2	2		48-1/8	06048
08048	56	8	1-13/16	1/2	2-1/2	2-1/4	55-1/2	8	1-13/16	1/2	2	2-1/2		48-1/4	08048

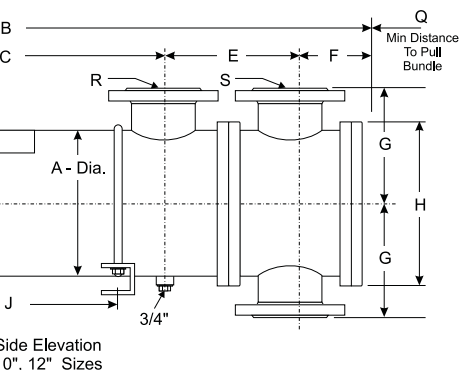
TWO-PASS							FOUR-PASS						Weight	E2	Model
Model	M	N	P	R-NPT	S-NPT	T	M	N	P	R-NPT	S-NPT	T			
10120	4	1-3/8	7	4FL	4FL	-	4	1-3/8	7	4FL	2-1/2	-		-	10120
12120	5	1-3/8	8-1/4	6FL	4FL	-	5	1-3/8	8-1/4	6FL	3	-		-	12120

All models are available in other lengths. Apply the appropriate dimension changes to all length measurements along the centerline. Maximum tube length for 3/8" tubing is 12 feet. Maximum tube length for 5/8" tubing is 20 feet. FL indicates ANSI 150 lb. RF flange. Code design models are equipped with bottom drain only on the shell side. Bonnet vents may not be tapped unless required or if equipped with zinc anodes.

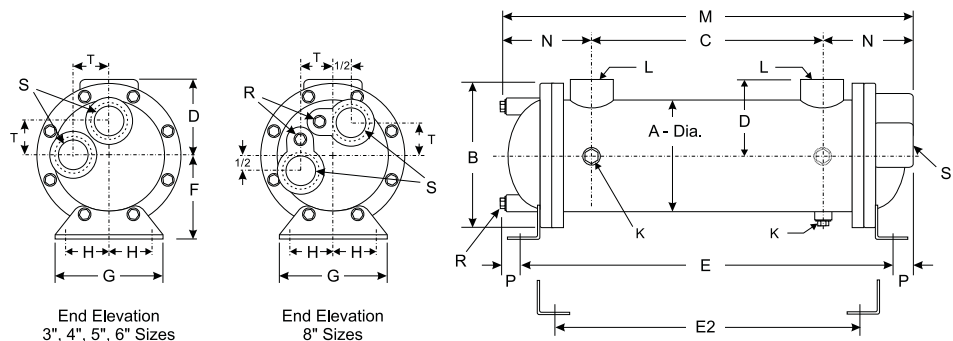
## RD and CODE



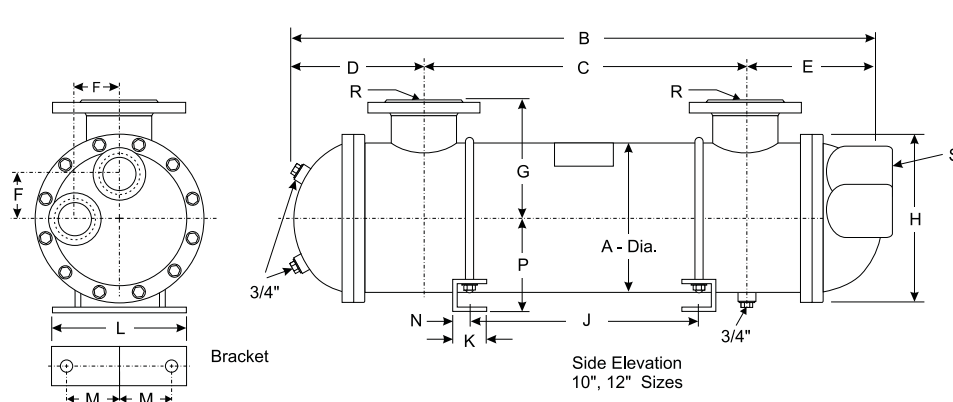
## ASME TEMA-C



## FOUR-PASS STANDARD and CODE



## FOUR-PASS ASME TEMA-C



# Basco Type 500 U-Tube Heat Exchangers

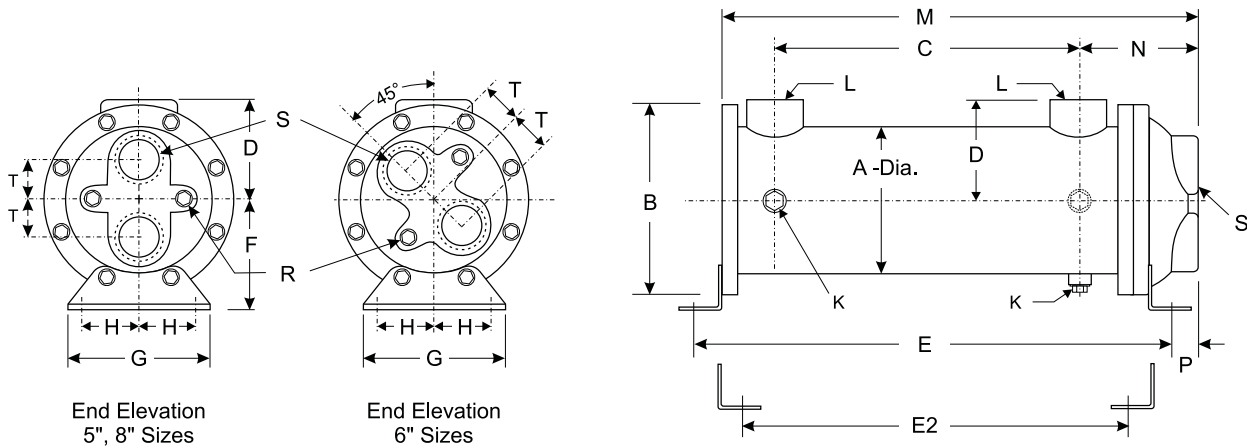
COMMERCIAL STANDARD U-TUBE - COMMON DIMENSIONS											
Model	A	B	C	D	E	F	G	H	J	K-NPT	L-NPT
05048	5-1/4	6-3/4	48-1/2	3-7/16	57-5/16	4	4-1/2	2	1/2 x 3/4	1/4	1-1/2
06048	6-1/4	7-3/4	49	4-1/16	58-3/8	4-1/2	6-1/4	2-1/2	1/2 x 3/4	3/8	2
08048	8-5/8	10-1/2	50-1/2	5-7/16	61-13/16	5-3/4	8-1/4	3-1/2	5/8 x 7/8	3/8	3

5" 6" & 8" ASME CODE MODELS											
Model	A	B	C	D	E	F	G	H	J	K-NPT	L-NPT
05048	5-1/4	6-3/4	48-1/2	3-7/8	57-5/16	4	5-1/4	2	1/2 x 3/4	1/4	1-1/2
06048	6-1/4	7-3/4	49	4-7/16	58-3/8	4-1/2	6-1/4	2-1/2	1/2 x 3/4	3/8	2
08048	8-5/8	10-1/2	50-1/2	5-7/8	61-13/16	5-3/4	8-1/4	3-1/2	5/8 x 7/8	3/8	3

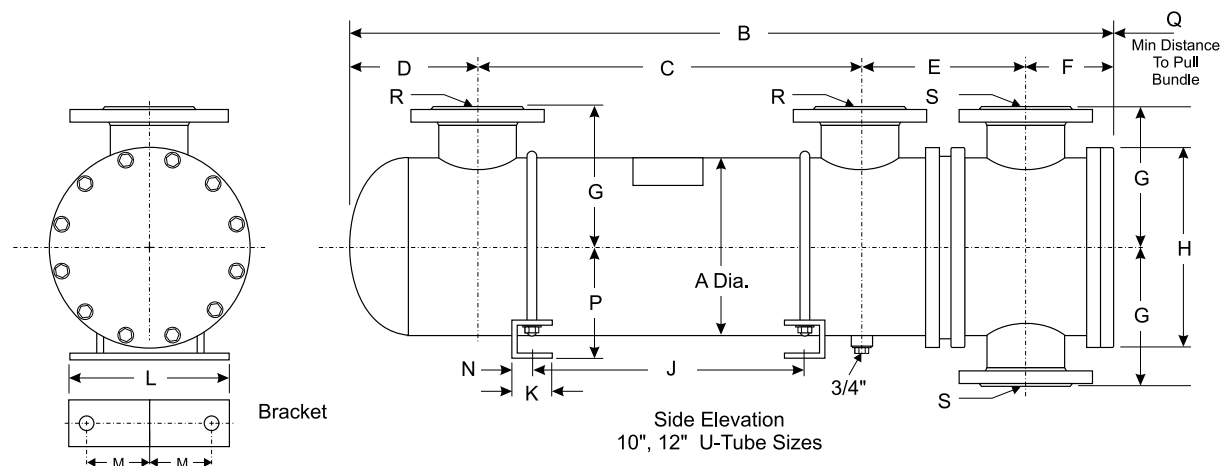
10" & 12" ASME / TEMA-C MODELS											
Model	A	B	C	D	E	F	G	H	J	K	L
10120	10-3/4	148-3/4	121	8-15/16	12	6-13/16	10	13-3/4	105	2-1/4	12-1/2
12120	12-3/4	153-1/2	122-1/2	10-9/16	13-1/2	6-15/16	11	15-3/4	109	2-1/4	14-1/2

All models are available in other lengths. Apply the appropriate dimension changes to all length measurements along the centerline. Maximum tube length for 3/8" tubing is 12 feet. Maximum tube length for 5/8" tubing is 20 feet. FL indicates ANSI 150 lb. RF flange.

## TWO-PASS U-TUBE MODELS



## TWO-PASS U-TUBE ASME-TEMA C





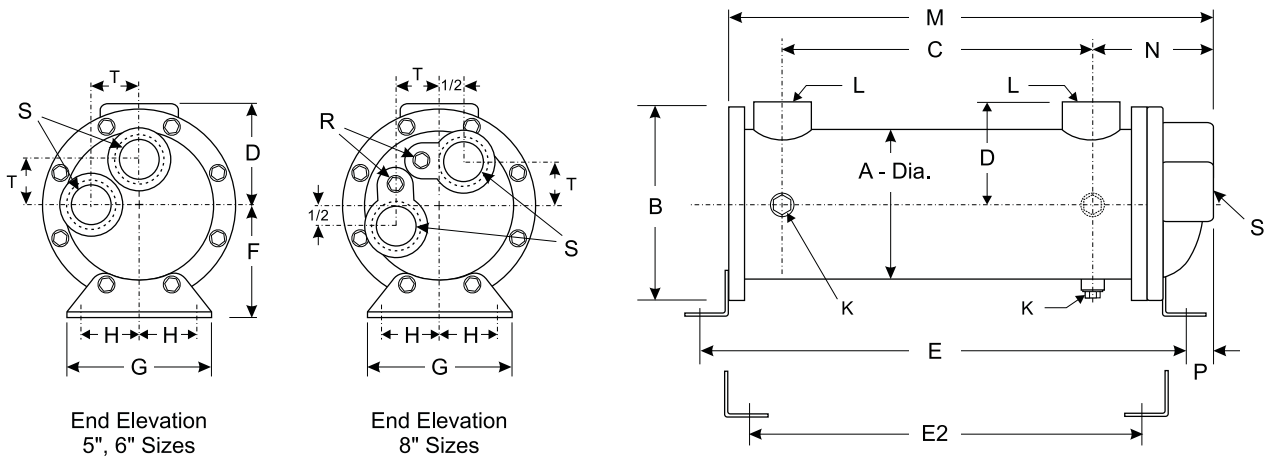
TWO-PASS						FOUR-PASS						Weight	E2	Model
M	N	P	R-NPT	S-NPT	T	M	N	P	R-NPT	S-NPT	T			
57-1/16	5-3/4	15/16	3/8	1-1/2	1-1/2	57-1/16	5-9/16	3/4	-	1	1-11/16	80	53-9/16	05048
58-3/8	6-1/8	1	1/2	2	1-9/16	58-3/8	6-1/8	1	-	1-1/2	2	135	54-3/4	06048
62-1/2	8	1-13/16	1/2	2-1/2	2-1/4	60-1/2	8	1-13/16	1/2	2	2-1/2	300	57-5/8	08048

TWO-PASS						FOUR-PASS						Weight	E2	Model
M	N	P	R-NPT	S-NPT	T	M	N	P	R-NPT	S-NPT	T			
57-1/4	5-3/4	15/16	3/8	1-1/2	1-1/2	57-1/16	5-9/16	3/4	-	1	1-11/16	90	53-9/16	05048
58-3/8	6-1/8	1	1/2	2	1-9/16	58-3/8	6-1/8	1	-	1-1/2	2	145	54-3/4	06048
62-1/2	8	1-13/16	1/2	2-1/2	2-1/4	62-1/2	8	1-13/16	1/2	2	2-1/2	310	57-11/16	08048

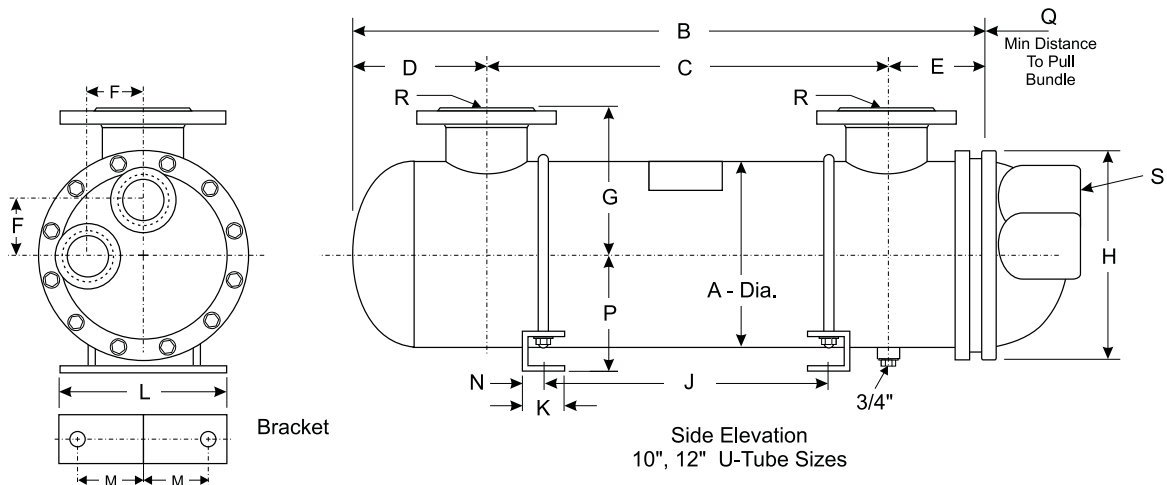
TWO-PASS						FOUR-PASS						Weight	E2	Model
M	N	P	Q	R	S	M	N	P	Q	R	S			
4	1-3/8	7	116	4FL	4FL	4	1-3/8	7	122	4FL	2-1/2	1085	-	10120
5	1-3/8	8-1/4	117	6FL	4FL	5	1-3/8	8-1/4	123	6FL	3	1580	-	12120

All models are available in other lengths. Apply the appropriate dimension changes to all length measurements along the centerline. Maximum tube length for 3/8" tubing is 12 feet. Maximum tube length for 5/8" tubing is 20 feet. FL indicates ANSI 150 lb. RF flange.

### FOUR-PASS U-TUBE MODELS

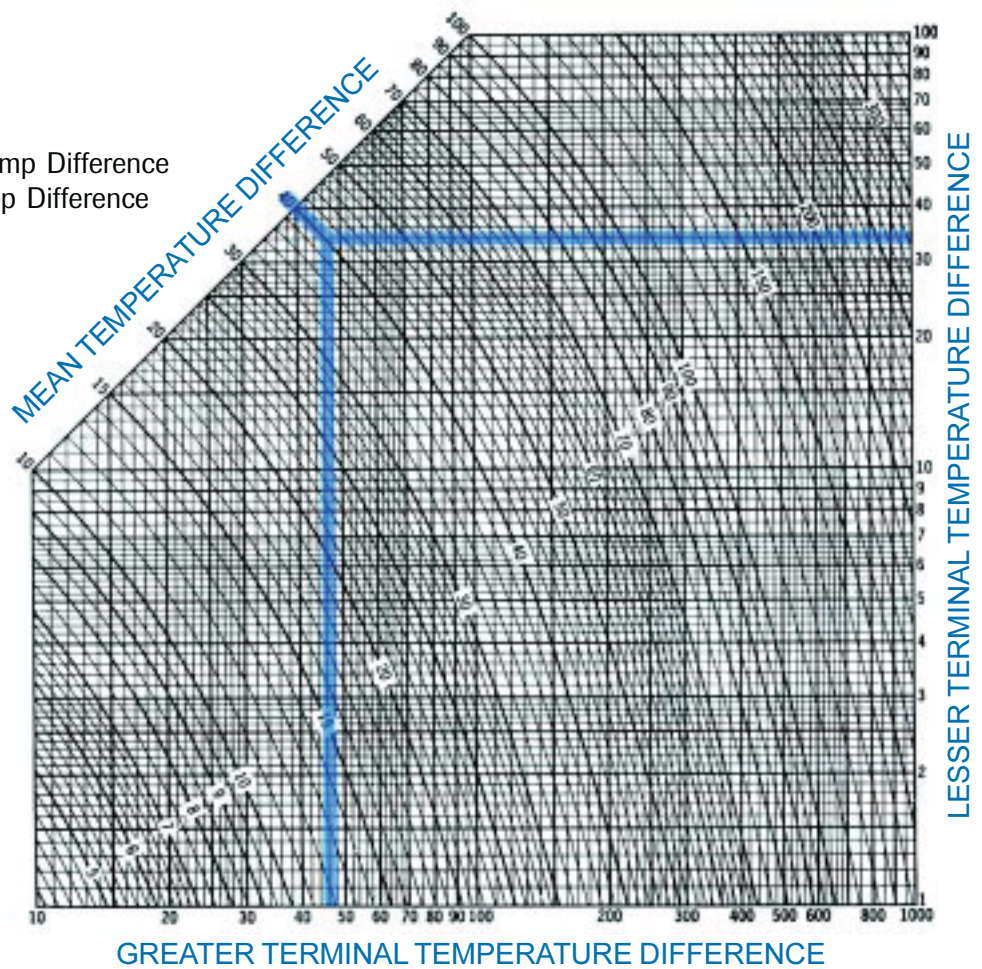


### FOUR-PASS U-TUBE ASME-TEMA C



$$LMTD = \frac{(GTTD - LTTD)}{\text{LogN} \left( \frac{GTTD}{LTTD} \right)}$$

GTTD = Greater Terminal Temp Difference  
 LTTD = Lesser Terminal Temp Difference



**P**

	0.5	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.6	0.7	0.8	0.9	1.0
0.2								.99	.99	.98	.97	.94	.90	.84	.71
0.4								.99	.98	.97	.95	.92	.85	.70	
0.6								.99	.98	.96	.94	.92	.84		
0.8								.99	.98	.96	.94	.91	.87		
1.0								.98	.97	.94	.91	.86	.77		
2.0			.99	.97	.94	.84	.74								
3.0			.97	.93	.83										

**R**

4.0	.99	.95	.85												
5.0	.98	.91													
6.0	.96	.85													
8.0	.93														
10.0	.99	.88													
12.0	.98	.72													
14.0	.97														
16.0	.95														
18.0	.94														
20.0	.91														

$$P = \frac{T_1 - T_2}{t_2 - t_1}$$

$$R = \frac{t_2 - t_1}{T_1 - T_2}$$

Locate Correction Factor at Intersection of "R" and "P"

### Correction for LMTD when Using Multi-Pass Heat Exchangers.

Multi-pass heat exchangers cannot take full advantage of counter-current flow, which changes the LMTD for the application.

To correct the LMTD, multiply the value obtained from the above graph by the correction factor obtained from this correction graph. If the P and R values intersect outside the graph, consult the factory to discuss your specific application.

- T<sub>1</sub> ..... Hot Fluid Inlet Temp, °F
- T<sub>2</sub> ..... Hot Fluid Outlet Temp, °F
- t<sub>1</sub> ..... Cold Fluid Inlet Temp, °F
- t<sub>2</sub> ..... Cold Fluid Outlet Temp, °F

## Sample Calculation To Select the Right Type 500 Heat Exchanger.

### Conditions

Process Fluid ..... 20 GPM of SAE 10 Oil to be cooled from 140° to 120°F.

Cooling Medium ... Water at 85°F. Assume a 10° maximum temperature rise.

Cooler Design ..... 4-Pass design is selected to conserve water and energy usage.

### Thermal Duty Determination

$Q = \Delta T \cdot \text{Thermal Duty Value (Chart)} \cdot \text{GPM (or air SCFM)}$

$$Q = (140-120) \cdot 204 \cdot 20$$

$$Q = 81,600 \text{ Btuh (Btu's per hour)}$$

### Determine Cooling Water Flow Required

$Q = \Delta t(\text{allowable temp rise}) \cdot \text{Flow Constant} \cdot \text{GPM}$

$$\frac{Q}{\Delta T \cdot \text{Flow Constant}} = \text{GPM} = \frac{81,000}{10 \cdot 500} = 16.3 \text{ GPM}$$

### Determine Exchanger Surface Required

$$\text{Area} = \frac{Q}{U \cdot \text{Log Mean Temp Difference}}$$

$$Q = 81,600 \text{ Btuh}$$

"U-Value" is obtained from the chart. For light oil the range is from 70-100. Assuming the oil to be typical machine lubricant with moderate fouling characteristics we will use 80 as a conservative U-Value.

### Calculate LMTD from graph on facing page

$$\begin{array}{ccc} 140^\circ & \text{---} & 120^\circ \quad (\text{Oil } \Delta T) \\ -95^\circ & \text{---} & -85^\circ \quad (\text{Water } \Delta T) \\ 45^\circ & \text{---} & 35^\circ \end{array}$$

Thus... greater temperature difference = 45°  
lesser temperature difference = 35°

### Reading from the graph, LMTD = 40°F

$$\text{Area} = \frac{Q}{U \cdot \text{LMTD}} = \frac{81,600 \text{ Btuh}}{80 \cdot 40} = 25.5 \text{ sq. ft.}$$

### Select a Type 500 Heat Exchanger

Refer to the Common Specification chart on page five. Notice that Model 05036 has 24 square feet of surface and is too small for the application.

Model 06036 has 116 tubes and contains 34 sq. ft. of tube surface. Now assure the max flow rate is not exceeded. The previous calculated flow rate is 16.3 GPM. The 06036 has a maximum flow rate of 57 GPM. This is acceptable.

In the event that the required flow rate exceeds the maximum flow rate for the heat exchanger, a larger model is required.

## Calculating Actual Heat Exchanger Length

You can calculate the actual length of the heat exchanger required to satisfy a given set of conditions. The typical tube surface contained per linear foot of tubing is:

1/4" Tubing ..... 0.0655 sq. ft per ft. of tubing

3/8" Tubing ..... 0.0982 sq. ft per ft. of tubing

5/8" Tubing ..... 0.1636 sq. ft per ft. of tubing

$$\text{Linear feet of tubing required} = \frac{\text{Area Required}}{\text{No. of Tubes} \cdot \text{Area Per Foot}}$$

Using the previous example...

$$\text{Linear Feet} = \frac{26 \text{ sq. ft.}}{116 \text{ tubes} \cdot 0.0982} = 2.28 \text{ feet}$$

## Calculating Tube Side Velocity

You can calculate the velocity of the fluid flowing through the tubes. Velocity should fall between 2 and 6 feet per second and not exceed 8 feet per second. Velocity factors for standard tubing are:

1/4" Tubing ..... 9.66 velocity factor, (Vf)

3/8" Tubing ..... 4.02 velocity factor, (Vf)

5/8" Tubing ..... 1.47 velocity factor, (Vf)

Using the previous example...

$$\text{Velocity (ft./sec.)} = \frac{16.3 \text{ (GPM)} \cdot 4.02 \text{ (Vf)} \cdot 4 \text{ (Passes)}}{116 \text{ (No. of Tubes)}} = 2.26 \text{ feet per second in the tubes}$$

## Common Heat Transfer Formulas

Btuh	=	Btu/min. • 60
Btuh	=	Horsepower • 2,545
Btuh	=	Kw • 3,413
Btuh Oil	=	GPM (Oil) • 204 • ΔT
Btuh Water	=	GPM (Water) • 500 • ΔT
LMTD °F	=	LMTD °C • 1.8

## TYPICAL THERMAL DUTY VALUES

Liquid Type	Constant Value	Spec. Gravity	Spec. Heat	°C Liters/min	°F Gallons/min
Water	500	x 1.0	x 1.0	= 238	or 500
50% Ethlene Glycol	500	x 1.04	x .83	= 203	or 428
Oil (150 SSU)	500	x .85	x .48	= 97	or 204
Air	4.58	x -	x .241	=	110 SCFM

## TYPICAL OVERALL U-VALUES

Hot Fluid	Cooling Fluid	U-Value (typical)
Steam	Water	300-500
Steam	Light Oil (SAE 10)	70-100
Steam	Heavy Oil	40-50
Steam	Air	30-40
Water	Water (85°F)	275-325
Oil (SAE 10)	Water (85°F)	70-100
Oil (SAE 30)	Water (85°F)	60-80
50% Glycol	Water	150-180

Note: Higher U-Values apply to clean, low viscosity flows. Use lower U-Values for higher pressure, dirty or viscous fluids as they tend to foul a heat exchanger.

# API Heat Transfer

API Heat Transfer, Inc.  
2777 Walden Avenue  
Buffalo, NY 14225  
(716) 684-6700

## Divisions:

### API Airtech ISO-9001 Certified

#### Air Cooled Aluminum Heat Exchangers

91 North Street • P.O. Box 68

Arcade, New York 14009-0068

(716) 496-5755 • Fax: (716) 496-5776

### API Basco ISO-9001 Certified

#### Basco®/Whitlock® Shell & Tube Heat Exchangers

2777 Walden Avenue

Buffalo, New York 14225

(716) 684-6700 • Fax: (716) 684-2129

### API Ketema

#### Acme® Refrigeration Equipment

2300 West Marshall Drive

Grand Prairie, Texas 75051

(972) 647-2626 • Fax: (972) 641-1518

### API Schmidt-Bretten

#### Plate Heat Exchangers and

#### Thermal Process Systems

2777 Walden Avenue

Buffalo, New York 14225

(716) 684-6700 • Fax: (716) 684-2129

### API Schmidt-Bretten GmbH.

#### ISO-9001 Certified

#### Plate Heat Exchangers and

#### Thermal Process Systems

P.O. Box 1580 D-75005 Bretten

Pforzheimer Strasse 46

D-75015 Bretten, Germany

49-7252-53101 • Fax: 49-7252-53201

**Call your local API Sales Representative or  
API directly toll-free at 1-877-API HEAT.**

**Visit us at [www.apiheattransfer.com](http://www.apiheattransfer.com) or  
e-mail us at [sales@apiheattransfer.com](mailto:sales@apiheattransfer.com)**

## Other Products Available from API Heat Transfer

*OptiDesign®*



Straight-tube, removable bundle exchangers made from standard components. Floating tubesheet for seal leak detection and easy maintenance. Diameters from 3" (7.62 cm) to 42" (106.68 cm). ASME, API, TEMA, ABS and other codes available.

*Hubbed Shell and Tube Heat Exchangers*



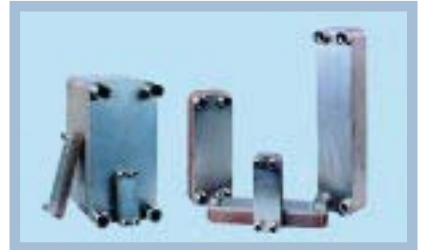
Straight or U-tube, fixed or removable tubesheet general purpose exchangers designed to cool oil, water, compressed air and other industrial fluids. A variety of port configurations and materials are available. Diameters from 3" (7.62 cm) to 12" (30.48 cm).

*TEMA Shell and Tube*



A wide variety of TEMA types are available using pre-engineered or custom designs in various sizes and materials. Shell diameters from 6" (15.24 cm) to 60" (152.4 cm), ASME, TEMA, API, ABS, TUV, ISPEL and other code constructions available.

*Brazed Plate Heat Exchangers*



Off-the-shelf, standard units reflect the latest in plate heat exchanger technology for maximum performance and low cost. Ideal for OEM or aftermarket applications. Many models stocked and ready to ship. Models for process or refrigeration applications.

*Extended Surface*



Unique, patented plate-fin design for centrifugal or axial compressor intercooler and aftercooler applications and minimal pressure loss. Design eliminates separators. ASME code design is standard. Diameters from 20" (50.8 cm) to 120" (304.8 cm).

*Air-Cooled Heat Exchangers*



High efficiency, brazed aluminum coolers for cooling a wide variety of liquids and gases with ambient air. Lightweight, yet rugged. Capable of cooling multiple fluids in single unit. Models can be supplied with cooling fan and a variety of drives.

*Plate Heat Exchangers*



Compact units provide excellent heat transfer and small size. Plates are pressed from Stainless Steel, Titanium and other alloys. Gaskets of Nitrile, EPDM, Viton®, compressed fiber and Teflon® are used. Gasket-free welded and brazed designs available.

*Pipeline Aftercoolers*



Straight-tube, counterflow aftercoolers designed to yield cool, dry compressed air. Available with or without accompanying moisture separators and constructed to a wide variety of design codes. Diameters from 6" (15.24 cm) to 42" (106.68 cm).