Thermal Transfer Products

A ThermaSys® Company

Product Catalog

thermaltransfer.com

INDUSTRIAL HYDRAULICS

MOBILE HYDRAULICS

OIL COOLERS

A global leader in manufacturing highly engineered heat transfer products

INDUSTRIAL COMPRESSOR COOLING

PROCESS INDUSTRIES

We COOL what you POWER

2011

Product Catalog

thermaltransfer.com

- Competitive pricing
- Highest quality materials and workmanship
- Stringent quality control
  Every water cooled and air cooled unit is leak-tested
- Prompt delivery
- Responsive engineering assistance
- Custom product capability
- Highest integrity and honest business style

A RECOGNIZED INDUSTRY LEADER

Thermal Transfer Products catalogs a wide offering of standard oil coolers and builds custom designed OEM Engine coolers and modules for the Industrial Fluid Power and Mobile markets. We design and build heat exchangers from Aluminum and Copper materials—both components and multi-tiered cooling modules. We have extensive experience engineering to applications in the Mobile, Industrial, Compressor and Process industries.

- Standard flushing of all coolers to ISO 15/13/10
- Special packaging and port sealing
- 110 GPM max flush flow
- Flush fluid type-Triple Lube 200
- Ability to flush every cooler that TTP produces
- Ability to clean to NAS 1638 and AS 4059E standards

COOL CLEAN

ISO CLEANLINESS LEVEL OIL COOLER FLUSHING

TTP introduces ISO 4406:1999 optional oil cooler flushing to level 15/13/10

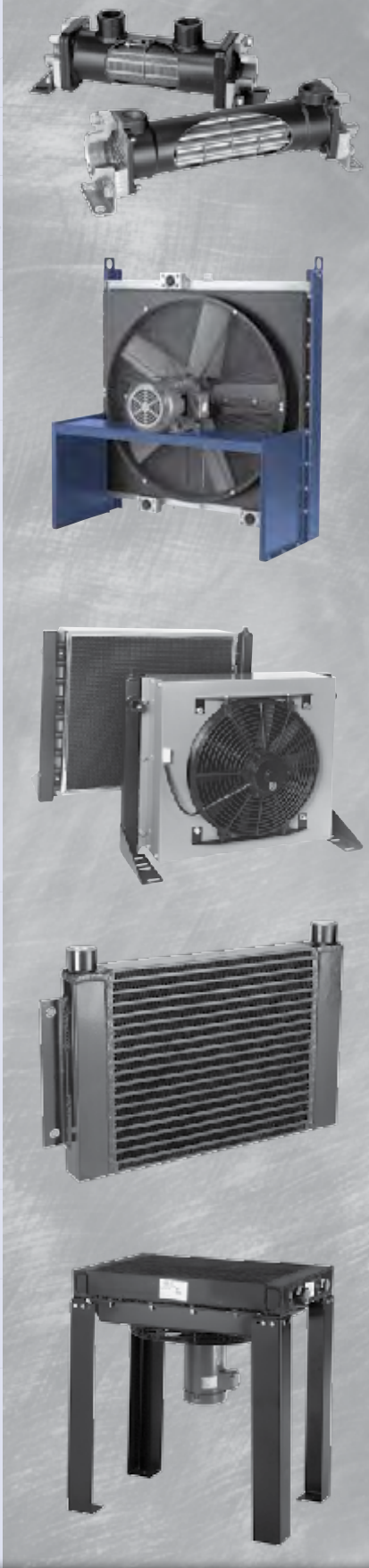
Thermal Transfer Products
A ThermaSys Company

5215 21st Street Racine, Wisconsin 53406-5096 TTPSales@thermasys.com (262) 554-8330

Thermal Transfer Products
A ThermaSys® Company

PRODUCT CATALOG

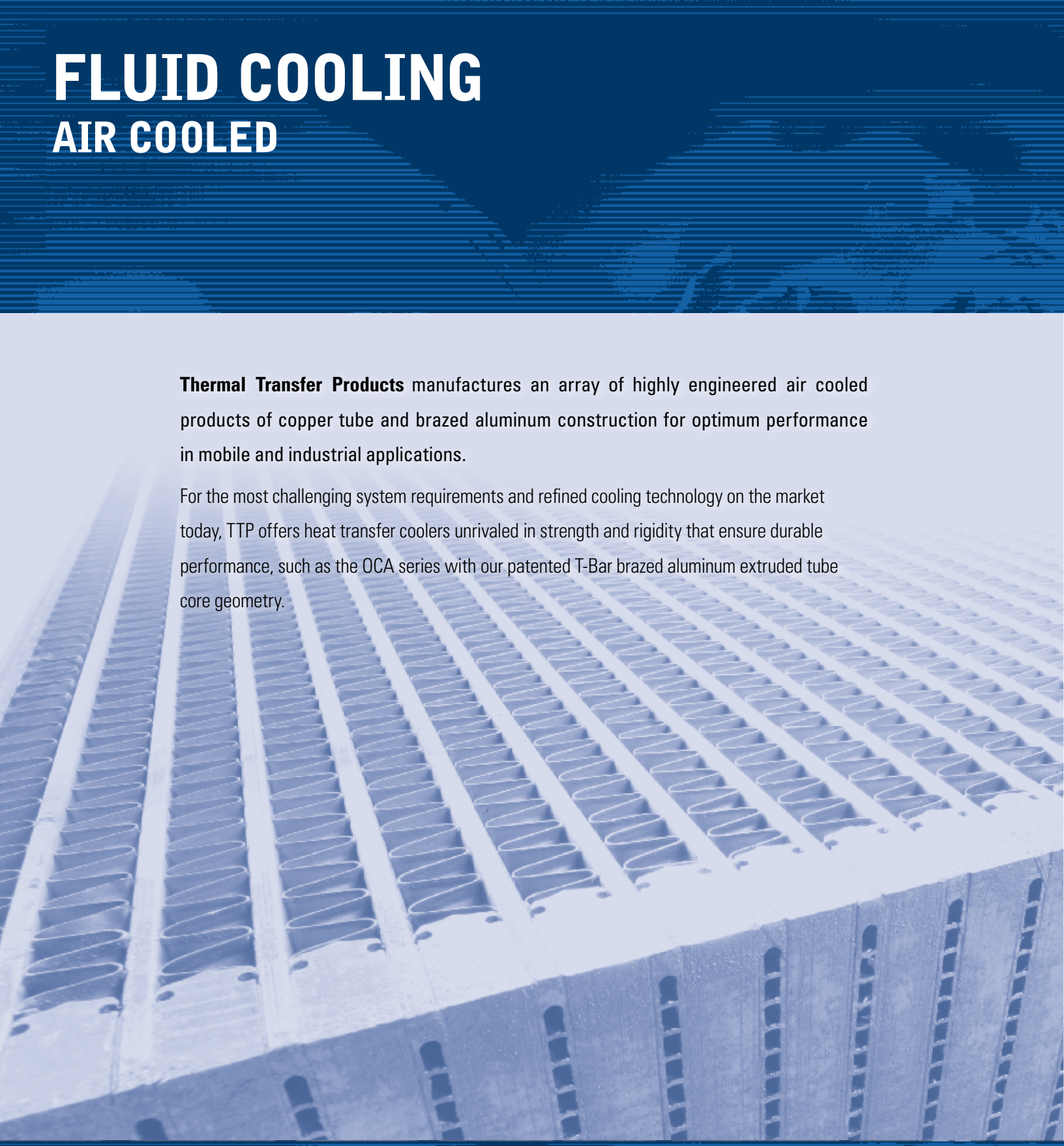
Contents



FLUID COOLING
AIR COOLED

Thermal Transfer Products manufactures an array of highly engineered air cooled products of copper tube and brazed aluminum construction for optimum performance in mobile and industrial applications.

For the most challenging system requirements and refined cooling technology on the market today, TTP offers heat transfer coolers unrivaled in strength and rigidity that ensure durable performance, such as the OCA series with our patented T-Bar brazed aluminum extruded tube core geometry.



1

COPPER TUBE CONSTRUCTION

Industrial Application (AC Fan Driven)

AOC Series Low cost, low flows (Perfect for off-line recirculation loop), high heat removal, optional serviceable bypass valve

AO Series Medium flows, moderate heat removal, optional bypass valve

AOVH Series High flows, moderate heat removal, optional bypass valve

AOF Series AO Series with filter

RM Series Low cost, low flows (case drain applications)

Mobile Application (DC or Hydraulic Fan Driven)

AOC Series Low cost, low flows (Perfect for off-line recirculation loop), high heat removal, optional serviceable bypass valve

DH Series Low cost, moderate flows, high heat removal, optional bypass valve

DF Series Steel fins, steel manifolds, and copper tubes

M Series High flows, high heat removal, optional bypass valve

MF Series Aluminum fins, steel manifolds, and copper tubes

AOHM & AOVHM Series High flows, moderate heat removal, optional bypass valve removal, hydraulic motor only

BRAZED ALUMINUM CONSTRUCTION

P-Bar Series

Industrial Application

AOL Series Bar & plate, industrial duty, very high flows, very high heat removal

BOL Series Bar & plate, brazed aluminum core, rugged, lightweight, and compact, provides the best heat transfer per given envelope size while minimizing pressure drop, with AC motor or hydraulic motor

Mobile Application

MA Series Bar & plate, brazed aluminum core, rugged, lightweight, and compact, provides the best heat transfer per given envelope size while minimizing pressure drop, with DC motor

Industrial & Mobile Application

OCA Series Available in a wide range of sizes, and designed for a broad range of applications with the advantage of providing ample cooling in areas where water is costly or unavailable

Thermal Transfer Products

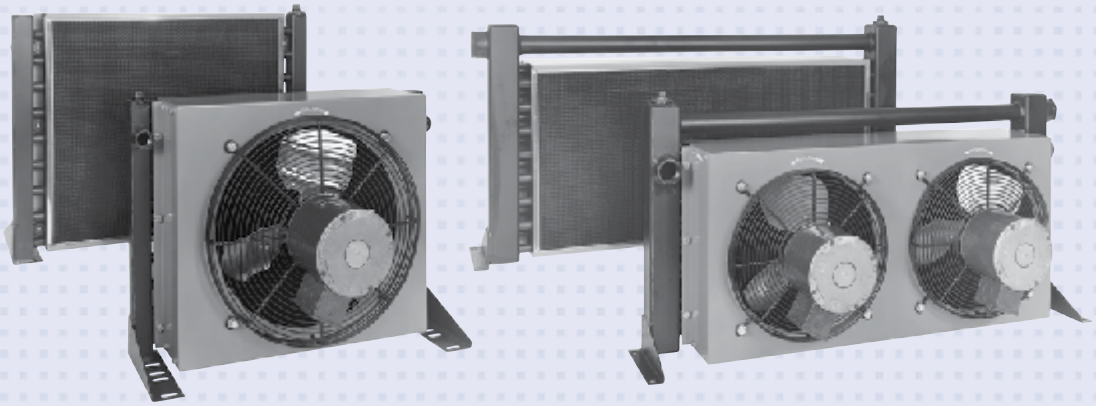
A ThermaSys® Company

a global leader in manufacturing highly engineered heat transfer products

FEATURES

- **AC Motors**
- **Core Filter**
- **3/4" Tubes**
- **Low Cost**
- **Industrial Duty**
- **Quiet Operation**
- For Low Flow Rates
- Oil Flows to 150 GPM
- Mounting Brackets Included
- SAE Connections
- Single or Three-Phase 60/50 Hz Motors
- Filter Standard

OPTIONS
Built-in Serviceable Bypass Valve;
NPT or BSPP Oil Connections



Ratings

Operating Pressure - 300 psi

Test Pressure - 300 psi

Operating Temperature - 350° F

Materials

Tubes Copper

Fins Aluminum

Turbulators Aluminum

Fan Blade Aluminum with steel hub

Fan Guard Steel with black baked enamel finish

Cabinet Steel with baked enamel finish

Manifolds Copper: Model AOC-08
Steel: Models AOC-19 – AOC-70

Connections Brass: Model AOC-08
Steel: Models AOC-19 – AOC-70

Nameplate Aluminum

Filter Stainless frame with washable media

Relief Bypass Valve Option

MODEL	DESCRIPTION
AOC-08	Available in one pass (30 and 60 psi), two pass (60 psi), designs only. Valves are built into tubes and do not affect external dimensions. All steel valves. Non-serviceable.
AOC-19 thru AOC-33	Available in 30 psi or 60 psi settings. 3/4", external, all steel valve. May be removed for servicing.
AOC-37 Thru AOC-70	Available in 30 psi or 60 psi settings. 1-1/2", external, all steel valve. May be removed for servicing.

How to Order (AOC-08 models only)

AOC – 0 8 – [ ] [ ] – [ ] – [ ]

Model Series
AOC - Standard

Model Size Selected

Number of Passes
1 - One Pass
2 - Two Pass
4 - Four Pass

Connection Type
1 - NPT
2 - SAE
3 - BSPP

Relief Bypass*
Blank - No Bypass
30 - 30 psi
60 - 60 psi

Specify Motor Required
115/230V Single Phase
No Motor

*Bypass not available in Four Pass

How to Order (Models AOC-19 through AOC-70)

AOC – [ ] [ ] – [ ] – [ ] – [ ]

Model Series
AOC - Standard

Model Size Selected

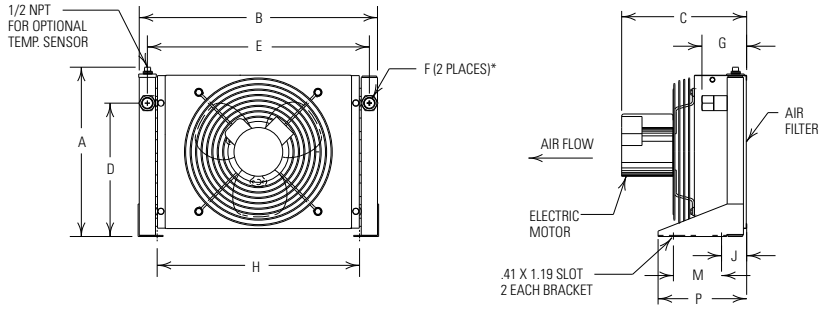
Connection Type
1 - NPT
2 - SAE
3 - BSPP

Relief Bypass
Blank - No Bypass
30 - 30 psi
60 - 60 psi

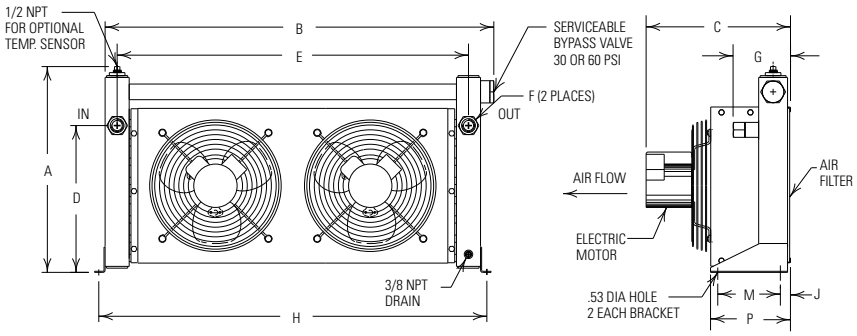
Specify Motor Required
115/230V Single Phase
208-230/460V Three Phase
575 Volt
No Motor

Dimensions

Models AOC-19 Through AOC-33



Models AOC-37 Through AOC-70



Model	A		B		C	D	E	F		G		H	J	M	P	LBS	60 Hz CFM
	No Bypass	Bypass	No Bypass	Bypass				SAE	NPT & BSPP	SAE	NPT & BSPP						
AOC-19	13.62	16.00	16.50	18.16	13.08	10.31	15.00	#12	.75	3.05	4.12	14.75	2.61	5.00	8.18	19	750
AOC-22	15.62	18.00	22.00	23.66	12.19	12.31	20.50					18.69				33	1150
AOC-24	19.62	22.00	24.75	26.41	13.19	16.31	23.25					21.44				46	1900
AOC-33	25.62	28.00	30.25	31.91		22.31	28.75	#16	1.00		4.34	26.97				65	2150
AOC-37	18.50	21.38	39.00	40.38	15.66	15.25	36.50	#20	1.25	4.62	5.97	40.50	1.06	6.50	8.31	95	2150
AOC-50	22.50	25.38	41.00	42.38	15.62	19.25	38.50			4.68	6.03	42.50	1.12		8.37	120	3200
AOC-54	30.50	33.28	42.00	43.38	17.09	27.25	39.50	#24	1.50	4.89	6.30	43.75	1.87	9.00	12.37	154	3800
AOC-57	36.50	39.38	48.00	49.38	16.72	32.75	45.50	#32	2.00	6.68	8.15	49.75				190	4200
AOC-70	38.38	41.25	51.00	52.38	22.62	34.00	48.50			8.44	9.91	52.75	1.62		12.12	322	7500

NOTE: All dimensions in inches. We reserve the right to make reasonable design changes without notice.
**Inlet and outlet oil ports reversible if relief bypass option is not used.*

Specifications

Electric Motor Data

MODEL	MOTOR POWER	# OF MOTORS	FRAME SIZE	SINGLE PHASE	THREE PHASE	575 VOLT	RPM	TYPE	B-BALL S-SLEEVE	THERMAL OVERLOAD	dB(A) 3 FT.
AOC-19 thru AOC-33	1/4	1	Custom	115/230V/60/50Hz 3.2/1.6 Amps Full Load 60 Hz 2.8/1.4 Amps Full Load 50 Hz	208-230/460V/60 Hz 190/380-415V/50 Hz 1.3/.65 Amps Full Load 60 Hz 1.1/.55 Amps Full Load 50 Hz	575/500V/60/50Hz .65 Amps Full Load 60 Hz .60 Amps Full Load 50 Hz	1700 (60 Hz) 1350 (50 Hz)	TEAO	B	YES	80
AOC-37 thru AOC-57		2									84
AOC-70	1		56C	115/208-230V/60 Hz 12.8/6.4 Amps Full Load	208-230/460V/60 Hz 190/380-415V/50 Hz 3.4/1.7 Amps Full Load 60 Hz 3.6/1.9 Amps Full Load 50 Hz	575/500V/60/50Hz 1.5 Amps Full Load 60 Hz 1.4 Amps Full Load 50 Hz	1725 (60 Hz) 1425 (50 Hz)	TEFC	B	NO	90

NOTE: Amp ratings are per motor.

Selection Procedure

Performance Curves are based on 50SSU oil leaving the cooler 40°F higher than the ambient air temperature used for cooling.This is also referred to as a 40°F approach temperature.

STEP 1 **Determine the Heat Load.**This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

STEP 2 **Determine Approach Temperature.** Desired oil leaving cooler °F – Ambient air temp. °F = Actual Approach

STEP 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
Horsepower heat load x $\frac{40 \times Cv}{\text{Actual Approach}}$ = Curve Horsepower

STEP 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI; ✛ = 40 PSI. Multiply pressure drop from curve by correction factor found in oil △P correction curve.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).
To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.
This formula may also be used in any application where the only temperature available is the entering oil temperature.

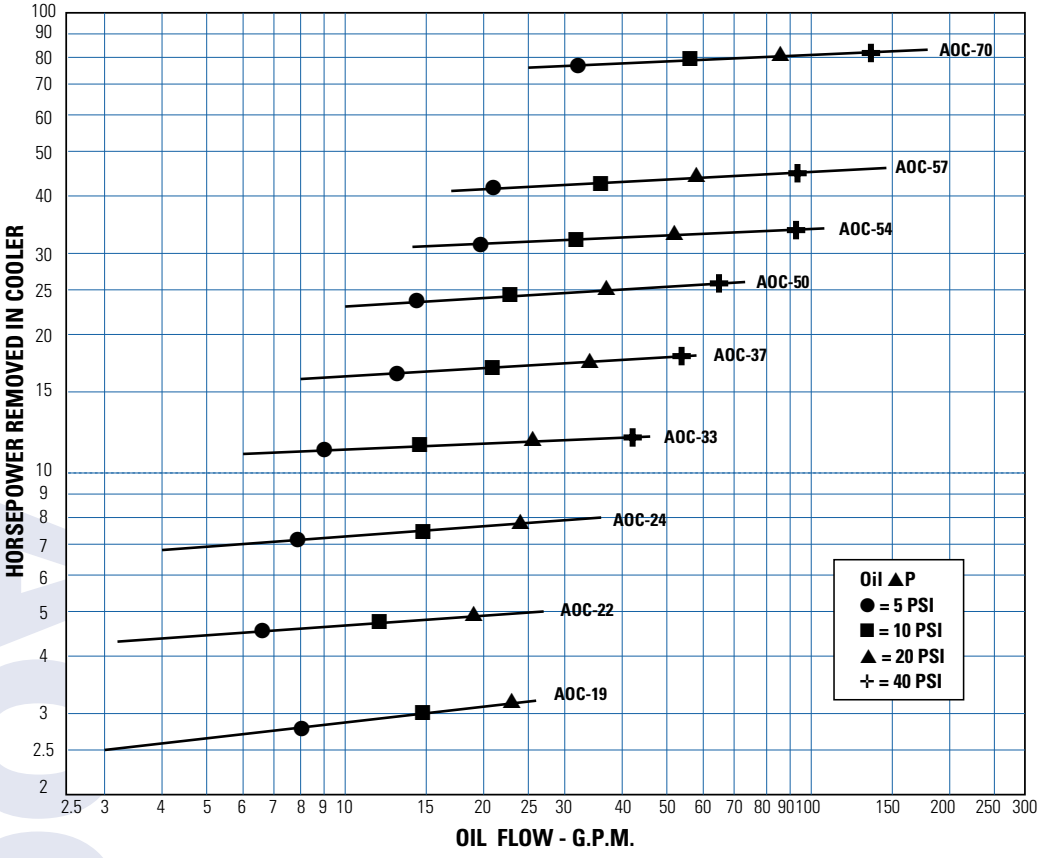
Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

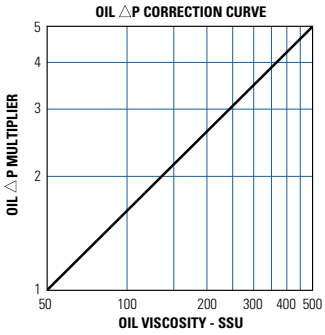
Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

Performance Curves





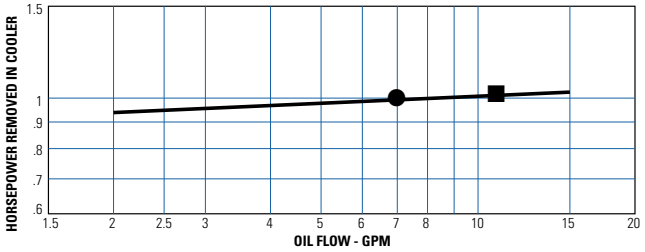
De-rate cooler performance by 10% when used in 50Hz service.

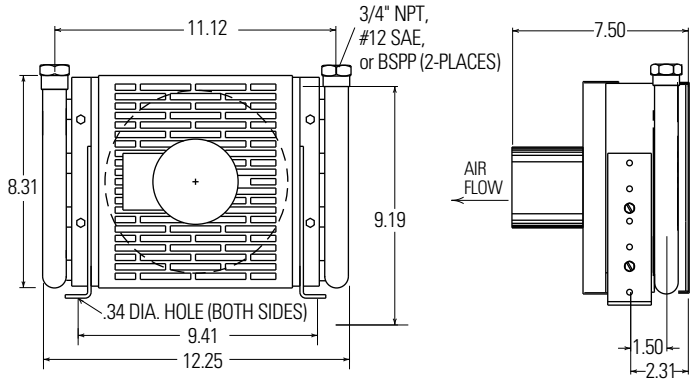
C_V Viscosity Correction

Average Oil Temp °F	OIL SAE 5 110 SSU at 100°F 40 SSU at 210°F	SAE 10 150 SSU at 100°F 43 SSU at 210°F	SAE 20 275 SSU at 100°F 50 SSU at 210°F	SAE 30 500 SSU at 100°F 65 SSU at 210°F	SAE 40 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

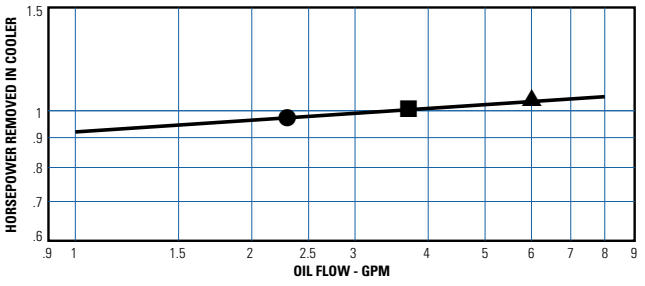
AOC-08 Model Only

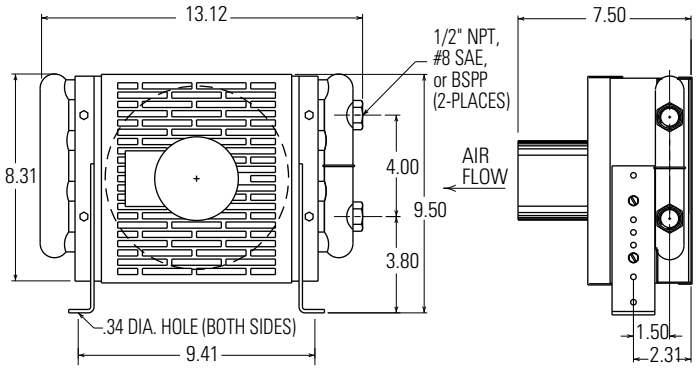
One Pass



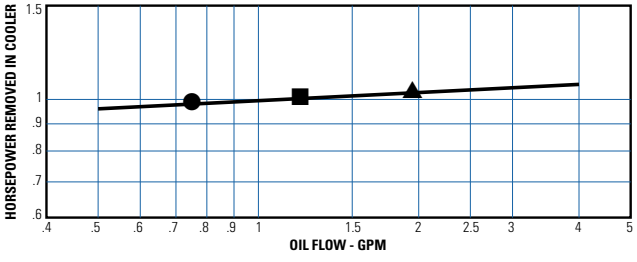


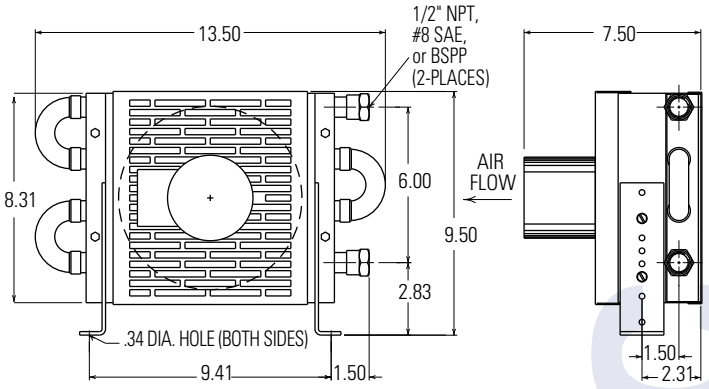
Two Pass





Four Pass





Specifications

Electric Motor Data

Model	MOTOR POWER	115/230 VOLT	50/60 Hz	TYPE	RPM	BEARINGS B-BALL S-SLEEVE	THERMAL OVERLOAD	SHIPPING WEIGHT (lbs.)	dB(A) 3 FT.	CFM
AOC-08	1/30	115 VOLT 230 VOLT	1.1 Amps Full Load .7 Amps Full Load	TEAO	3000	S	YES	12	70	208

FEATURES

- **Young Interchange – OCH**
- **Adjustable Louvers**
- **Medium Flow Rates**
- **Moderate Heat Removal**
- **One or Two Pass**
- Fluid Power Systems
- Gear Drives
- Injection Molding Machines
- Machine Tools
- Torque Converters
- Hydraulic Presses

OPTIONS

SAE & Metric Connections
Relief Bypass
Foot Brackets
Corrosive Resistant
Marine Coating

Ratings

Operating Pressure - 300 psi
Test Pressure - 300 psi
Operating Temperature - 400° F

Materials

Tubes Copper
Fins Aluminum
Turbulators Steel
Fan Blade Aluminum with steel hub
Fan Guard Zinc plated steel
Cabinet Steel with baked enamel finish
Manifolds Steel
Connections Steel

Weights

MODEL	Net Weight (LBS)
AO-5	47
AO-10	62
AO-15	72
AO-20	86
AO-25	120
AO-30	135
AO-35	160
AO-40	185

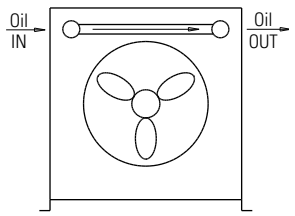
One Pass (Medium to High Oil Flows)

Model Number	Flow Range GPM (USA)
AOR - 5-1	2 - 80
AOR - 10-1	3 - 80
AOR - 15-1	4 - 80
AOR - 20-1	5 - 80
AOR - 25-1	6 - 100
AOR - 30-1	7 - 100
AOR - 35-1	8 - 112
AOR - 40-1	9 - 118

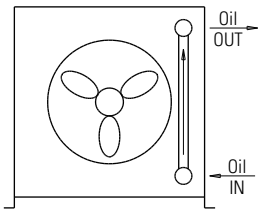
Two Pass (Low to Medium Oil Flows)

Model Number	Flow Range GPM (USA)
AOR - 5-2	2 - 25
AOR - 10-2	2 - 30
AOR - 15-2	2 - 30
AOR - 20-2	2 - 40
AOR - 25-2	2 - 40
AOR - 30-2	2 - 40
AOR - 35-2	3 - 40
AOR - 40-2	4 - 40

One Pass



Two Pass



How to Order

[ ] – [ ][ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Model Series
AO
AOR-Includes Bypass

Model Size Selected

Number of Passes*
Blank - No Bypass
1 - One Pass
2 - Two Pass

Connection Type
Blank - NPT
S - SAE
M - Metric

Relief Bypass Setting*
30-30 psi
60 - 60 psi

Foot Mounted Brackets
Blank - No Brackets
FB - Foot Brackets

Specify Motor Required
Single Phase
Single Phase Expl. Proof
Three Phase
Three Phase 575 Volt
Three Phase Expl. Proof

***ADD FOR AOR MODELS ONLY:** Relief Bypass Setting & Number of Passes

TTPSales@thermasys.com 262.554.8330 www.thermaltransfer.com

Specifications

Electric motor & Fan data*

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Bal S-Sleeve
AO-5	401/487 494	68 70	1/12 1/4	110/115 208-230/460	1 3	1.2/1.2 1.4-1.3/.65	50/60 60	48	1400/1700 1725	TEAO TEFC	A D	No	B
AO-10	576/700 710	68 70	1/12 1/4	110/115 208-230/460	1 3	1.2/1.2 1.4-1.3/.65	50/60 60	48	1400/1700 1725	TEAO TEFC	A D	No	B
AO-15	824/1000 1015	69 71	1/12 1/4	110/115 208-230/460	1 3	1.2/1.2 1.4-1.3/.65	50/60 60	48	1400/1700 1725	TEAO TEFC	A D	No	B
AO-20	1555	70 72	1/6 1/4	115/208-230 208-230/460	1 3	4/2.1-2 1.4-1.3/.65	60 60	48	1725	TEFC TEFC	C D	No	B
AO-25	2240	72 73	1/6	115/208-230 208-230/460	1 3	4.6/2.2 1.3-1.2/.6	60	48	1140	TEFC	C D	No	B
AO-30	3100	75 76	1/6	115/208-230 208-230/460	1 3	5.2/2.7-2.6 1.3-1.2/.6	60	48	1140	TEFC	C D	No	B
AO-35	4370	76 77	1/2	115/208-230 208-230/460	1 3	8/4.2-4 2.5-2.4/1.2	60	56	1140	TEFC	C D	No	B
AO-40	5450	78 79	1/2	115/208-230 208-230/460	1 3	8/4.2-4 2.5-2.4/1.2	60	56	1140	TEFC	C D	No	B

**Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.*
***Catalog dB(A) sound levels are at seven (7) feet. dB(A) sound levels increase by six (6) dB(A) for halving this distance and decrease by six (6) dB(A) for doubling this distance.*

Explosion Proof Motors (Class I GP.D & Class II GP.F, G)*

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Bal S-Sleeve
AO-5	494	68 70	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.65	60	48	1725	FC	C D	Yes	B
AO-10	710	68 70	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.65	60	48	1725	FC	C D	Yes	B
AO-15	1015	69 71	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.65	60	48	1725	FC	C D	Yes	B
AO-20	1555	70 72	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.65	60	48	1725	FC	C D	Yes	B
AO-25	2240	72 73	1/3	115/230 208-230/460	1 3	6.8/3.4 1.8-1.6/.8	60	56	1140	FC	C D	Yes	B
AO-30	3100	75 76	1/3	115/230 208-230/460	1 3	6.8/3.4 1.8-1.6/.8	60	56	1140	FC	C D	Yes	B
AO-35	4370	76 77	1/2	115/230 208-230/460	1 3	8/4 2.5-2.4/1.2	60	56	1140	FC	C D	Yes	B
AO-40	5450	78 79	1/2	115/230 208-230/460	1 3	8/4 2.5-2.4/1.2	60	56	1140	FC	C D	Yes	B

**Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.*

575 Volt

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Bal S-Sleeve
AO-5	494	70	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AO-10	710	70	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AO-15	1015	71	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AO-20	1555	72	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AO-25	2240	73	1/2	575	3	.88	60	56	1140	TEFC	D	No	B
AO-30	3100	76	1/2	575	3	.88	60	56	1140	TEFC	D	No	B
AO-35	4370	77	1/2	575	3	.88	60	56	1140	TEFC	D	No	B
AO-40	5450	79	1/2	575	3	.88	60	56	1140	TEFC	D	No	B

**D Squirrel Cage*
***Catalog dB (A) sound levels at seven (7) feet. dB (A) sound levels increase by six (6) dB (A) for halving this distance, and decrease by six (6) dB (A) for doubling this distance.*

Lubrication Notes

Caution: Do not over oil or over grease. **Ball bearings –** No grease needed at start up. Grease as follows:

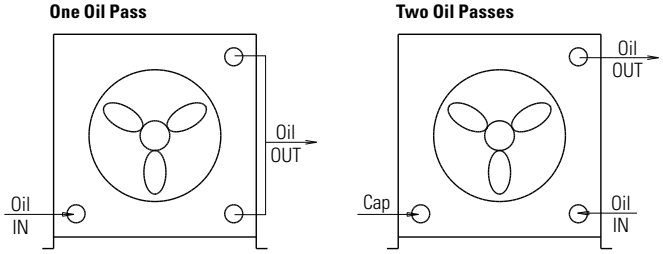
5,000 Hours/Year	5 Year Grease Interval
Continuous Normal Applications	2 Years
Seasonal Service Motor is idle for 6 months or more	1 Year
Continuous High ambients, dirty or moist locations, high vibration	6 Months

Dimensions

Model	A	B	C	D	E	F	G	H	J	K	L	M NPT	M SAE	N	P	T
AO-5	7.40	14.81	5.90	11.81	20.00	9.19	8.31	6.47	12.94	3.78	7.56	1"	#16 SAE	5.84	11.69	—
AO-10	9.50	19.00	6.56	13.12	19.25	10.50	12.50	8.56	17.12	4.44	8.88	1"	1-5/16-12UN-2B	7.94	15.88	—
AO-15	10.19	20.38	7.87	15.75	19.25	13.12	13.88	9.25	18.50	5.75	11.50	1"	Thread	8.62	17.25	—
AO-20	11.91	23.81	9.19	18.38	19.25	15.75	17.91	10.90	21.81	7.00	14.00	1-1/4"		10.28	20.56	—
AO-25	13.34	26.68	11.81	23.62	19.25	21.00	20.19	12.40	24.81	9.62	19.25	1-1/4"	#20 SAE	11.78	23.56	—
AO-30	15.81	31.62	13.78	27.56	19.50	24.94	25.12	14.87	29.75	11.59	23.19	1-1/4"	1-5/8-12UN-2B	14.25	28.50	11.00
AO-35	16.90	33.81	15.09	30.19	21.50	27.56	27.31	15.97	31.94	12.90	25.81	1-1/4"	Thread	15.34	30.69	11.00
AO-40	20.81	41.62	18.37	36.75	20.50	34.12	35.12	19.87	39.75	16.19	32.38	1-1/4"		19.25	38.50	13.25

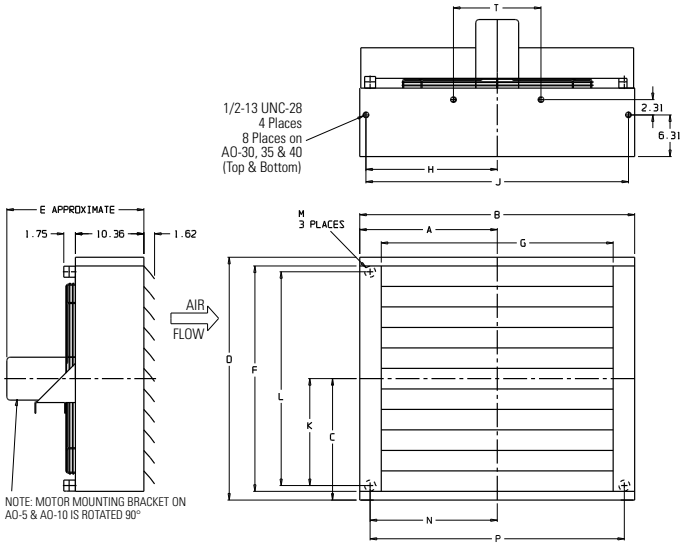
NOTE: All dimensions in inches.

Installation Piping Diagram



**See dimension chart for NPT or optional internal SAE connection size.*

Fan Rotation Clockwise/Facing Motor Shaft

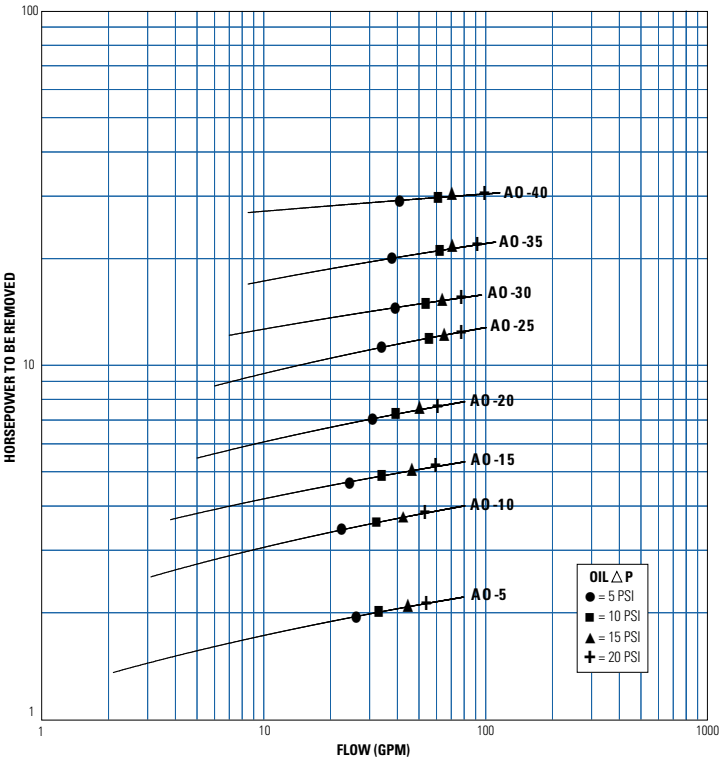


C_V Viscosity Correction

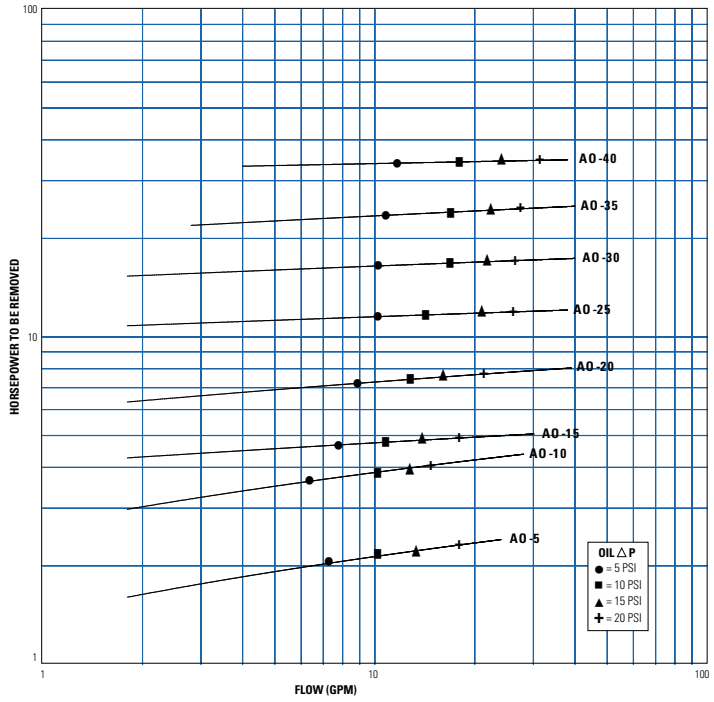
	OIL					
Average Oil Temp °F	**SAE 5** 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F	**50-50 Ethylene Glycol & Water**
100	1.14	1.22	1.35	1.58	1.77	1.11
150	1.01	1.05	1.11	1.21	1.31	1.02
200	.99	1.00	1.01	1.08	1.10	.96
250	.95	.98	.99	1.00	1.00	.95

Performance Curves

One Pass Oil



Two Pass Oil



Selection Procedure

Performance Curves are based on 50SSU oil leaving the cooler 40°F higher than the ambient air temperature used for cooling.This is also referred to as a 40°F approach temperature.

STEP 1 **Determine the Heat Load.**This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load.)

If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

STEP 2 **Determine Approach Temperature.** Desired oil leaving cooler °F – Ambient air temp. °F = Actual Approach

STEP 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:

Horsepower heat load x $\frac{40 \times Cv}{\text{Actual Approach}}$ = Curve Horsepower

STEP 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

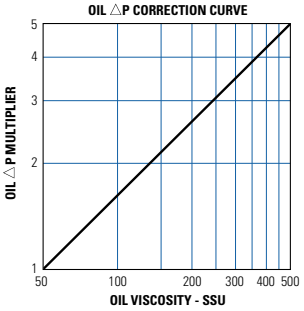
STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 14 PSI; ✚ = 20 PSI. Multiply pressure drop from curve by correction factor found in oil △P correction curve.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).
To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.
This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.



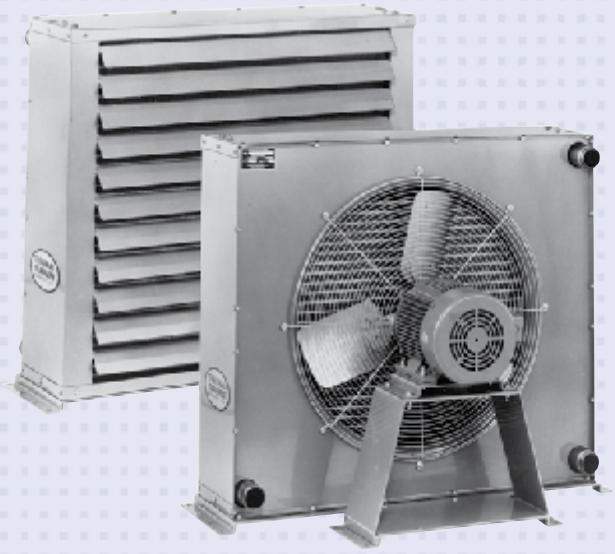
Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

FEATURES

- **High Performance AO**
- **High Flow Rates**
- **Compact**
- **One or Two Pass**
- Fluid Power Systems
- Gear Drives
- Injection Molding Machines
- Machine Tools
- Torque Converters
- Hydraulic Presses



OPTIONS

Internal SAE Straight Threads
SAE & Metric Connections
Relief Bypass
Corrosive Resistant
Marine Coating

Ratings

Operating Pressure - 300 psi
Operating Temperature - 400° F

Materials

Tubes Copper
Fins Aluminum
Turbulators Steel
Fan Blade Aluminum with steel hub
Fan Guard Zinc plated steel
Cabinet Steel with baked enamel finish
Manifolds Steel
Connections Steel

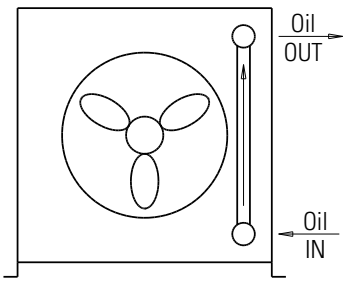
Weights

MODEL	Net Weight (LBS)
AOVHR - 5	67
AOVHR - 10	78
AOVHR - 15	90
AOVHR - 20	110
AOVHR - 25	157
AOVHR - 30	190
AOVHR - 35	315
AOVHR - 40	350

Two Pass Only (Low to Medium Oil Flows)

Model Number	Flow Range GPM (USA)
AOVHR - 5-2	4 - 50
AOVHR - 10-2	4 - 60
AOVHR - 15-2	4 - 60
AOVHR - 20-2	4 - 80
AOVHR - 25-2	4 - 80
AOVHR - 30-2	4 - 80
AOVHR - 35-2	6 - 80
AOVHR - 40-2	8 - 80

AOVHR Series



How to Order

[ ] – [ ][ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Model Series
AOVH
AOVHR-Includes Bypass

Model Size Selected

Number of Passes*
Blank - No Bypass
2 - Two Pass Only

Connection Type
Blank - NPT
S - SAE
M - Metric

Relief Bypass Setting*
30-30 psi
60 - 60 psi

Specify Motor Required
Single Phase
Single Phase Expl. Proof
Three Phase
Three Phase 575 Volt
Three Phase Expl. Proof

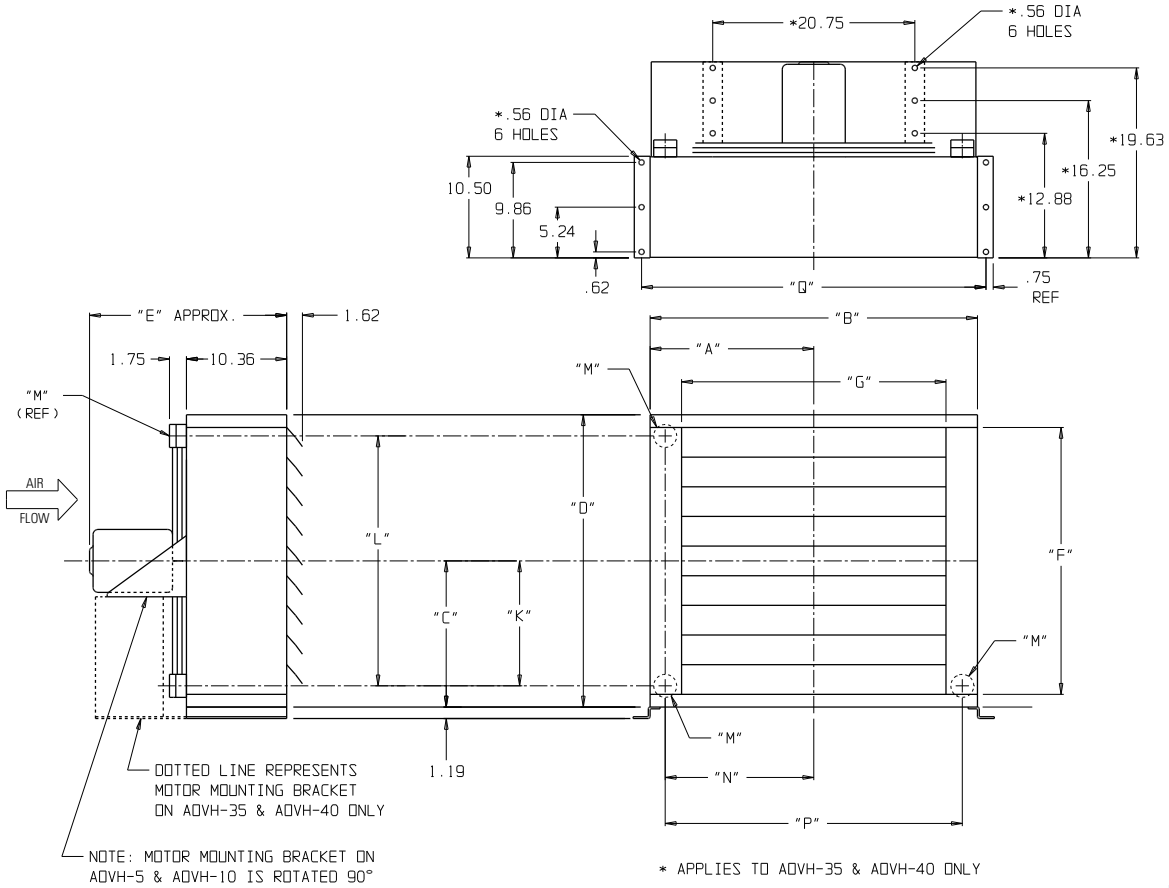
***ADD FOR AOVHR MODELS ONLY:** Relief Bypass Setting & Number of Passes

Dimensions

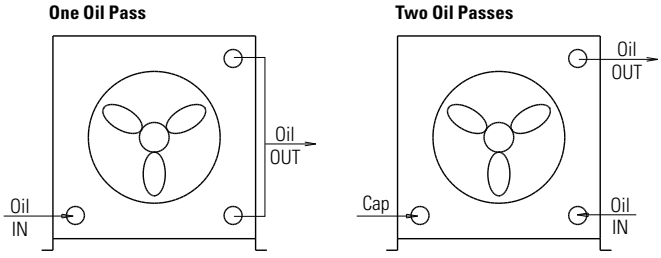
Model	A	B	C	D	E	F	G	K	L	M NPT	M SAE	N	P	Q	Net Wt (Lbs.)
AOVH-5	7.40	14.81	5.90	11.81	19.93	9.19	8.31	3.84	7.69	1-1/2"	#24 SAE 1-7/8-12UN Thread	5.84	11.69	16.81	67
AOVH-10	9.50	19.00	6.56	13.12	19.49	10.50	12.50	4.44	8.88			7.94	15.88	21.00	78
AOVH-15	10.19	20.38	7.87	15.75	19.49	13.12	13.88	5.75	11.50			8.62	17.25	22.38	90
AOVH-20	11.91	23.81	9.19	18.38	19.49	15.75	17.19	7.00	14.00	2"	#32 SAE 2-1/2-12UN Thread	10.28	20.56	25.81	110
AOVH-25	13.34	26.68	11.81	23.62	23.58	21.00	20.19	9.62	19.25			11.78	23.56	28.68	157
AOVH-30	15.81	31.62	13.78	27.56	23.33	24.94	25.12	11.59	23.19			14.25	28.50	33.62	190
AOVH-35	16.90	33.81	15.09	30.19	23.06	27.56	27.31	12.90	25.81			15.34	30.69	35.81	315
AOVH-40	20.81	41.62	18.37	36.75	23.06	34.12	35.12	16.19	32.38			19.25	38.50	43.62	350

NOTE: All dimensions in inches.

Fan Rotation Clockwise/Facing Motor Shaft



Installation Piping Diagram



**See dimension chart for NPT or optional internal SAE connection size.*

Lubrication Notes

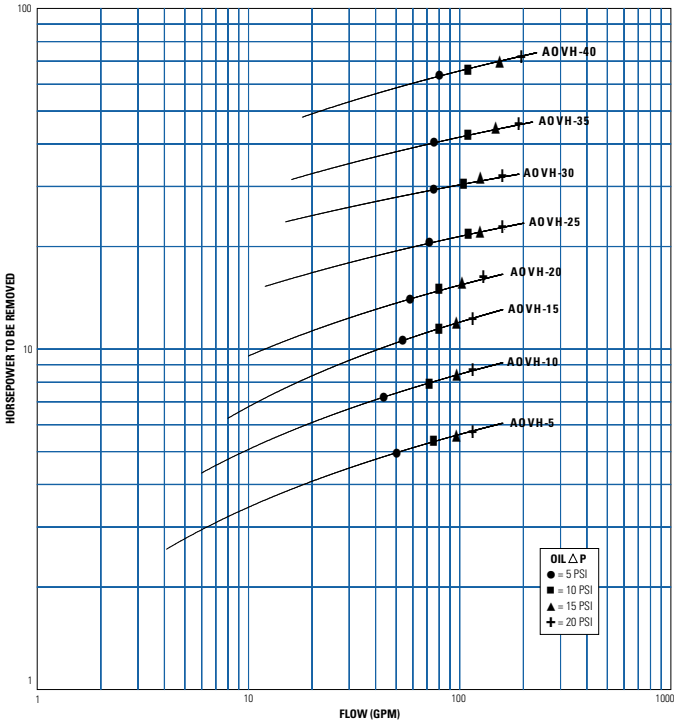
Caution: Do not over oil or over grease.

Ball bearings – No grease needed at start up. Grease as follows:

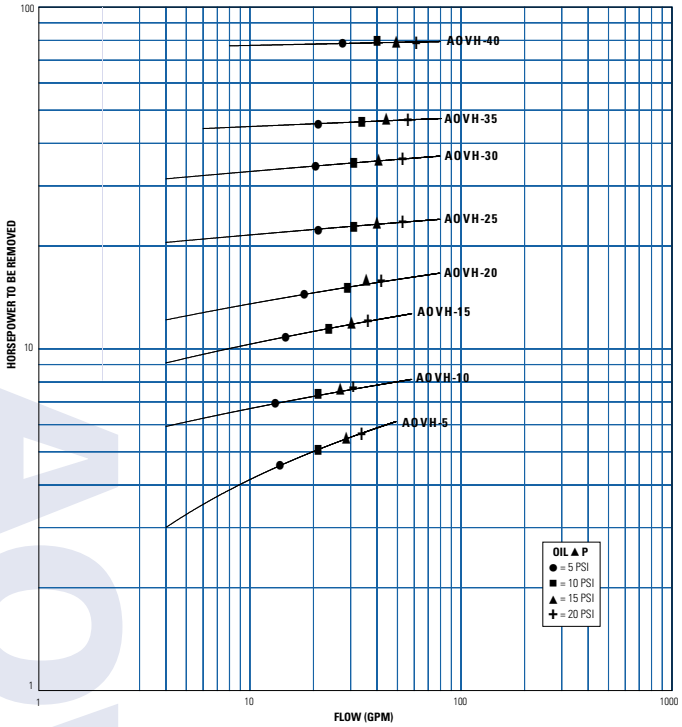
5,000 Hours/Year	5 Year Grease Interval
Continuous Normal Applications	2 Years
Seasonal Service Motor is idle for 6 months or more	1 Year
Continuous High ambients, dirty or moist locations, high vibration	6 Months

Performance Curves

One Pass Oil (AOVH)



Two Pass Oil (AOVH or AOVHR)



Selection Procedure

Performance Curves are based on 50SSU oil leaving the cooler 40°F higher than the ambient air temperature used for cooling.This is also referred to as a 40°F approach temperature.

STEP 1 **Determine the Heat Load.**This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

STEP 2 **Determine Approach Temperature.** Desired oil leaving cooler °F – Ambient air temp. °F = Actual Approach

STEP 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
Horsepower heat load x $\frac{40 \times Cv}{\text{Actual Approach}}$ = Curve Horsepower

STEP 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

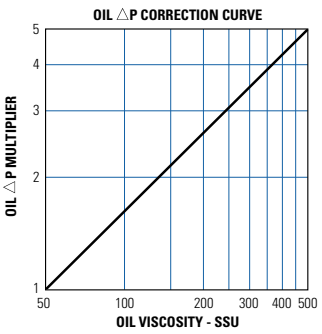
STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 15 PSI; ✛ = 20 PSI. Multiply pressure drop from curve by correction factor found in oil △P correction curve.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).
To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.
This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.



Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

C_V Viscosity Correction

Average Oil Temp °F	OIL					
	SAE 5 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F	**50-50 Ethylene Glycol & Water**
100	1.14	1.22	1.35	1.58	1.77	1.11
150	1.01	1.05	1.11	1.21	1.31	1.02
200	.99	1.00	1.01	1.08	1.10	.96
250	.95	.98	.99	1.00	1.00	.95

Specifications

Electric motor & Fan data*

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Ball S-Sleeve
AOVH-5	780	85	1/2	115/208-230 208-230/460	1 3	7.4/3.9-3.7 2.1-2./1.	60 60	48 48	3450 3450	TEFC TEFC	C D	No No	B B
AOVH-10	1110	85	1/2	115/208-230 208-230/460	1 3	7.4/3.9-3.7 2.1-2./1.	60 60	48 48	3450 3450	TEFC TEFC	A D	No	B
AOVH-15	1590	91	1/2	115/208-230 208-230/460	1 3	7.4/3.9-3.7 2.1-2./1.	60 60	48 48	3450 3450	TEFC TEFC	A D	No	B
AOVH-20	2168	91	1/2	115/208-230 208-230/460	1 3	7.4/3.9-3.7 2.1-2./1.	60 60	48 48	3450 3450	TEFC TEFC	C D	No	B
AOVH-25	3000	81	1	115/208-230 208-230/460	1 3	12.4/6.5-6.2 3.6-3.4/1.7	60 60	56 56	1725 1725	TEFC TEFC	C D	No	B
AOVH-30	4095	84	1	115/208-230 208-230/460	1 3	12.4/6.5-6.2 3.6-3.4/1.7	60 60	56 56	1725 1725	TEFC TEFC	C D	No	B
AOVH-35	NOT AVAILABLE				1	9.-8.6/4.3	60	182T	1725	TEFC	D	No	B
	5921	89	3	208-230/460	3								
AOVH-40	NOT AVAILABLE				1	9.-8.6/4.3	60	182T	1725	TEFC	D	No	B
	9609	91	3	208-230/460	3								

**Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.*

***Catalog dB(A) sound levels are at seven (7) feet. dB(A) sound levels increase by six (6) dB(A) for halving this distance and decrease by six (6) dB(A) for doubling this distance.*

Explosion Proof Motors (Class I GP.D & Class II GP.F, G)*

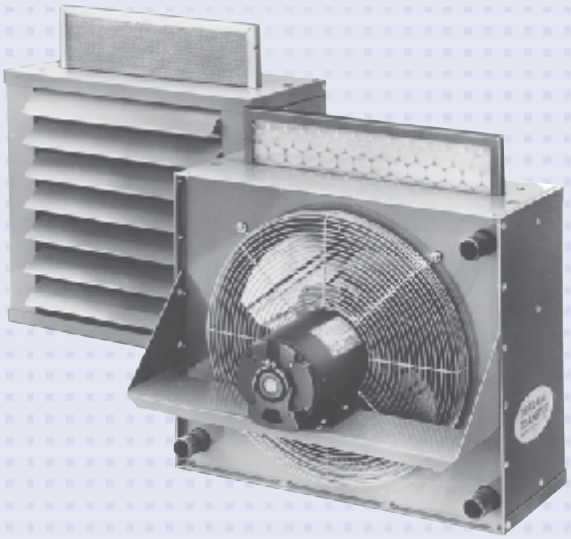
Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Ball S-Sleeve
AOVH-5	780	85	1/2	115/230 208-230/460	1 3	7.4/3.7 2.4-2.2/1.1	60	48	3450	FC	C D	Yes	B
AOVH-10	1110	85	1/2	115/230 208-230/460	1 3	7.4/3.7 2.4-2.2/1.1	60	48	3450	FC	C D	Yes	B
AOVH-15	1590	91	1/2	115/230 208-230/460	1 3	7.4/3.79 2.4-2.2/1.1	60	48	3450	FC	C D	Yes	B
AOVH-20	2168	91	1/2	115/230 208-230/460	1 3	7.4/3.79 2.4-2.2/1.1	60	48	3450	FC	C D	Yes	B
AOVH-25	3000	81	1	115/230 230/460	1▲ 3	12.4/6.2 3.4/1.7	60	56	1725	FC	C D	Yes No	B
AOVH-30	4095	84	1	115/230 230/460	1▲ 3	12.4/6.2 3.4/1.7	60	56	1725	FC	C D	Yes No	B
AOVH-35	NOT AVAILABLE				1	8.6/4.3	60	182T	1725	FC	D	No	B
	5921	89	3	230/460	3								
AOVH-40	NOT AVAILABLE				1	8.6/4.3	60	182T	1725	FC	D	No	B
	9609	91	3	230/460	3								

**Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.*

▲ = CL. 1, GP. D only **TEFC** = Totally enclosed, fan cooled **FC** = Fan cooled **C** = Capacitor start - Induction run **D** = Squirrel cage

FEATURES

- **AO with Removable Filter**
- **Adjustable Louvers**
- **Medium Flow Rates**
- **Moderate Heat Removal**
- **One or Two Pass Option**
- Fluid Power Systems
- Gear Drives
- Injection Molding Machines
- Machine Tools
- Torque Converters
- Hydraulic Presses



OPTIONS

SAE & Metric Connections

Built-in Bypass Relief

Foot Mounting Brackets

Corrosion Resistant/Marine Duty Coating

Ratings

Operating Pressure - 300 psi

Test Pressure - 300 psi

Operating Temperature - 400° F

Replacement Air Filters

MODEL	Fiberglass Disposable Type Part Number	Aluminum Washable Type Part Number
AOF - 5	65528	65559
AOF - 10	65530	65560
AOF - 15	65507	65561
AOF - 20	65532	65562
AOF - 25	65519	65563
AOF - 30	65535	65564
AOF - 35	65537	65565
AOF - 40	65543	65566

Materials

Tubes Copper

Fins Aluminum

Turbulators Steel

Fan Blade Aluminum with steel hub

Fan Guard Zinc plated steel

Cabinet Steel with baked enamel finish

Manifolds and Connection Pipes Steel

Weights

MODEL	Net Weight (LBS)
AOF-5	60
AOF-10	70
AOF-15	80
AOF-20	95
AOF-25	125
AOF-30	140
AOF-35	165
AOF-40	230

How to Order

[ ] – [ ][ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Model Series
AOF - No Bypass
AOFR - Includes Bypass

Model Size Selected

Number of Passes*
Blank - No Bypass
1 - One Pass
2 - Two Pass

Connection Type
Blank - NPT
S - SAE
M - Metric

Relief Bypass Setting*
30-30 psi
60 - 60 psi

Foot Mounted Brackets
Blank - No Brackets
FB - Foot Brackets

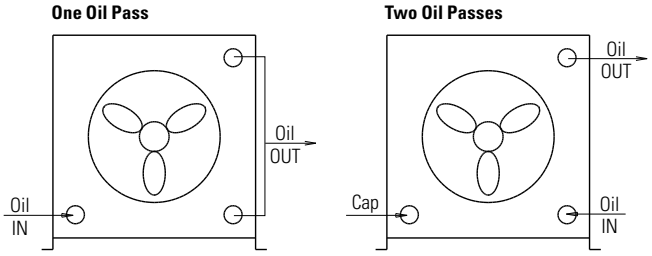
Specify Motor Required
Single Phase
Single Phase Expl. Proof
Three Phase
Three Phase 575 Volt
Three Phase Expl. Proof

***ADD FOR AOFR MODELS ONLY:** Relief Bypass Setting & Number of Passes

Dimensions

Model	A	B	C	D	E	F	G	H	J	K	L	M NPT	M SAE	N	P	Q	R	S	T
AOF-5	7.40	14.81	5.90	11.81	17.50	9.19	8.31	6.47	12.94	3.78	7.69	1"	#16 SAE 1-5/16-12UN-2B Thread	5.84	11.69	10.06	1.09	3.92	—
AOF-10	9.50	19.00	6.56	13.12	17.00	10.50	12.50	8.56	17.12	4.44	8.88	1"		7.94	15.88	14.38	1.09	3.92	—
AOF-15	10.19	20.38	7.87	15.75	17.62	13.12	13.88	9.25	18.50	5.75	11.50	1"		8.62	17.25	15.62	1.09	3.92	—
AOF-20	11.91	23.81	9.19	18.38	19.62	15.75	17.91	10.90	21.81	7.00	14.00	1-1/4"	#20 SAE 1-5/8-12UN-2B Thread	10.28	20.56	18.62	1.09	3.92	—
AOF-25	13.34	26.68	11.81	23.62	20.68	21.00	20.19	12.40	24.81	9.62	19.25	1-1/4"		11.78	23.56	21.62	1.09	3.92	—
AOF-30	15.81	31.62	13.78	27.56	20.12	24.94	25.12	14.87	29.75	11.59	23.19	1-1/4"		14.25	28.50	26.62	1.09	3.92	11.00
AOF-35	16.90	33.81	15.09	30.19	21.25	27.56	27.31	15.97	31.94	12.90	25.81	1-1/4"		15.34	30.69	28.88	1.09	3.94	11.00
AOF-40	20.81	41.62	18.37	36.75	20.31	34.12	35.12	19.87	39.75	16.19	32.38	1-1/4"		19.25	38.50	37.00	1.18	3.87	13.25

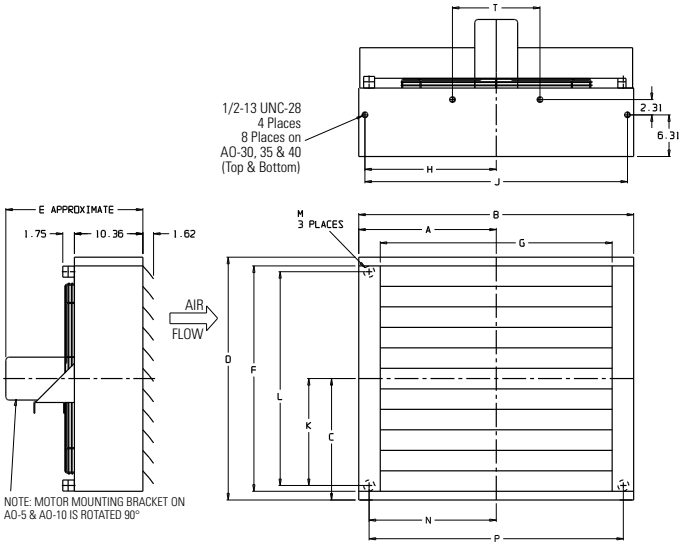
Installation Piping Diagram



**See dimension chart for NPT or optional internal SAE connection size.*

NOTE: All dimensions in inches.

Fan Rotation Clockwise/Facing Motor Shaft



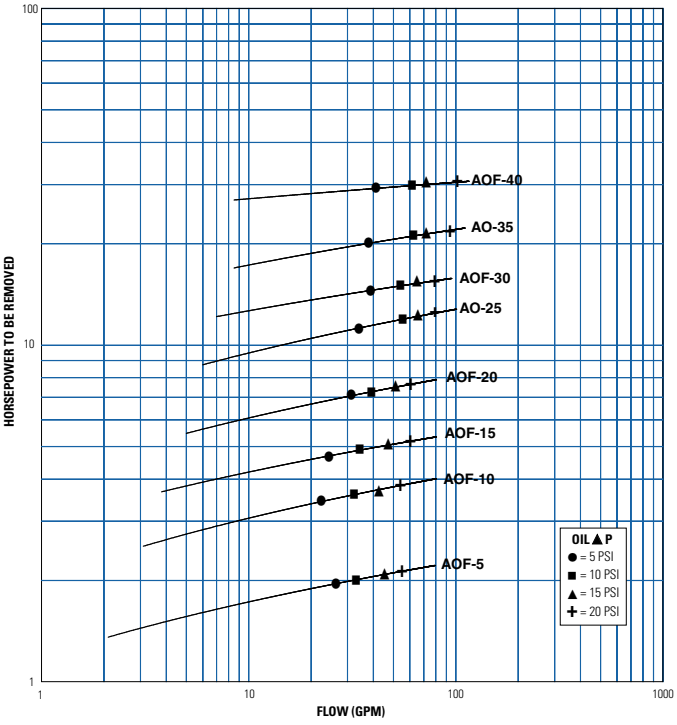
Lubrication Notes

Caution: Do not over oil or over grease. **Ball bearings –** No grease needed at start up. Grease as follows:

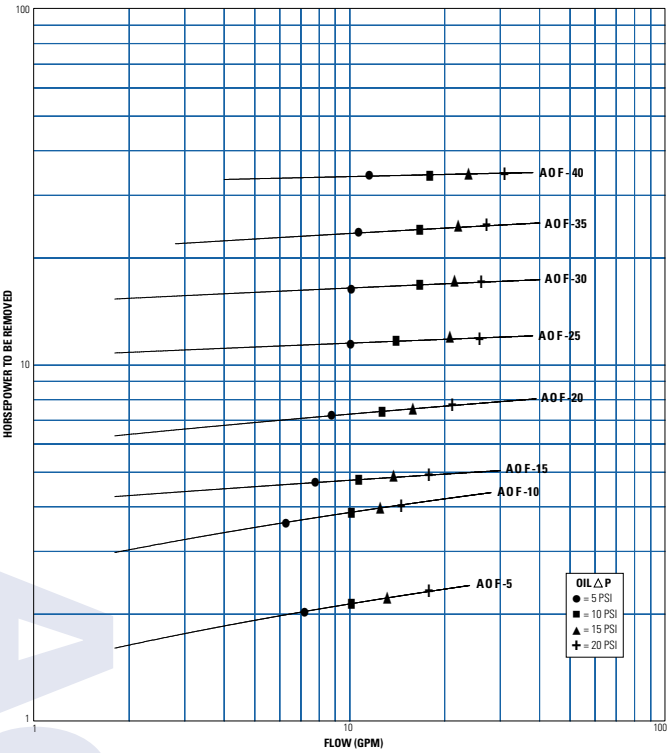
5,000 Hours/Year	5 Year Grease Interval
Continuous Normal Applications	2 Years
Seasonal Service Motor is idle for 6 months or more	1 Year
Continuous High ambients, dirty or moist locations, high vibration	6 Months

Performance Curves

One Pass Oil



Two Pass Oil



Selection Procedure

Performance Curves are based on 50SSU oil leaving the cooler 40°F higher than the ambient air temperature used for cooling.This is also referred to as a 40°F approach temperature.

STEP 1 **Determine the Heat Load.**This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

STEP 2 **Determine Approach Temperature.** Desired oil leaving cooler °F – Ambient air temp. °F = Actual Approach

STEP 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
Horsepower heat load x $\frac{40 \times Cv}{\text{Actual Approach}}$ = Curve Horsepower

STEP 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

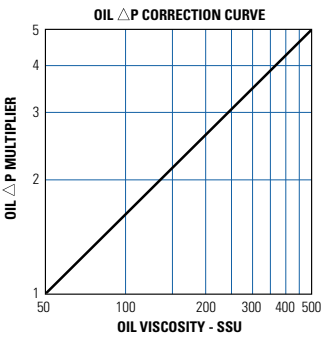
STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 15 PSI; ✛ = 20 PSI. Multiply pressure drop from curve by correction factor found in oil △P correction curve.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).
To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.
This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.



Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

C_V Viscosity Correction

Average Oil Temp °F	OIL					
	SAE 5 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F	**50-50 Ethylene Glycol & Water**
100	1.14	1.22	1.35	1.58	1.77	1.11
150	1.01	1.05	1.11	1.21	1.31	1.02
200	.99	1.00	1.01	1.08	1.10	.96
250	.95	.98	.99	1.00	1.00	.95

Specifications

Electric motor & Fan data*

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Ball S-Sleeve
AOF-5	465 494	68 70	1/6 1/4	115/208-230 208-230/460	1 3	4./2.1-2 1.4-1.3/.65	60	48	1725	TEFC	C D	No	B
AOF-10	669 710	68 70	1/6 1/4	115/208-230 208-230/460	1 3	4./2.1-2 1.4-1.3/.65	60	48	1725	TEFC	C D	No	B
AOF-15	956 1015	69 71	1/4	115/208-230 208-230/460	1 3	5.8/3-2.9 1.4-1.3/.65	60	48	1725	TEFC	C D	No	B
AOF-20	1460 1555	70 72	1/2	115/208-230 208-230/460	1 3	7.8/4.1-3.9 2.1-2./1.	60	48	1725	TEFC	C D	No	B
AOF-25	2160 2240	72 73	1/2	115/208-230 208-230/460	1 3	8/4.2-4 2.5-2.4/1.2	60	56	1140	TEFC	C D	No	B
AOF-30	2990 3100	75 76	1/2	115/208-230 208-230/460	1 3	8/4.2-4 2.5-2.4/1.2	60	56	1140	TEFC	C D	No	B
AOF-35	NOT AVAILABLE				1	4-3.8/1.9	60	56	1140	TEFC	D	No	B
	4370	77	1.0	208-230/460	3								
AOF-40	NOT AVAILABLE				1	4-3.8/1.9	60	56	1140	TEFC	D	No	B
	5450	79	1.0	208-230/460	3								

**Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.*

***Catalog dB(A) sound levels are at seven (7) feet. dB(A) sound levels increase by six (6) dB(A) for halving this distance and decrease by six (6) dB(A) for doubling this distance.*

Explosion Proof Motors (Class I GP.D & Class II GP.F, G)*

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit	Thermal Overload	Bearing B-Ball S-Sleeve
AOF-5	494	68 70	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.65	60	48	1725	FC	C D	Yes	B
AOF-10	710	68 70	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.76	60	48	1725	FC	C D	Yes	B
AOF-15	1015	69 71	1/4	115/230 208-230/460	1 3	5.8/2.9 1.4-1.3/.65	60	48	1725	FC	C D	Yes	B
AOF-20	1555	70 72	1/2	115/230 208-230/460	1 3	7.8/3.9 2.1-2./1.	60	48	1725	FC	C D	Yes	B
AOF-25	2240	72 73	1/2	115/230 230/460	1 3	8./4. 2.5-2.4/1.2	60	56	1140	FC	C D	Yes	B
AOF-30	3100	75 76	1/2	115/230 230/460	1 3	8./4. 2.5-2.4/1.2	60	56	1140	FC	C D	Yes	B
AOF-35 ▲	NOT AVAILABLE				1	3.8/1.9	60	56	1140	FC	D	No	B
	4370	77	1.0	230/460	3								
AOF-40 ▲	NOT AVAILABLE				1	3.8/1.9	60	56	1140	FC	D	No	B
	5450	79	1.0	230/460	3								

▲ = AOF 35 & 40, CL. 1, GP. D only **TEFC** = Totally enclosed, fan cooled **FC** = Fan cooled **C** = Capacitor start - Induction run **D** = Squirrel cage

**Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.*

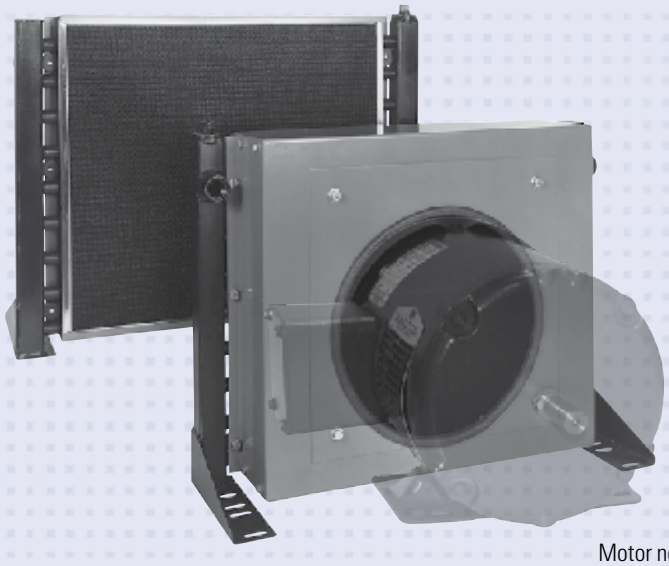
575 Volt Specifications

Model	CFM	Sound dB(A)** at 7 ft.	Horse Power	Volts	Phase	Full Load Amps	Hz	Nema Frame	RPM	Type	Circuit*	Thermal Overload	Bearing B-Ball S-Sleeve
AOF-5	494	70	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AOF-10	710	70	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AOF-15	1015	71	1/4	575	3	.52	60	48	1725	TEFC	D	No	B
AOF-20	1555	72	1/2	575	3	.80	60	48	1725	TEFC	D	No	B
AOF-25	2240	73	1/2	575	3	.88	60	56	1140	TEFC	D	No	B
AOF-30	3100	76	1/2	575	3	.88	60	56	1140	TEFC	D	No	B
AOF-35	4370	77	1.0	575	3	1.6	60	56	1140	TEFC	D	No	B

Catalog dB (A) sound levels at seven (7) feet. dB (A) sound levels increase by six (6) dB (A) for halving this distance, and decrease by six (6) dB (A) for doubling this distance.

FEATURES

- **Mounts to Rear of Electric Motor – TEFC**
- **Utilizes Electric Motor Fan Air Flow**
- **Ideal for Case Drain Applications**
- **Compact, Efficient Design**
- **Low Flow & Heat Removal**
- Mounts Behind Existing TEFC Motor for Compact, Low Cost Application
- SAE, NPT or Metric Conversion
- Mounting Brackets Included



Motor not included.

Ratings

Operating Pressure - 300 psi

Test Pressure - 300 psi

Operating Temperature - 350° F

Materials

Tubes Copper

Fins Aluminum

Turbulators Aluminum

Cabinet Steel with baked enamel finish

Filter Stainless frame with washable media

Manifolds Copper; RM-08
Steel; RM-19 & RM-24

Connections Brass; RM-08
Steel; RM-19 & RM-24

Nameplate Aluminum

How to Order - RM-08 Models Only

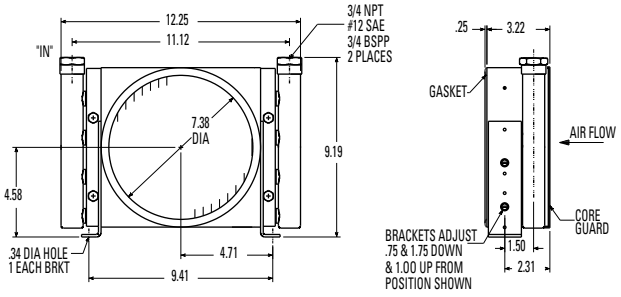
RM	–	0	8	–		
Model Series		Model Size Selected			Number of Passes 1 - 1 Pass 2 - 2 Pass 4 - 4 Pass	Connection Type 1 - NPT 2 - SAE 3 - BSPP

How to Order - all models except RM-08 Size

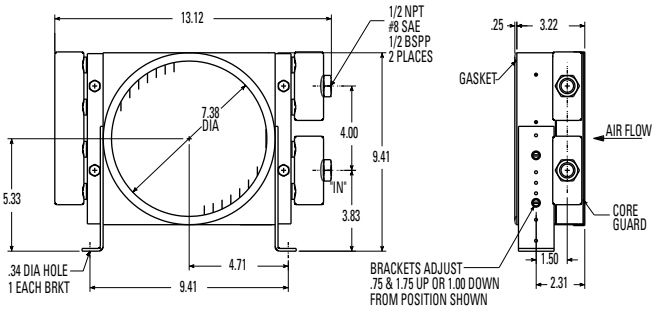
RM	–			–		
Model Series		Model Size Selected			Number of Passes 1 - 1 Pass 2 - 2 Pass	Connection Type 1 - NPT 2 - SAE 3 - BSPP

Dimensions

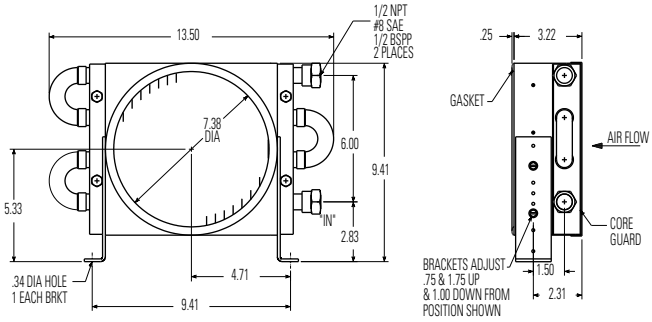
RM-08-1
One Pass



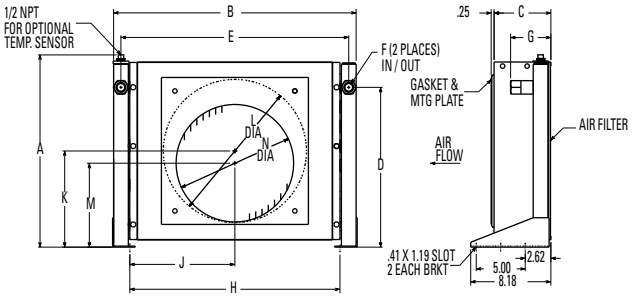
RM-08-2
Two Pass



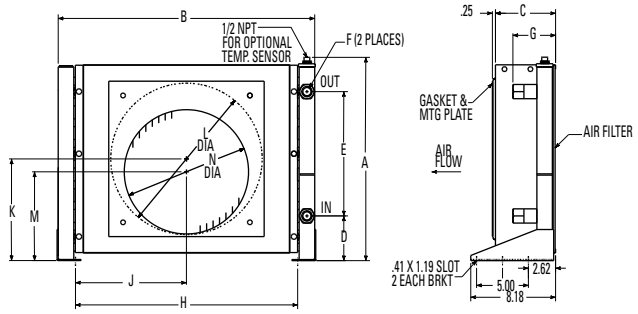
RM-08-4
Four Pass



RM-19-1, RM-24-1
One Pass



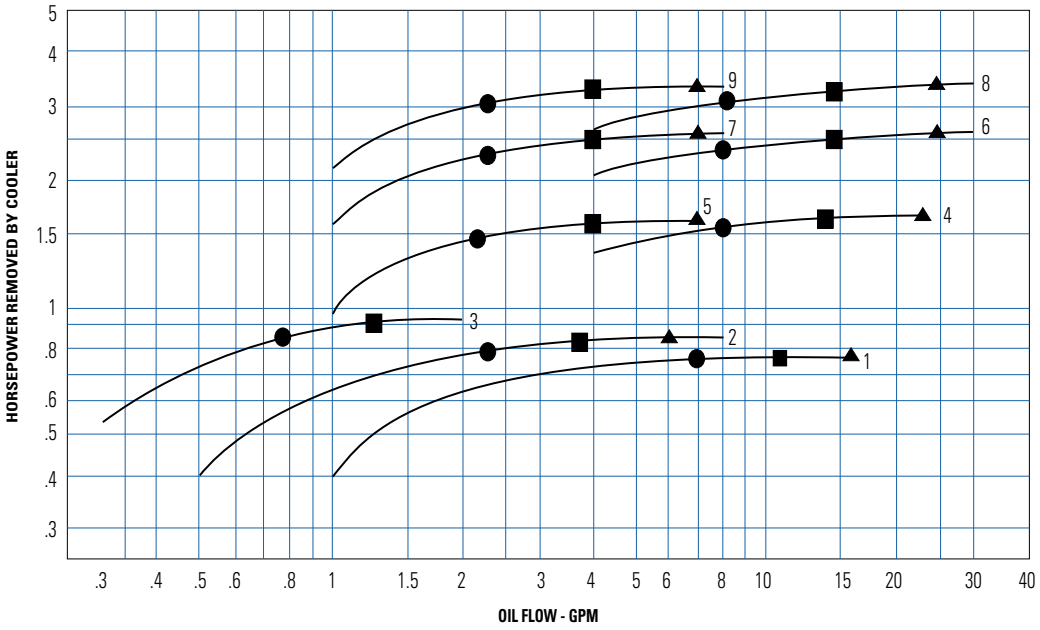
RM-19-2, RM-24-2
Two Pass

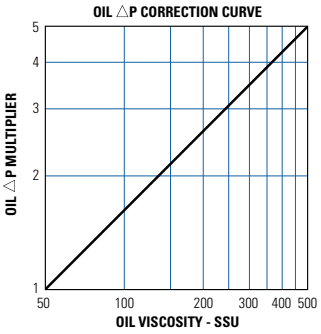


Model	A	B	C	D	E	F		G		H	J	K	L	M	N	NET WTS.
						SAE	NPT/BSPP	SAE	NPT/BSPP							
RM-19-1*	13.62	16.50	5.11	10.31	15.00	#12	.75	3.05	4.12	14.75	7.38	6.81	10.38	5.81	7.50	16
RM-19-2*				4.31	6.00											16
RM-24-1*	19.62	24.75	5.85	16.31	23.25					21.44	10.72	9.81	14.62	8.56	12.00	31
RM-24-2*				4.31	12.00											31

Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Performance Curves





Selection Procedure

Performance Curves are based on 50SSU oil leaving the cooler 40°F higher than the ambient air temperature used for cooling and 1800 RPM motor speed. This is also referred to as a 40° approach temperature.

STEP 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load. For 1200 RPM motors, multiply Heat Load by 1.5.)

If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

STEP 2 **Determine Approach Temperature.**
Desired oil leaving cooler °F – Ambient air temp.
°F = Actual Approach

STEP 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:

Horsepower heat load x $\frac{40 \times Cv}{\text{Actual Approach}}$ = Curve Horsepower

STEP 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI. Multiply pressure drop from curve by correction factor found in oil △P correction curve.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

C_V Viscosity Correction

Average Oil Temp °F	OIL				
	SAE 5 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

Curve	Model	TEFC Motor Frame Sizes
1	RM-08-1*	48-184
2	RM-08-2*	
3	RM-08-4*	
4	RM-19-1*	213-256
5	RM-19-2*	
6	RM-24-1*	254-286
7	RM-24-2*	
8	RM-24-1*	324-365
9	RM-24-2*	

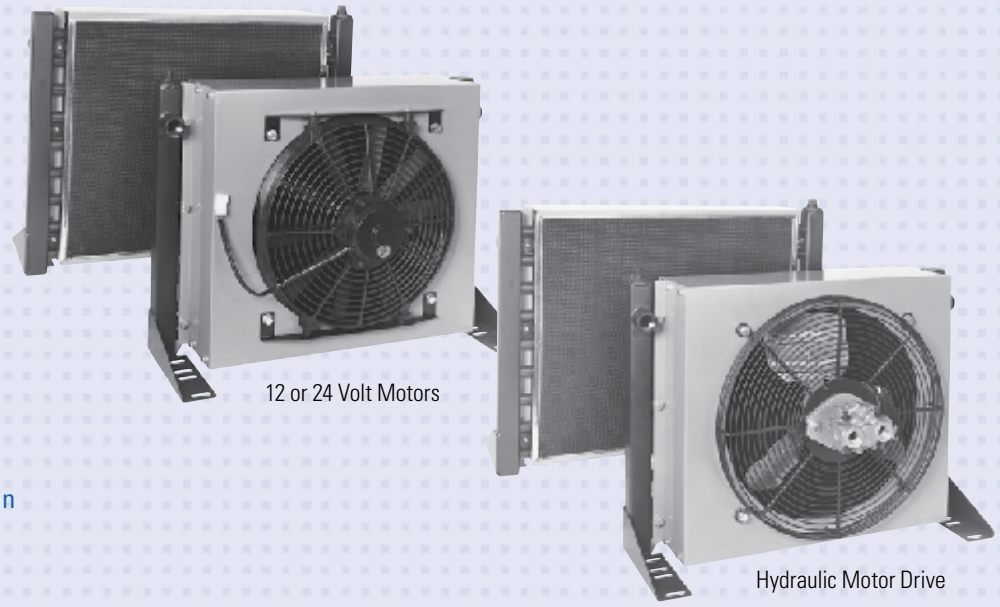
Features

- **Low AMP Draw Motors**
- **Remote Mount**
- **Does Not Block Main Engine Radiator**
- **Long Life Hydraulic Motor**
- **Heavy Duty Construction**
- **3/4" Tube Size**
- Heat Removal up to 160 HP
- Oil Flows to 150 GPM
- DC or Hydraulic Motors
- SAE Connections Standard
- High Performance Air Side Fin Design

OPTIONS

Built-in Serviceable Bypass Valve

NPT or BSPP or SAE Connections



12 or 24 Volt Motors

Hydraulic Motor Drive

Ratings

Operating Pressure 300 psi

Test Pressure 300 psi

Operating Temperature 350° F

Materials

Tubes Copper

Fins Aluminum

Turbulators Aluminum

Fan Blade (DC Motor) High Impact Plastic

Fan Blade (Hydraulic motor) Aluminum with steel hub

Fan Guard (Hydraulic Motor) Steel with black baked enamel finish

Manifolds Steel

Connections Steel

Cabinet Steel with baked enamel finish

Filter Stainless frame with washable media

Nameplate Aluminum

Relief Bypass Valve Option

MODEL	DESCRIPTION
AOC-19 thru AOC-33	Available in either 30 psi or 60 psi settings. 3/4", external, all steel valve. May be removed for servicing.
AOC-37 thru AOC-70	Available in either 30 psi or 60 psi settings. 1-1/2", external, all steel valve. May be removed for servicing.

How to Order

AOC – [ ][ ] – [ ] – [ ] – [ ]

Model Series
AOC - Standard

Model Size Selected

Connection Type*
1 - NPT
2 - SAE
3 - BSPP

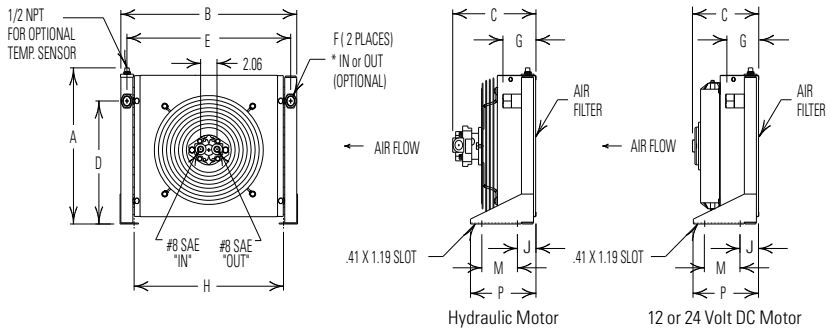
Relief Bypass
Blank - No Bypass
30 - 30 psi
60 - 60 psi

Specify Motor Required
NM - No Motor
4A - 12 Volt
4B - 24 Volt
9 - Hydraulic Motor

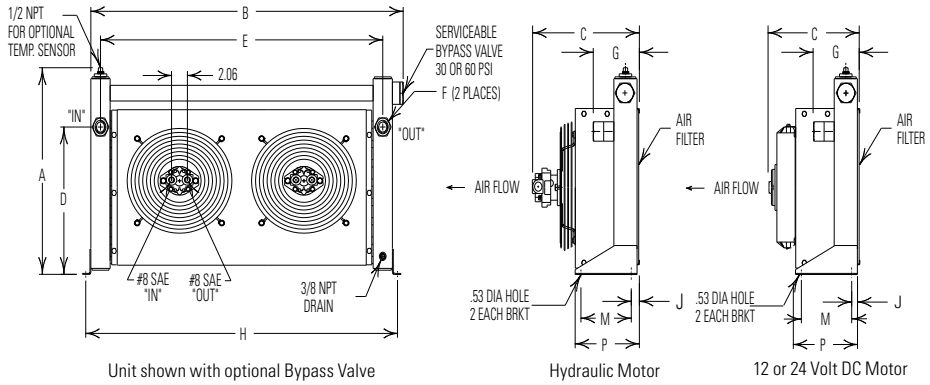
**Other connection types available. Please consult factory for assistance.*

Dimensions

AOC-19 thru AOC-33



AOC-37 thru AOC-70



Model	A		B		C		D	E	F		G		H	J	M	P	Weight LBS.	HYD Motor CFM	12/24 V Motor CFM
	No Bypass	With Bypass	No Bypass	With Bypass	HYD Motor	DC Motor			SAE	NPT & BSPP	SAE	NPT & BSPP							
AOC-19	13.62	16.00	16.50	18.16	10.40	7.92	10.31	15.00	#12	.75	3.05	4.12	14.75	2.61	5.00	8.18	30	750	800
AOC-22	15.62	18.00	22.00	23.66			12.31	20.50					18.69				33	1150	1050
AOC-24	19.62	22.00	24.75	26.41	11.58	9.69	16.31	23.25					21.44				46	1900	1300
AOC-33	25.62	28.00	30.25	31.91		9.31	22.31	28.75	#16	1.00		4.34	26.97				65	2150	1500
AOC-37	18.50	21.38	39.00	40.38	14.06	10.84	15.25	36.50	#20	1.25	4.62	5.97	40.50	1.06	6.50	8.31	95	2150	1850
AOC-50	22.50	25.38	41.00	42.38			19.25	38.50			4.68	6.03	42.50	1.12		8.37	120	3200	2300
AOC-54	30.50	33.28	42.00	43.38	14.93	15.08	27.25	39.50	#24	1.50	4.89	6.30	43.75	1.87	9.00	12.37	154	3800	2600
AOC-57	36.50	39.38	48.00	49.38			32.75	45.50	#32	2.00	6.68	8.15	49.75				190	4200	2900
AOC-70	38.38	41.25	51.00	52.38	17.79	24.62	34.00	48.50			8.44	9.91	52.75	1.62		12.12	304	7500	7050

Notes: Maximum pressure is 2000 PSI. Stated Minimum Operating Pressure is at Inlet Port of Motor. 1000 PSI Allowable Back Pressure.

Specifications

Hydraulic motor data

Model	NUMBER OF FANS	MAXIMUM FAN SPEED	OIL FLOW REQUIRED PER FAN (GPM)	MINIMUM OPERATING PRESSURE (PSI)	MOTOR (IN3/REV) DISPLACEMENT
AOC - 19 thru AOC - 33	1	1725 RPM	1.6	300	.22
AOC - 37 thru AOC - 57	2				
AOC - 70			3.4	500	.45

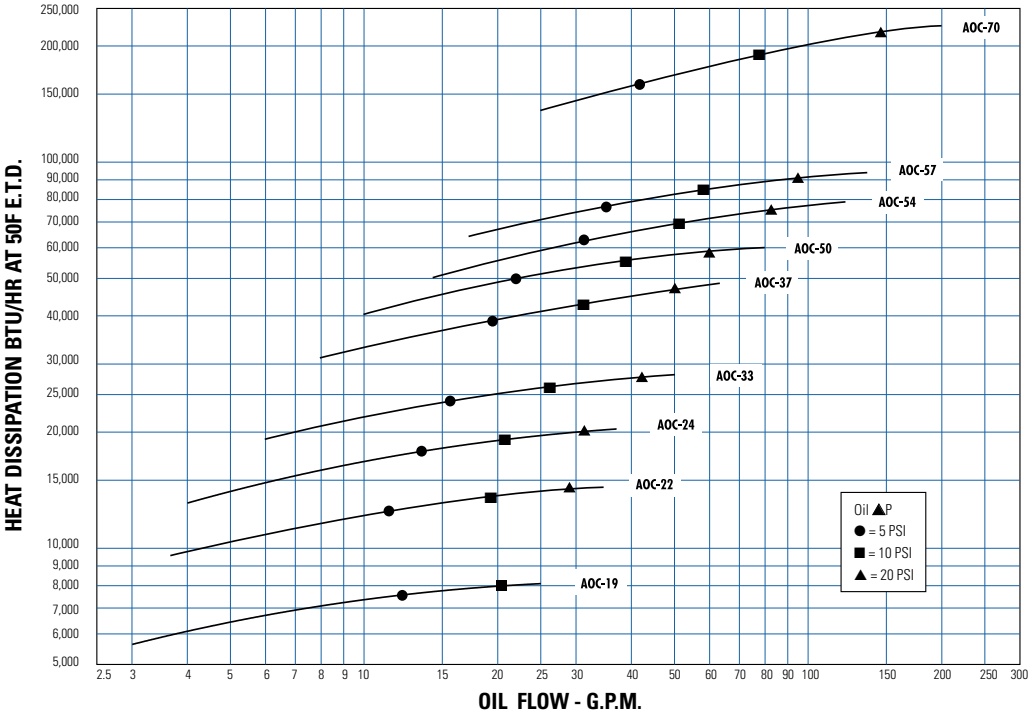
*All dimensions in inches. We reserve the right to make reasonable design changes without notice. *Inlet and outlet oil ports reversible if relief bypass option is not used.*

12 and 24 volt DC motor data

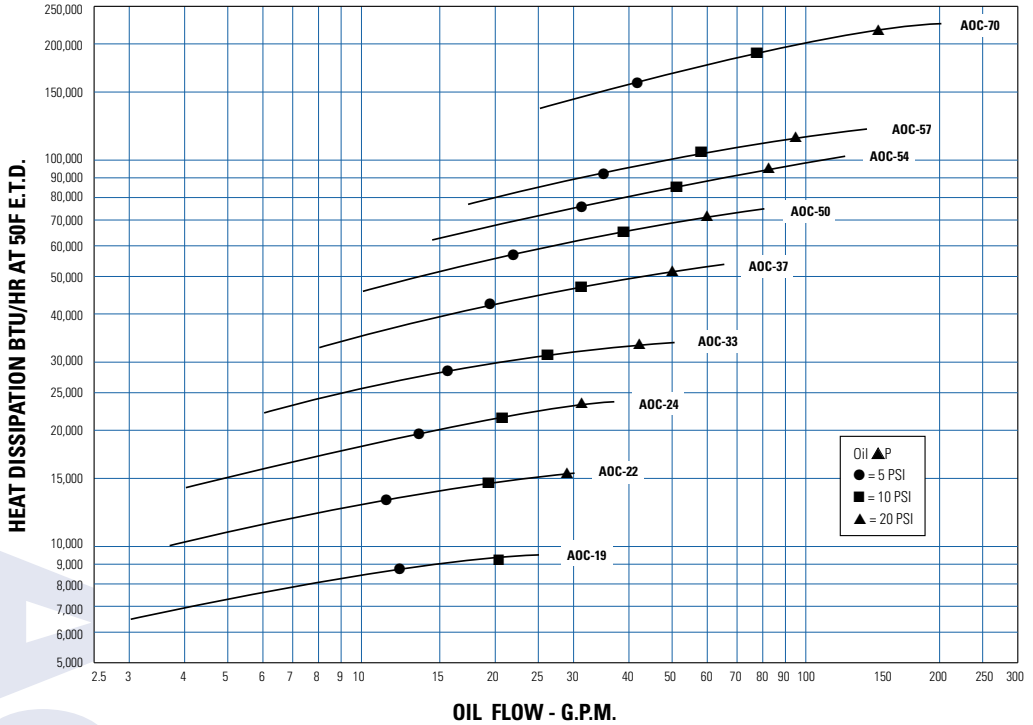
Model	NUMBER OF FANS	FULL LOAD AMPS PER MOTOR 12 VOLT	FULL LOAD AMPS PER MOTOR 24 VOLT	HORSEPOWER PER MOTOR	FAN SPEED	FAN DIAMETER (INCHES)
AOC - 19	1	12.5	6.3	1/5	1800 RPM	10
AOC - 22						12
AOC - 24, 33						14
AOC - 37	2					12
AOC - 50, 54, 57						14
AOC - 70		80	39	1		20

Performance Curves

AOC - with DC Motor



AOC - with Hydraulic Motor



Selection Procedure

Performance Curves are based on 50SSU oil entering the cooler 50°F higher than the ambient air temperature used for cooling. This is also referred to as a 50°F Entering Temperature Difference (ETD).

STEP 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load.)

To convert HP to BTU/Hr: HP x 2545 = BTU/Hr

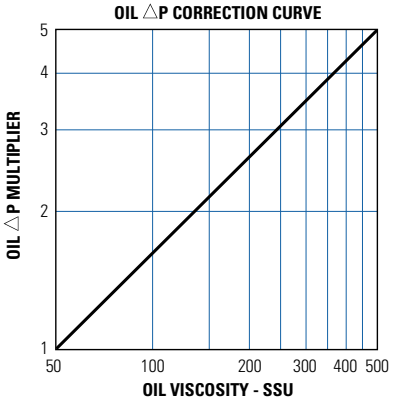
STEP 2 **Entering Temperature Difference.** Desired oil entering cooler °F – Ambient air temp. °F = Actual ETD

STEP 3 **Determine Curve BTU/Hr Heat Load.** Enter the information from above:

$$\text{BTU/Hr heat load} \times \frac{50 \times Cv}{ETD} = \text{Curve BTU/Hr}$$

STEP 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI. Multiply pressure drop from curve by correction factor found in oil △P correction curve.



Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).
To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.
This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

Oil Temperature

Typical operating temperature ranges are:

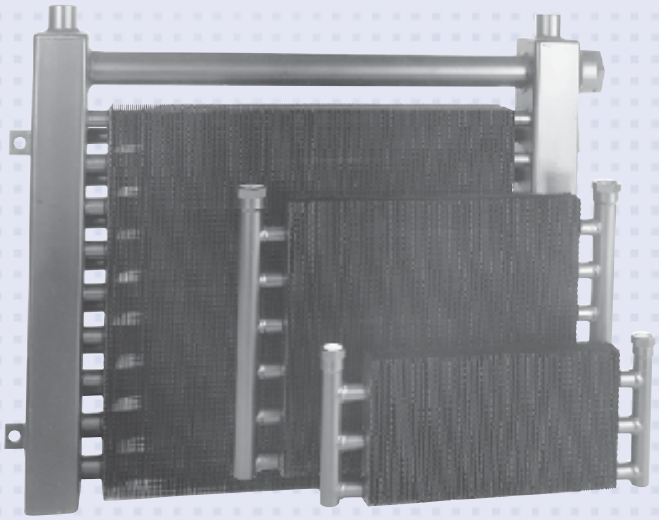
Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

C_V Viscosity Correction

	OIL				
Average Oil Temp °F	**SAE 5** 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

Features

- **Hayden Interchange**
- **Excellent for Radiator Face Mount Cooling**
- **3/4" Tube Size**
- **Steel or Aluminum Fin**
- **Copper Manifolds – One Row**
- **Steel Manifolds – Two Row**
- High Performance Oil Turbulators
- Rugged Off-Highway Steel Designs Available
- Oil Flows to 150 GPM, Heat Removal to 175,000 BTU/HR
- Oil Cooler
- Transmission Cooler
- Fuel Cooler



OPTIONS

- Built-in Relief Bypass
- Steel Components
- Custom Sizes/ Mounting Brackets
- Connection Sizes/ Locations
- Corrosion Resistant Marine Coating

Ratings

Operating Pressure 300 psi

Test Pressure 300 psi

Operating Temperature 350° F

Materials

Tubes Copper

Fins Aluminum or Steel

Turbulators Aluminum

Manifolds Copper: Models DH-051 – DH-447
Steel: Models DH-513 – DH-670

Connections Brass: Models DH-051 – DH-447
Steel: Models DH-513 – DH-670

Relief Bypass Valve Option

MODEL	DESCRIPTION
DH-051 thru DH-447	Available in either 30 psi or 60 psi settings. Bypass valve is built into tubes and does not effect external dimensions. All steel valves. Not serviceable.
DH-513	Available in either 30 psi or 60 psi settings. 3/4", external all steel valve. May be removed for servicing.
DH-524 thru DH-670	Available in either 30 psi or 60 psi settings. 1-1/2", external, all steel valve. May be removed for servicing.

How to Order

[ ] – [ ][ ][ ] – [ ] – [ ] – [ ]

Model Series
DH
DHR - Relief Bypass Included

Model Size Selected

Connection Type*
1 - NPT
2 - SAE

Fin Material
1 - Aluminum
2 - Steel

Relief Bypass
Blank - No Bypass
30 - 30 psi
60 - 60 psi

ADD FOR DHR MODELS ONLY

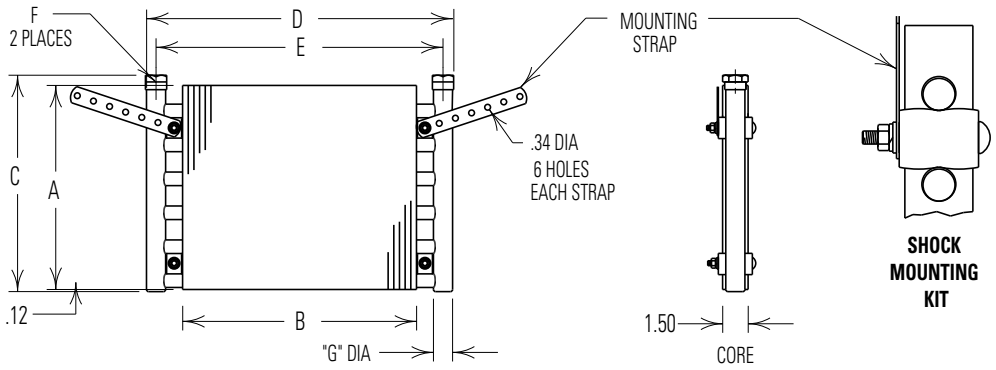
Examples: DH-051-1-1 or DHR-062-2-2-30

Note: All positions must be filled. Mounting Kits (where needed) must be ordered separately, by part number.

*Other connection types available. Please consult factory for assistance.

Dimensions & Weights

DH-051 thru DH-447



Mounting Kits

Optional Mounting Kits are available with or without straps.

	Part Number
With strap	L-84741
Without strap	L-84740

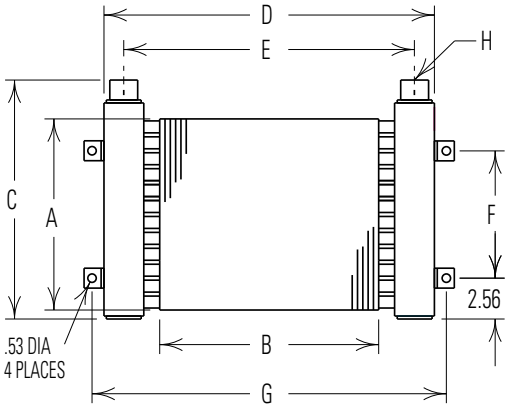
MODEL	A	B	C	D	E	F NPT	F SAE	G DIA	QTY MTG KITS	FACE AREA SQ FT	WEIGHT LBS.
DH-051	4.00	11.25	4.50	15.00	14.12				2	0.31	2
DH-062				15.00	14.12					0.47	3
DH-073	6.00	14.25	6.50	18.00	17.12					0.60	3
DH-084		20.25		24.00	23.12	0.50	#10	0.88		0.84	4
DH-095		14.25		18.00	17.12					0.79	4
DH-106	8.00	17.25	8.50	21.00	20.12				4	0.96	5
DH-117		20.25		24.00	23.12					1.12	5
DH-194		13.75		18.00	16.88					1.15	6
DH-205	12.00	16.75	12.73	21.00	19.88					1.40	7
DH-216		19.75		24.00	22.88	0.75	#12	1.12		1.64	8
DH-227	14.00		14.73	24.00	22.88					1.92	9
DH-249	18.00		18.73	24.00	22.88				6	2.47	12
DH-326	24.00	19.25	25.00	24.00	22.62					3.21	16
DH-337		25.25		30.00	28.62					4.21	20
DH-348		19.25		24.00	22.62	1.00	#16	1.38		4.00	19
DH-359	30.00	25.25	31.00	30.00	28.62				8	5.26	24
DH-370		31.25		36.00	34.62					6.51	28
DH-425	36.00	24.75	37.41	30.00	28.38	1.25	#20	1.62		6.19	32
DH-447	40.00	36.75	41.41	42.00	40.38					10.21	43

All dimensions in inches. Weights are for aluminum fins.
After making your base model selection with the connection of your choice, please refer to the How to Order section.
Note: We reserve the right to make reasonable design changes without notice.

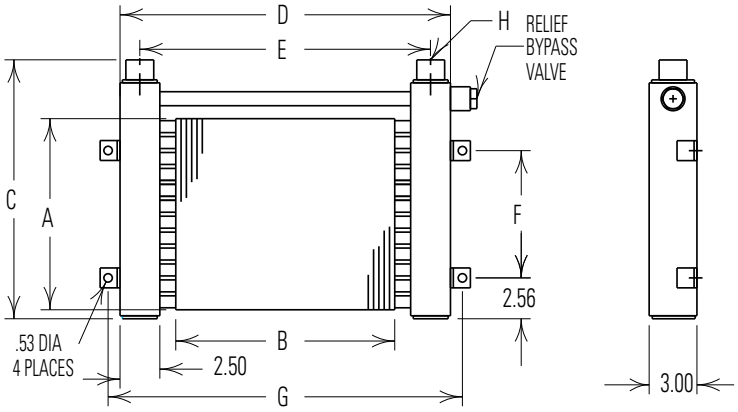
Dimensions & Weights

DH-513 thru DH-670

DH Series



DHR Series



MODEL	A	B	C		D		E	F	G	H		FACE AREA SQ FT	WEIGHT LBS
			DH	DHR	DH	DHR				NPT	SAE		
DH-513	12.00	13.75	15.00	16.25	20.75	22.41	18.25	8.00	22.25	0.75	#12	1.15	16
DH-524	18.00	19.75	21.00	23.25	26.75	28.13	24.25	14.00	28.25			2.47	27
DH-535	24.00	19.25	27.00	29.25	26.75	27.63	23.75	20.00	27.75	1.00	#16	3.21	53
DH-626	36.00	22.75	39.03	41.20	29.75	31.13	27.25	32.00	31.25	2.00	#32	5.69	60
DH-670	40.00	34.75	43.03	45.28	41.75	43.13	39.25	36.00	43.25			9.65	115

All dimensions in inches. Weights are for aluminum fins.
After making your base model selection with the connection of your choice, please refer to the How to Order section.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).
To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.
This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

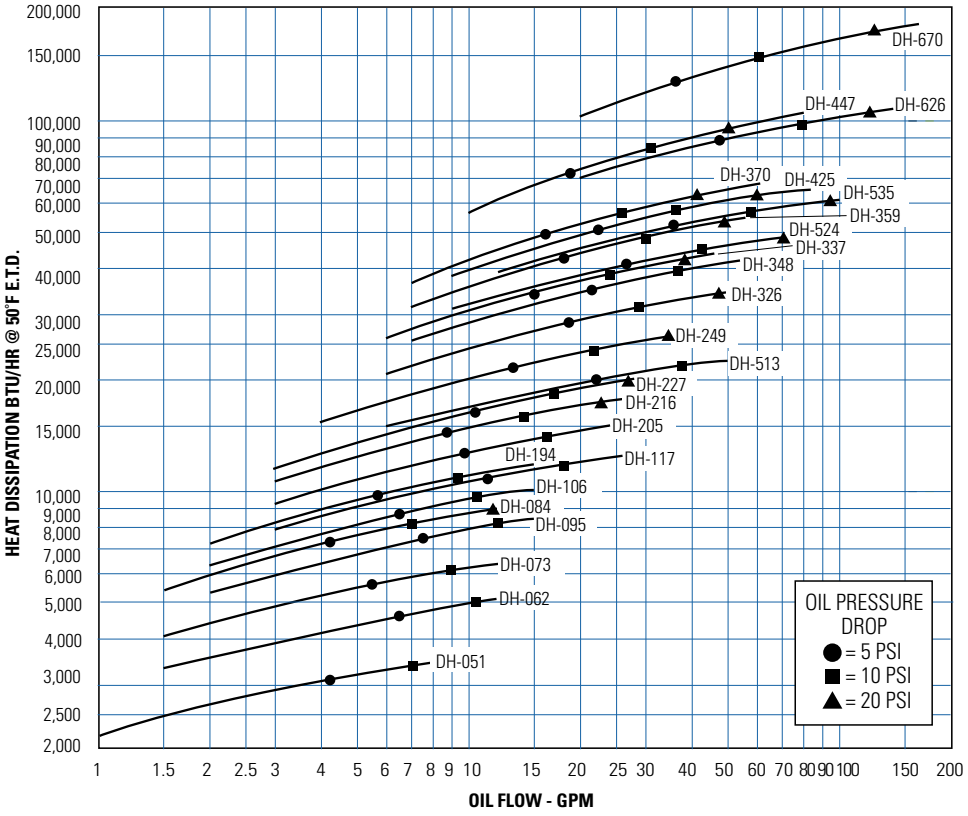
Oil Temperature

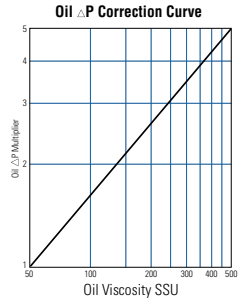
Typical operating temperature ranges are:

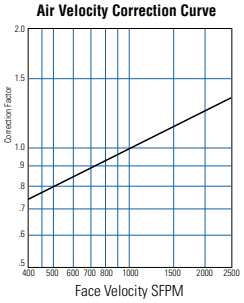
Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

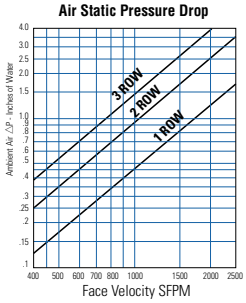
Oil Temp °F	TYPICAL OIL VISCOSITY, SSU				
	SAE 5	SAE 10	SAE 20	SAE 30	SAE 40
100	110	150	275	500	750
150	60	70	100	135	190
210	40	43	50	65	75

Performance Curves









Selection Procedure

Performance Curves are based on 50 SSU oil, 1000 Standard Feet per Minute (SFPM) Air Velocity, and a 50°F Entering Temperature Difference (E.T.D.)
E.T.D. = Entering oil temperature - Ambient air temperature

Step 1 **Determine Heat Load:** Heat load may be expressed as either Horsepower or BTU/Hr. BTU/Hr. = Horsepower x 2545

Step 2 **Determine entering temperature difference:** The entering oil temperature is generally the maximum desired system temperature. E.T.D. = Entering oil temperature - Ambient air temperature.

Step 3 **Determine the corrected heat dissipation to use the curves:**

$$\text{Corrected Heat Dissipation} = \text{BTU/Hr. (Heat Load)} \times \left[\frac{50°\text{F} \times \text{Cv}}{\text{Desired E.T.D.} \times \text{Air Velocity Correction Factor}} \right]$$

Step 4 **Enter the Performance Curves** at the bottom with the GPM oil flow and proceed upward to the adjusted heat load from Step 3. Any curve on or above this point will meet these conditions.

Step 5 **Calculate actual SFPM Air Velocity or SCFM** (Standard Cubic Feet Per Minute) using the Face Area from the table.

A. SFPM Air Velocity* $= \dfrac{\text{SCFM Air Flow}}{\text{Square Feet Face Area}}$

B. SCFM Air Flow = SFPM Air Velocity x Square Feet Face Area

*If the Air Velocity calculated is different than the value in Step 3, recheck Corrected oil Pressure Drop.

Step 6 **Multiply Oil Pressure Drop** from curve by correction factor found in Oil △ P Correction Curve.

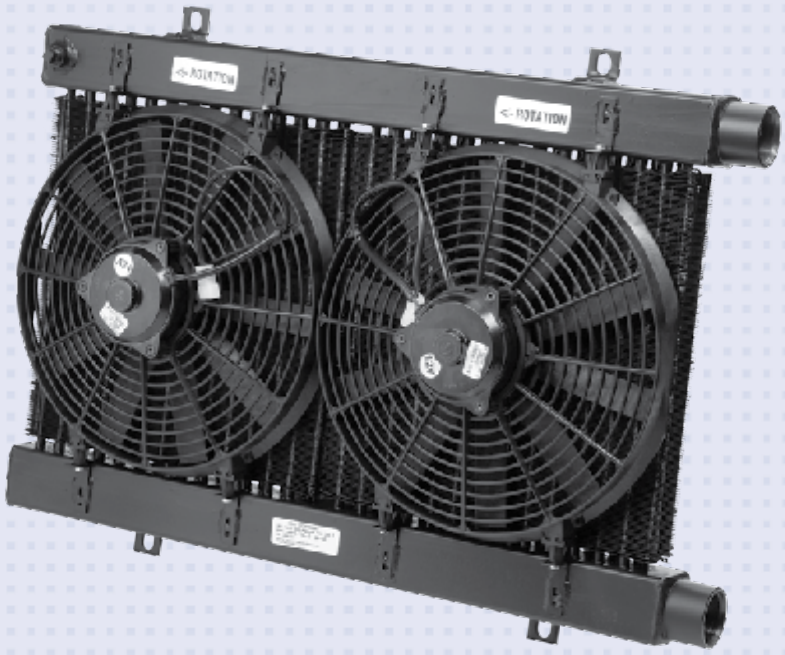
*Note: If air velocity is unknown assume 750 SFPM.

C_V Viscosity Correction

	OIL				
Average Oil Temp °F	**SAE 5** 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

Features

- **Same as DH with DC Fan**
- **3/4" Tube Size**
- **Low AMP Draw 12 or 24 Volt DC Motors**
- **Heavy Duty Construction**
- **Optional Serviceable Relief Bypass Valve**
- **Optional Fan Control Switch**
- **Long Life Hydraulic Motors**
- **Rugged Applications**
- **Steel Manifolds**
- Heat Removal TO 35,000 BTU/Hr.
- Oil Flows to 110 GPM
- Mounting Brackets Included
- SAE, NPT or 37° Flare Oil Connections
- Damage Resistant Steel Fins



Ratings

Operating Pressure 300 psi

Test Pressure 300 psi

Operating Temperature 350° F

Materials

Tubes Copper

Fins Steel

Turbulators Aluminum

Manifolds Steel

Fan Assembly High Impact Plastic

Motor Displacement .22in^3/Rev. (Hydraulic)

Maximum Pressure 2000 PSI (Hydraulic)

Allowable Backpressure 1000 PSI (Hydraulic)

Relief Bypass Valve Option

MODEL	DESCRIPTION
DFR-11	3/4", external, all steel valve. Available in either 30 PSI or 60 PSI settings. May be removed for servicing.
DFR-12 DFR-22	1-1/2", external, all steel valve. Available in either 30 PSI or 60 PSI settings. May be removed for servicing.

Number of Fans	DC current required		Hydraulic Motor Data		
	12 Volt	24 Volt	Oil Flow Required (GPM)	Minimum Operating Pressure (PSI)	Maximum Fan Speed (RPM)
1	12.5 amps	6.3 amps	2.1	300	2200
2	25 amps	12.6 amps	4.2	300	2200

How to Order

[ ] – [ ][ ][ ] – [ ] – [ ] – [ ]

Model Series
DF
DFR - Relief Bypass Included

Model Size Selected

Connection Type*
1 - NPT
2 - SAE
3 - BSPP
7 - 37° Male Flare

Motor Specification
NM - No Motor
4A - 12 Volt DC
4B - 24 Volt DC
9 - Hydraulic Motor

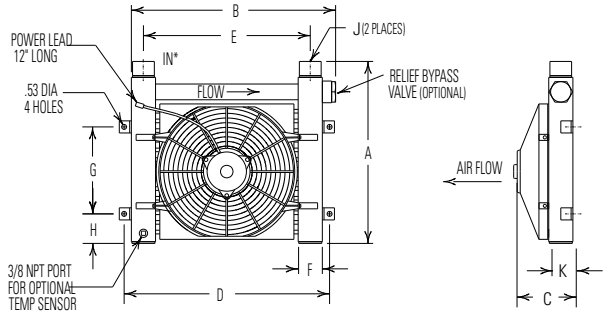
Relief Bypass
Blank - No Bypass
30 - 30 psi
60 - 60 psi

ADD FOR DFR MODELS ONLY

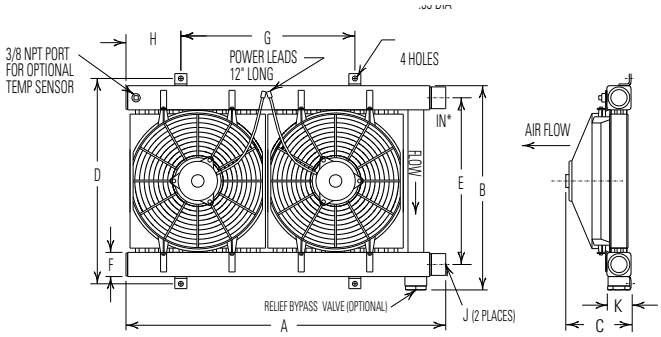
*Other connection types available. Please consult factory for assistance.

Dimensions - 12 & 24 Volt DC Motors

Models DF-11 and DF-12



Model DF-22



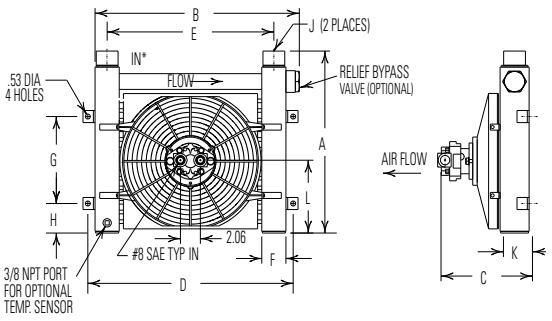
Units shown with optional bypass valve

MODEL	A		B		C	D	E	F	G	H	J		K	LBS
	DF	DFR	DF	DFR							NPT	SAE		
DF-11	16.12	18.00	19.25	20.91	5.51	20.75	17.75	1.50	7.50	3.69	1.00	#16	1.50	38
DF-12	17.00	18.25	21.25	22.91	7.01	22.75	18.75	2.50					3.00	57
DF-22	31.47	33.73		22.62					14.25	7.69	1.50	#24		110

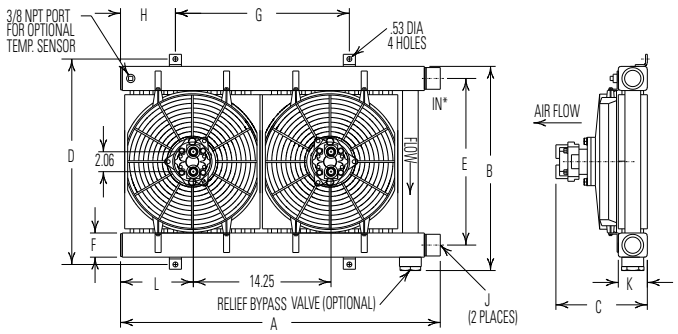
*Note: All dimensions are in inches. We reserve the right to make reasonable design changes without notice. *Inlet and outlet oil connections can be reversed when the bypass valve is not used.*

Dimensions - Hydraulic Motors

Models DF-11 and DF-12



Model DF-22

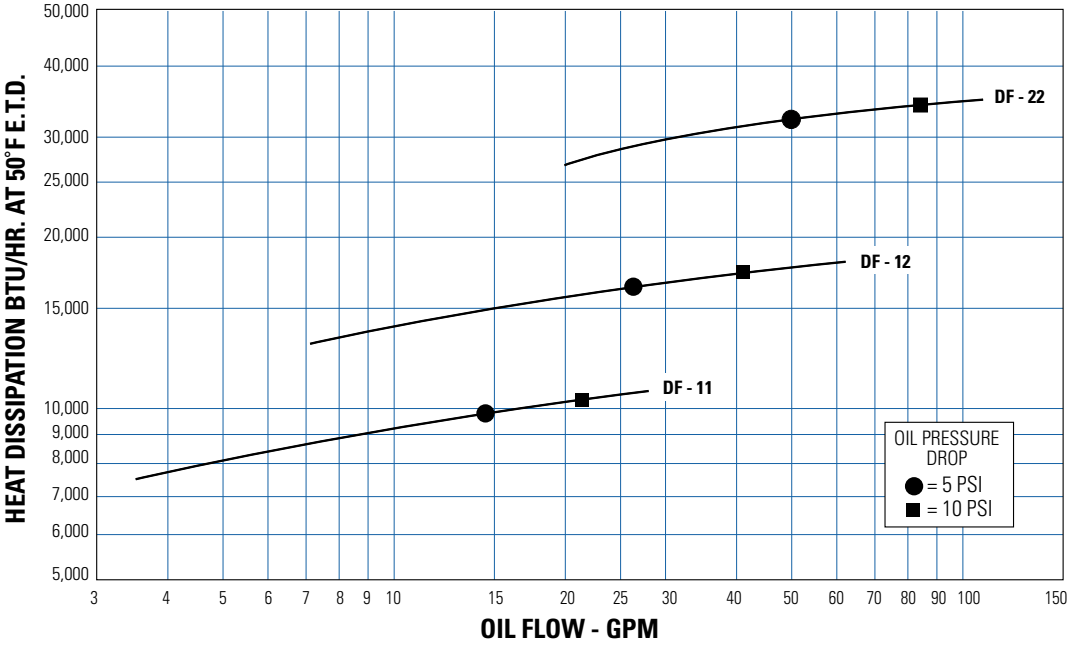


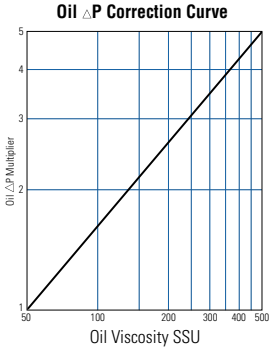
Units shown with optional bypass valve

MODEL	A		B		C	D	E	F	G	H	J		K	L	LBS
	DF	DFR	DF	DFR							NPT	SAE			
DF-11	16.12	18.00	19.25	20.91	7.47	20.75	17.75	1.50	7.50	3.69	1.00	#16	1.50	7.56	38
DF-12	17.00	18.25	21.25	22.91	9.46	22.75	18.75	2.50					3.00		57
DF-22	31.47	33.73		22.62					14.25	7.69	1.50	#24		7.60	110

*Note: All dimensions are in inches. We reserve the right to make reasonable design changes without notice. *Inlet and outlet oil connections can be reversed when the bypass valve is not used.*

Performance Curves





Selection Procedure

Performance Curves are based on 50 SSU oil entering the cooler 50°F higher than the ambient air temperature used for cooling. This is referred to as a 50°F E.T.D.

Step 1 **Determine the Heat Load.** Heat load may be expressed as either horsepower or BTU/Hr. To convert horsepower to BTU/Hr.:
BTU/HR = Horsepower x 2545

Step 2 **Determine Entering Temperature Difference.** The entering oil temperature is generally the maximum desired oil temperature.
Entering oil temperature – Ambient air temperature = E.T.D.

Step 3 **Determine the Corrected Heat Dissipation to use the curves.**

$$\text{Corrected Heat Dissipation} = \text{BTU/HR heat load} \times \frac{50°F \times Cv}{E.T.D.}$$

Step 4 **Enter curves** at oil flow through cooler and curve heat dissipation. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; Multiply pressure drop from curve by correction factor found in oil △ P correction curve.

Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	120°F - 180°F
Hydrostatic Drive Oil	160°F - 180°F
Engine Lube Oil	180°F - 200°F
Automatic Transmission Fluid	200°F - 300°F

C_V Viscosity Correction

	OIL				
Average Oil Temp °F	**SAE 5** 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

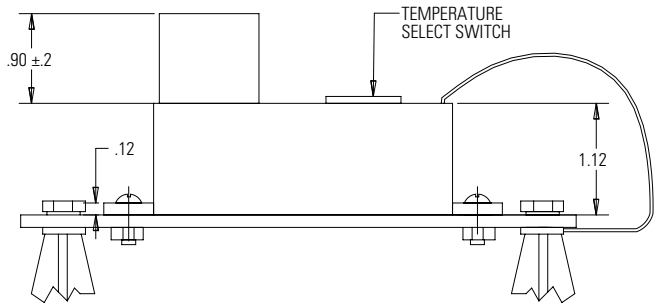
Thermostatic Temperature Control Option (DC)

This controller was designed to mount on the cooler without requiring extensive wiring or plumbing. It provides accurate temperature control by cycling the cooling fan(s) to maintain desired oil temperature.

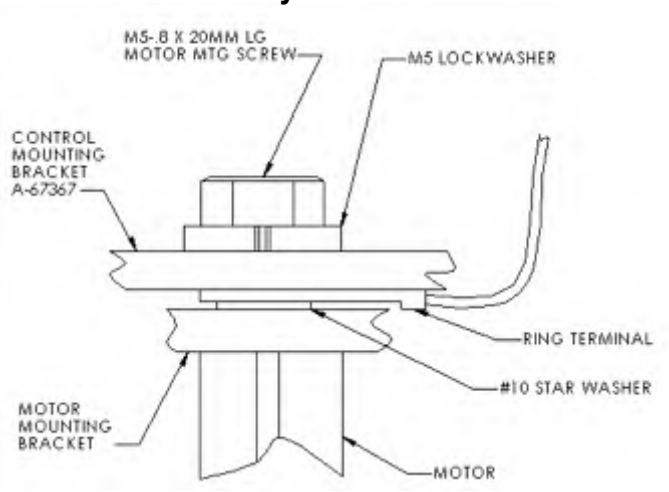
- 12 or 24 volt operation
- Adjustable temperature settings range from 100°F thru 210°F in 20°F increments
- For use with one or two fan models
- Temperature sensor provided
- Wiring provided for remote manual override
- Mounting hardware included

Part Number	Description
96171	Electronic Fan Control Kit
68790	Replacement Control Only
67699	Replacement Sensor Only

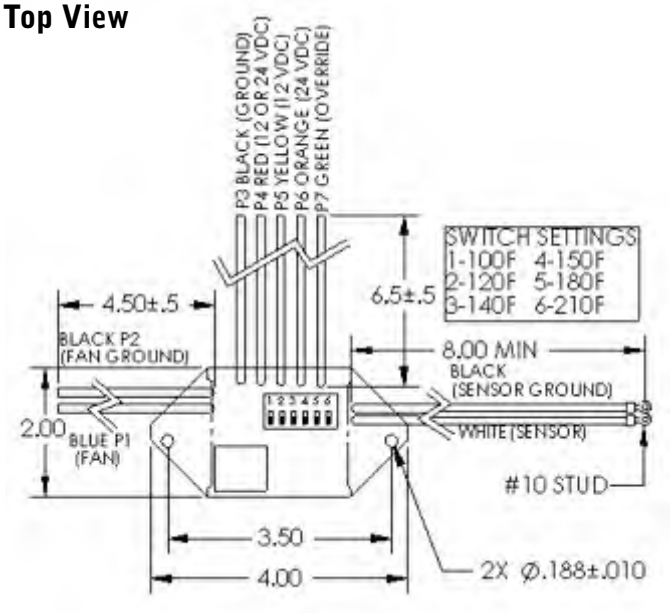
Side View



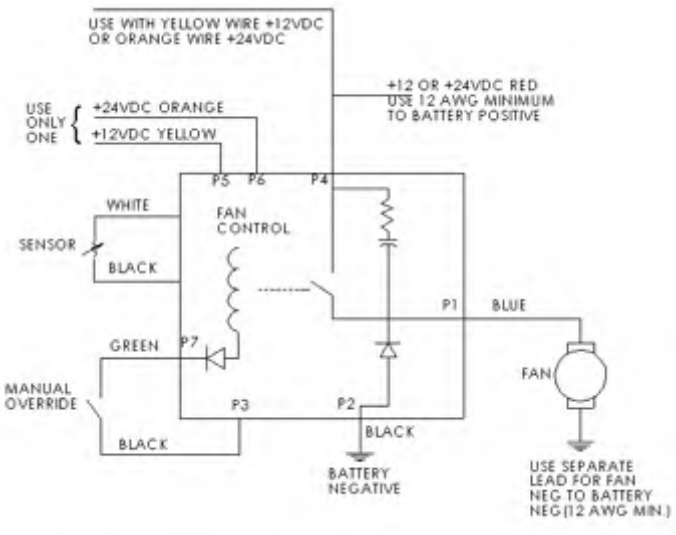
Connection Assembly



Top View



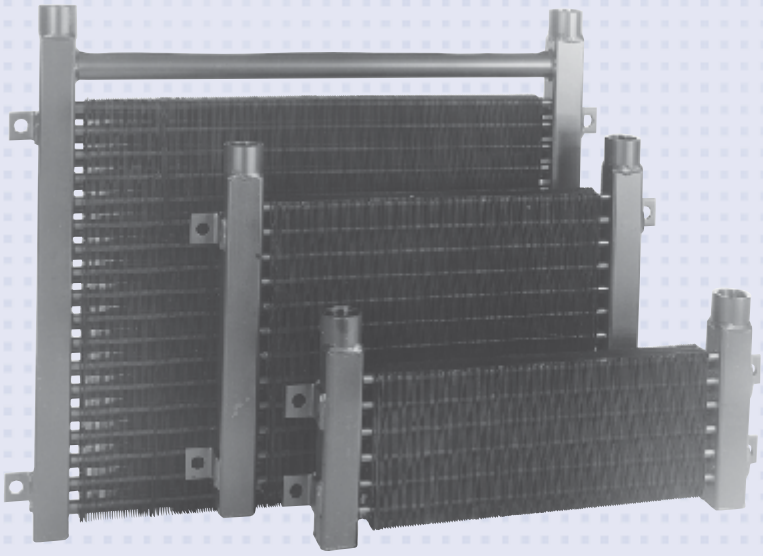
Electrical Schematic



NOTE: This switch should be fused to prevent damage if ground is lost. A 30 amp fuse is required in the power supply.

Features

- **High Strength Construction**
- **3/8" Tube Size**
- **Eliminate Piping, Reduce Cost with Optional Built-in Relief Bypass**
- **Aluminum Fins**
- **Rugged Steel Manifolds**
- Heat Removal up to 90,000 BTU/Hr.
- Oil Flows to 100 GPM
- Mounting Brackets Included
- SAE, NPT or 37° Flair Oil Connections



Ratings

Operating Pressure 300 psi
Test Pressure 300 psi
Operating Temperature 400° F

Materials

Tubes Copper
Fins Aluminum
Turbulators Steel
Manifolds Steel
Relief Valve Steel
Connections Steel

How to Order

[ ] – [ ][ ] – [ ] – [ ]

Model Series
M
MR - Relief Bypass Included

Model Size Selected

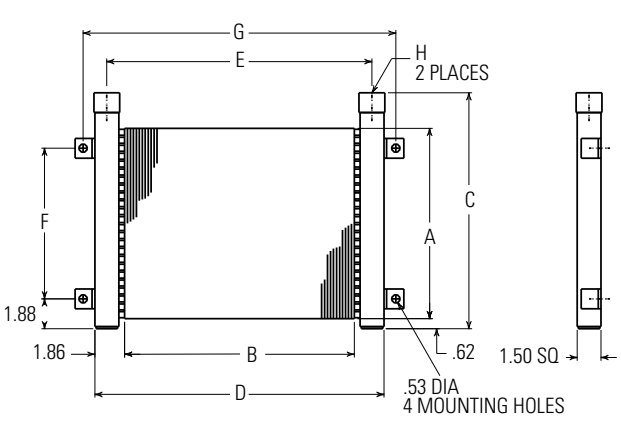
Connection Type*
Blank - NPT
S - SAE

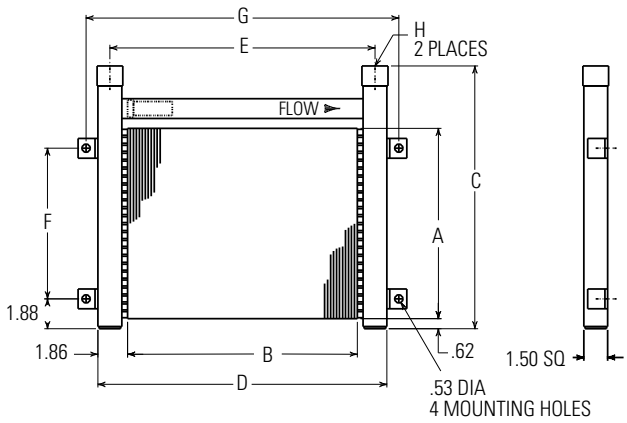
Relief Bypass
Blank - No Bypass
30 - 30 psi
60 - 60 psi

ADD FOR MR MODELS ONLY

*Other connection types available. Please consult factory for assistance.

Dimensions & Weights

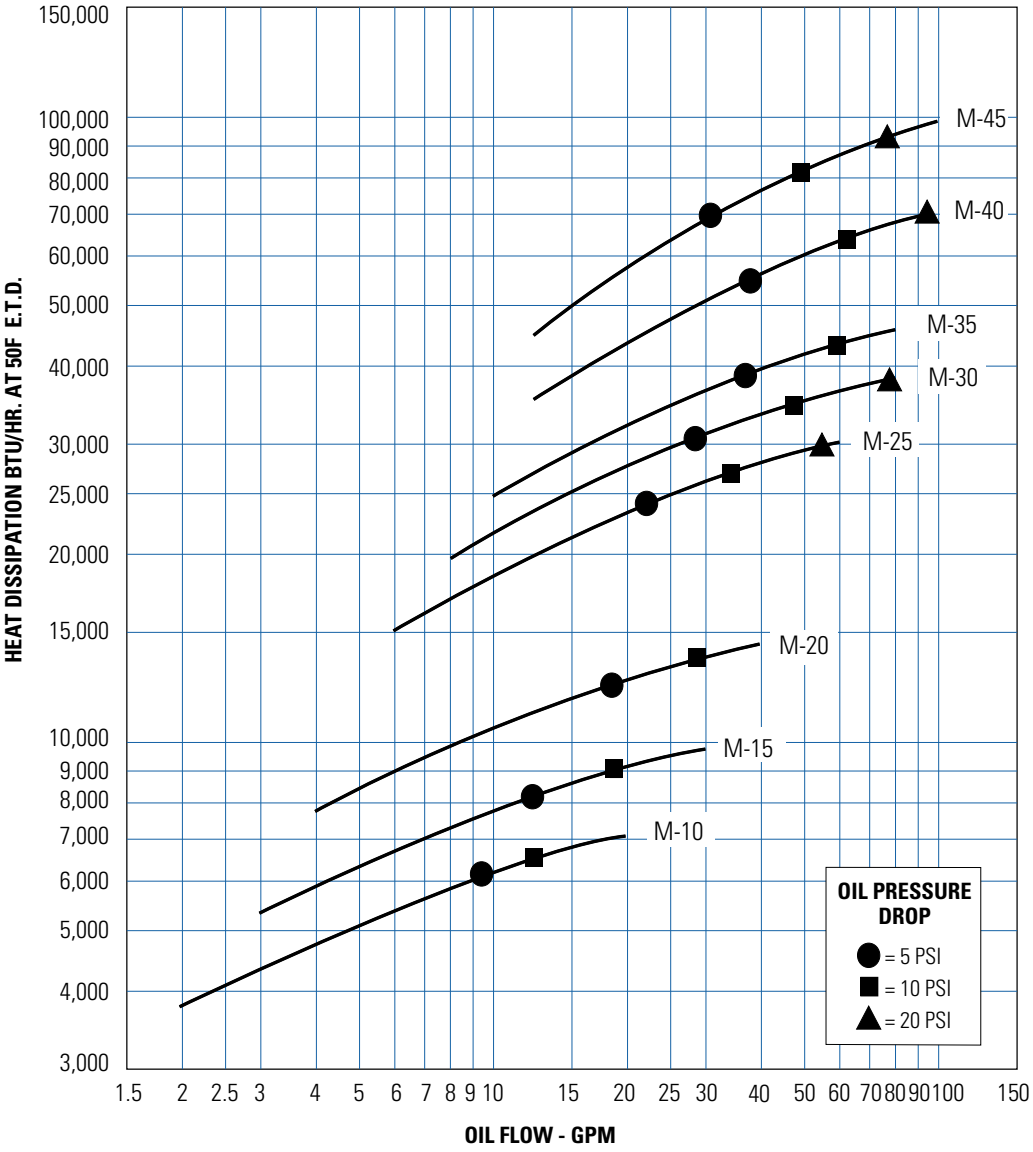


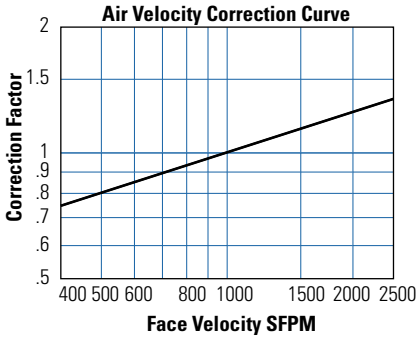


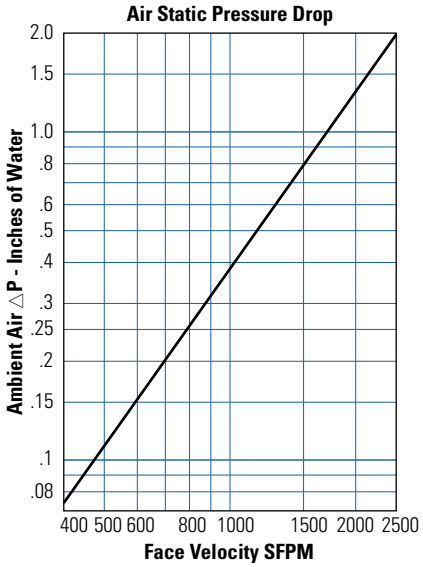
Unit shown with optional Bypass Valve

Model	A	B	C		D	E	F	G	H		Face Area (Sq. Ft.)	Shipping Weight Lbs.
			M Series	MR Series					NPT	SAE		
M-10	6.00	14.50	8.88	10.56	18.22	16.72	3.50	19.72	1.00	#16	.60	11
M-15	8.00		10.88	12.56			5.50				.81	12
M-20	12.00		14.88	16.56			9.50				1.21	16
M-25	18.00	20.50	20.88	22.56	24.22	22.72	15.50	25.72			2.56	28
M-30	24.00	19.50	26.88	28.62	23.22	21.72	21.50	24.72	1.25	#20	3.25	34
M-35	30.00		32.88	34.62			27.50				4.06	40
M-40	36.00	25.00	38.62	40.69	28.72	27.22	33.50	30.22			6.25	56
M-45		35.50			39.22	37.72		40.72			8.88	73

Performance Curves







Selection Procedure

Performance Curves are based on 50 SSU oil, 1000 Standard Feet per Minute (SFPM) Air Velocity, and a 50°F Entering Temperature Difference (E.T.D.) E.T.D. = Entering oil temperature - Ambient air temperature

Step 1 **Determine Heat Load:** Heat load may be expressed as either Horsepower or BTU/Hr. To convert Horsepower to BTU/Hr: BTU/Hr. = Horsepower x 2545

Step 2 **Calculate entering temperature difference:** The entering oil temperature is generally the maximum desired oil temperature. E.T.D. = Entering oil temperature - Ambient air temperature

Step 3 **Determine Air Velocity Correction Factor:**

A. If SFPM (Standard Feet per Minute) air velocity is known, read value from curve above. A reasonable assumption for this value is 750 SFPM.

B. If SCFM (Standard Cubic Feet per Minute) air flow is known, calculate velocity as follows:

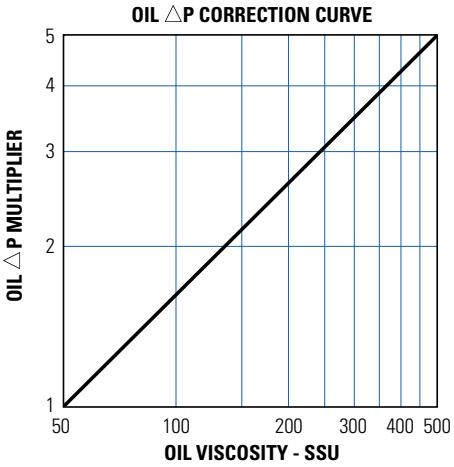
$$\text{SFPM Air Velocity} = \frac{\text{SCFM Air Flow}}{\text{Ft}^2 \text{ Face Area of Cooler}}$$

Step 4 **Calculate corrected heat load to enter curves:**

$$\text{Corrected Heat Dissipation} = \text{BTU/Hr. (Heat Load)} \times \frac{50°\text{F} \times \text{Cv}}{\text{Desired E.T.D.} \times \text{Air Velocity Correction Factor}}$$

Step 5 **Enter the Performance Curves** at the bottom with the GPM oil flow and proceed upward to the adjusted heat load from Step 4. Any curve on or above this point will meet these conditions.

Step 6 **Multiply oil Pressure Drop** from curve by correction factor found in Oil △ P Correction Curve.



C_V Viscosity Correction

	OIL				
Average Oil Temp °F	**SAE 5** 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:
Oil Leaving Temp. = Oil Entering Temp – Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

Oil Temperature

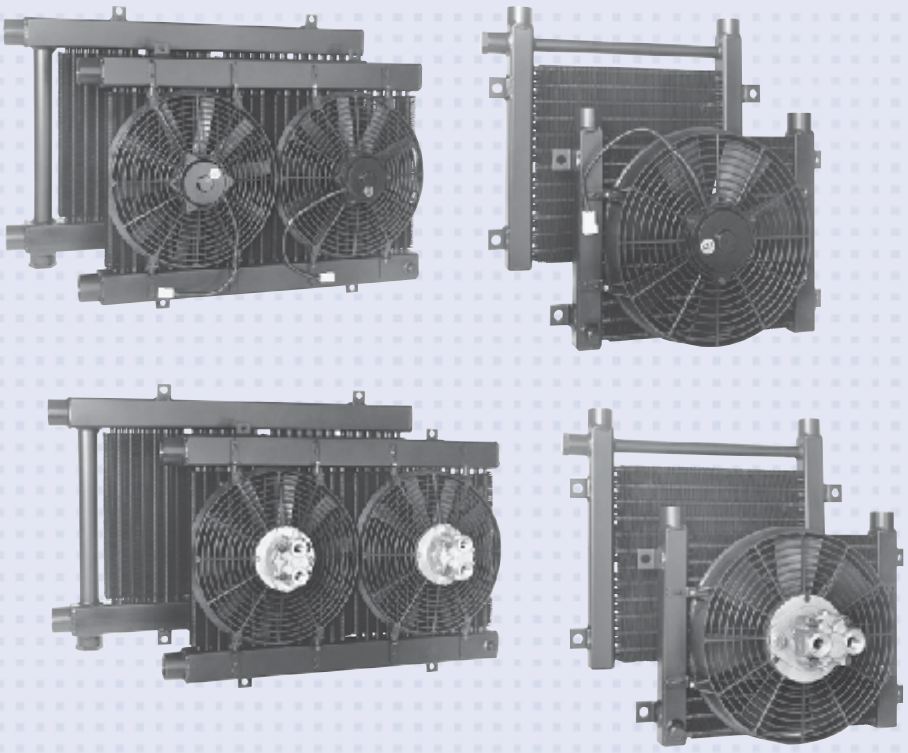
Typical operating temperature ranges are:

Hydraulic Motor Oil	110° - 130°F
Hydrostatic Drive Oil	130° - 180°F
Bearing Lube Oil	120° - 160°F
Lube Oil Circuits	110° - 130°F

Features

- **Same as M Series with DC Fan or Hydraulic Motor**
- **3/8" Tube Size**
- **Aluminum Fins**
- **Low AMP Draw 12 or 24 Volt DC Motor**
- **Heavy Duty Construction**
- **Optional Serviceable Relief Bypass Valve**
- **Optional Fan Control Switch**
- **Long Life Hydraulic Motors**
- Heat Removal TO 50,000 BTU/Hr.
- Oil Flows to 150 GPM
- Mounting Brackets Included
- SAE, NPT or 37° Flare Oil Connections
- Rugged Steel Manifolds

HI-LO TURBULAROR
Low Pressure Drop
High Flow Capacity



Ratings

Operating Pressure 300 psi

Operating Temperature 350° F

Materials

Tubes Copper

Fins Aluminum

Turbulators Steel

Manifolds Steel

Fan Assembly High Impact Plastic

Motor Displacement .22in³/Rev. (Hydraulic)

Maximum Pressure 2000 PSI (Hydraulic)

Allowable Backpressure 1000 PSI (Hydraulic)

Relief Bypass Valve Option

MODEL	DESCRIPTION
MFR-15	3/4", external, all steel valve. Available in either 30 PSI or 60 PSI settings. May be removed for servicing.
MFR-30 MFR-60	1-1/2", external, all steel valve. Available in either 30 PSI or 60 PSI settings. May be removed for servicing.

Number of Fans	DC current required		Hydraulic Motor Data		
	12 Volt	24 Volt	Oil Flow Required (GPM)	Minimum Operating Pressure (PSI)	Maximum Fan Speed (RPM)
1	12.5 amps	6.3 amps	2.1	300	2200
2	25 amps	12.6 amps	4.2	300	2200

How to Order

[ ] – [ ][ ] – [ ] – [ ] – [ ]

Model Series
MF
MFR - Relief Bypass Included

Model Size Selected

Connection Type*
1 - NPT
2 - SAE
3 - BSPP
7 - 37° Male Flare

Motor Specification
NM - No Motor
4A - 12 Volt DC
4B - 24 Volt DC
9 - Hydraulic Motor

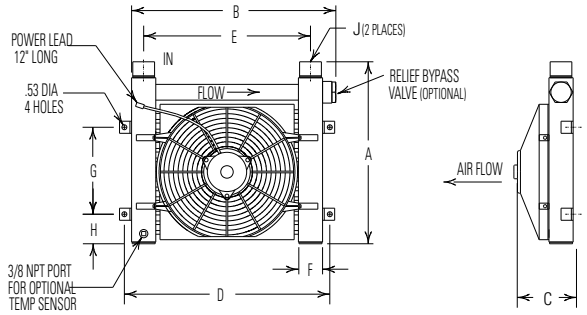
Relief Bypass
Blank - No Bypass
30 - 30 psi
60 - 60 psi

ADD FOR MFR MODELS ONLY

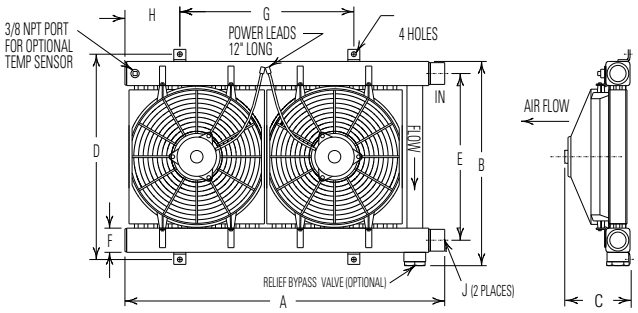
*Other connection types available. Please consult factory for assistance.

Dimensions - 12 & 24 Volt DC Motors

Models MF-15 and MF-30



Model MF-60



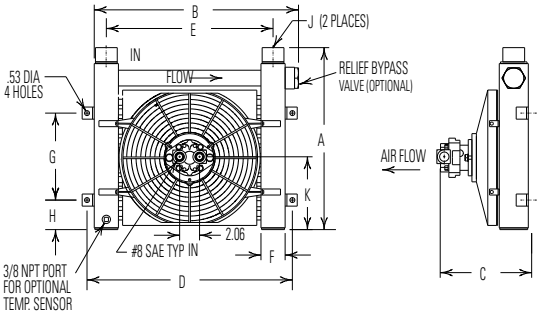
Units shown with optional bypass valve

MODEL	A		B		C	D	E	F	G	H	J		SHIPPING WEIGHT
	MF	MFR	MF	MFR							NPT	SAE	
MF-15	13.88	15.88	15.75	17.41	4.99	17.25	14.25	1.50 SQ	9.00	1.88	1.00	#16	27
MF-30	16.58	18.83	19.75	21.12	6.10	21.25	17.25	2.50 SQ		3.06	1.50	#24	41
MF-60	30.83	33.08							18.00	5.68			78

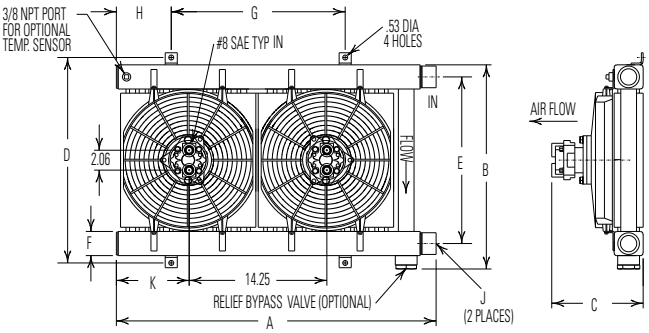
*Note: All dimensions are in inches. We reserve the right to make reasonable design changes without notice. *Inlet and outlet oil connections can be reversed when the bypass valve is not used.*

Dimensions - Hydraulic Motors

Models MF-15 and MF-30



Model MF-60

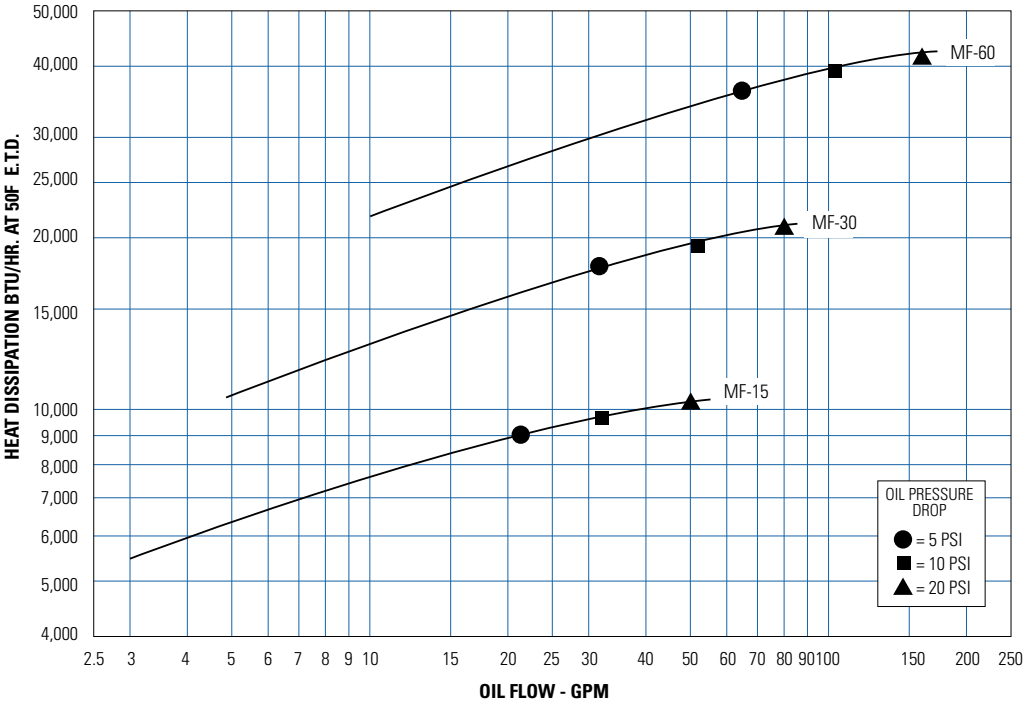


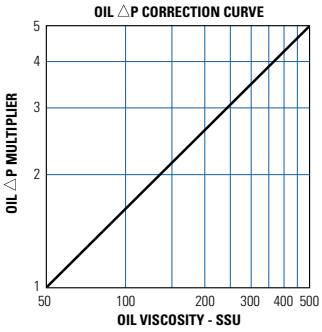
Units shown with optional bypass valve

MODEL	A		B		C	D	E	F	G	H	J		SHIPPING WEIGHT
	MF	MFR	MF	MFR							NPT	SAE	
MF-15	13.88	15.88	15.75	17.41	7.87	17.25	14.25	1.50 SQ	9.00	1.88	1.00	#16	27
MF-30	16.58	18.83	19.75	21.12	8.96	21.25	17.25	2.50 SQ		3.06	1.50	#24	41
MF-60	30.83	33.08							18.00	5.68			78

*Note: All dimensions are in inches. We reserve the right to make reasonable design changes without notice. *Inlet and outlet oil connections can be reversed when the bypass valve is not used.*

Performance Curves





Selection Procedure

Performance Curves are based on 50 SSU oil entering the cooler 50°F higher than the ambient air temperature used for cooling. This is referred to as a 50°F E.T.D.

Step 1 **Determine the Heat Load.** Heat load may be expressed as either horsepower or BTU/Hr. To convert horsepower to BTU/Hr.:
BTU/HR = Horsepower x 2545

Step 2 **Determine Entering Temperature Difference.** The entering oil temperature is generally the maximum desired oil temperature.
Entering oil temperature – Ambient air temperature = E.T.D.

Step 3 **Determine the Corrected Heat Dissipation to use the curves.**

$$\text{Corrected Heat Dissipation} = \text{BTU/HR heat load} \times \frac{50°F \times Cv}{E.T.D.}$$

Step 4 **Enter curves** at oil flow through cooler and curve heat dissipation. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI. Multiply pressure drop from curve by correction factor found in oil △ P correction curve.

Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	120°F - 180°F
Hydrostatic Drive Oil	160°F - 180°F
Engine Lube Oil	180°F - 200°F
Automatic Transmission Fluid	200°F - 300°F

C_V Viscosity Correction

	OIL				
Average Oil Temp °F	**SAE 5** 110 SSU at 100°F 40 SSU at 210°F	**SAE 10** 150 SSU at 100°F 43 SSU at 210°F	**SAE 20** 275 SSU at 100°F 50 SSU at 210°F	**SAE 30** 500 SSU at 100°F 65 SSU at 210°F	**SAE 40** 750 SSU at 100°F 75 SSU at 210°F
100	1.14	1.22	1.35	1.58	1.77
150	1.01	1.05	1.11	1.21	1.31
200	.99	1.00	1.01	1.08	1.10
250	.95	.98	.99	1.00	1.00

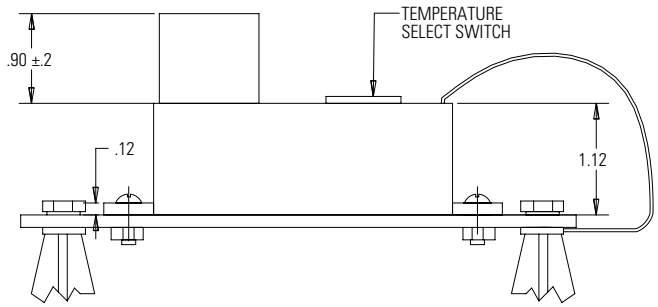
Thermostatic Temperature Control Option (DC)

This controller was designed to mount on the cooler without requiring extensive wiring or plumbing. It provides accurate temperature control by cycling the cooling fan(s) to maintain desired oil temperature.

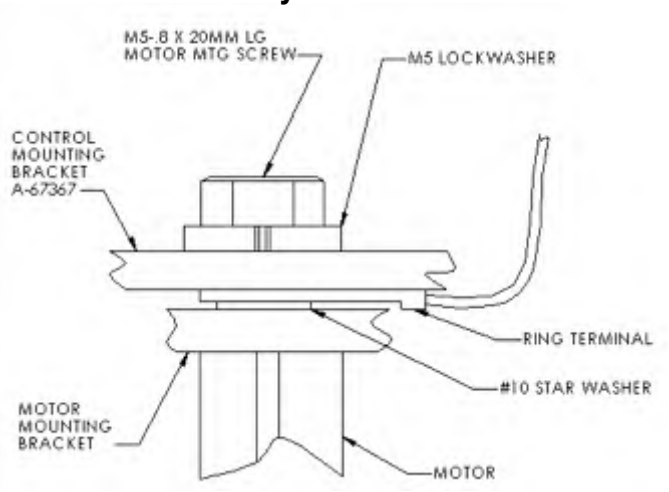
- 12 or 24 volt operation
- Adjustable temperature settings range from 100°F thru 210°F in 20°F increments
- For use with one or two fan models
- Temperature sensor provided
- Wiring provided for remote manual override
- Mounting hardware included

Part Number	Description
96171	Electronic Fan Control Kit
68790	Replacement Control Only
67699	Replacement Sensor Only

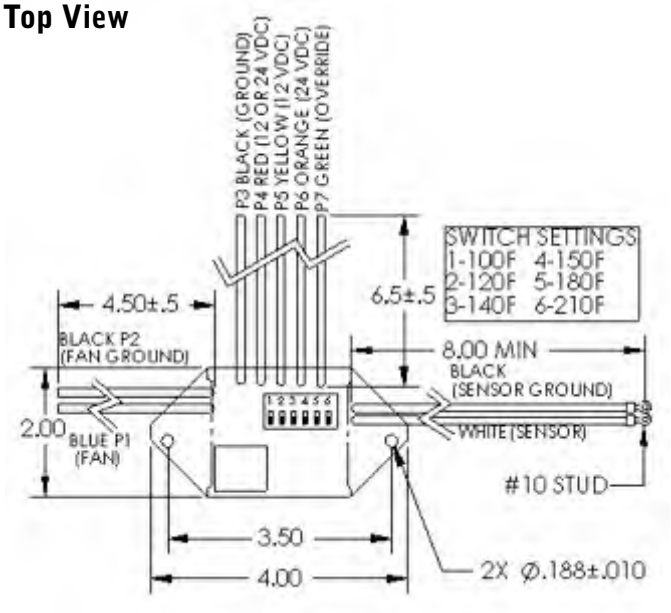
Side View



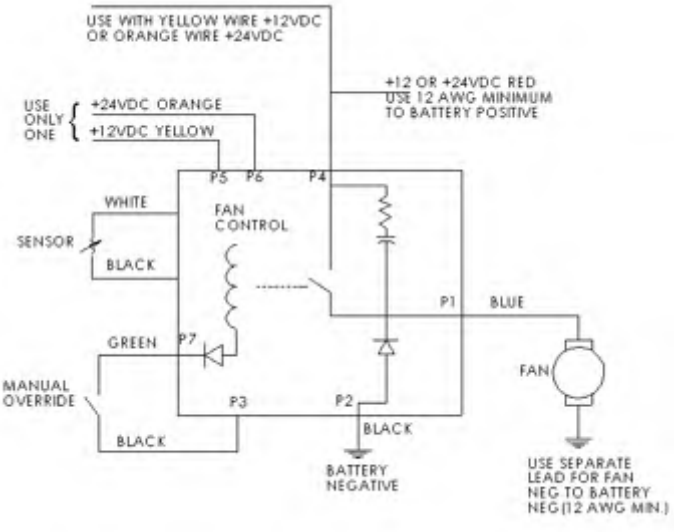
Connection Assembly



Top View



Electrical Schematic



NOTE: This switch should be fused to prevent damage if ground is lost. A 30 amp fuse is required in the power supply.

Features

- **AO/AOVH Series with Hydraulic Motor**
- **High Heat Removal**
- **Heavy Duty Construction**
- **Wide Flow Range**
- Heat Removal up to 210,000 BTU/Hr.
- Long Life Hydraulic Motor
- NPT Connections

OPTIONS
Built-in Relief Bypass Valve
SAE or BSPP Connections
Corrosion Resistant Coating

Ratings

Operating Pressure 300 psi
Test Pressure 300 psi
Operating Temperature 400° F

Materials

Tubes Copper
Fins Aluminum
Turbulators Steel
Manifolds Steel
Connections Steel
Cabinet Steel with Baked Enamel Finish
Fan Blade Aluminum with Steel Hub
Fan Guard Zinc Plated Steel
Fan Adapter Steel

How to Order

[ ] – [ ][ ] – [ ] – [ ] – [ ] – [ ]

Model Series
AOHM
AOHMR
AOVHM
AOVHMR

Model Size Selected

Number of Passes**
Blank - No Bypass
1 - One Pass*
2 - Two Pass

Connection Type*
Blank - NPT
S - SAE

Relief Bypass**
Blank - No Bypass
30 - 30 psi
60 - 60 psi

Foot Mounting Brackets
Blank - No Brackets
FB - Foot Brackets

ADD FOR AOHM & AOHMR MODELS ONLY

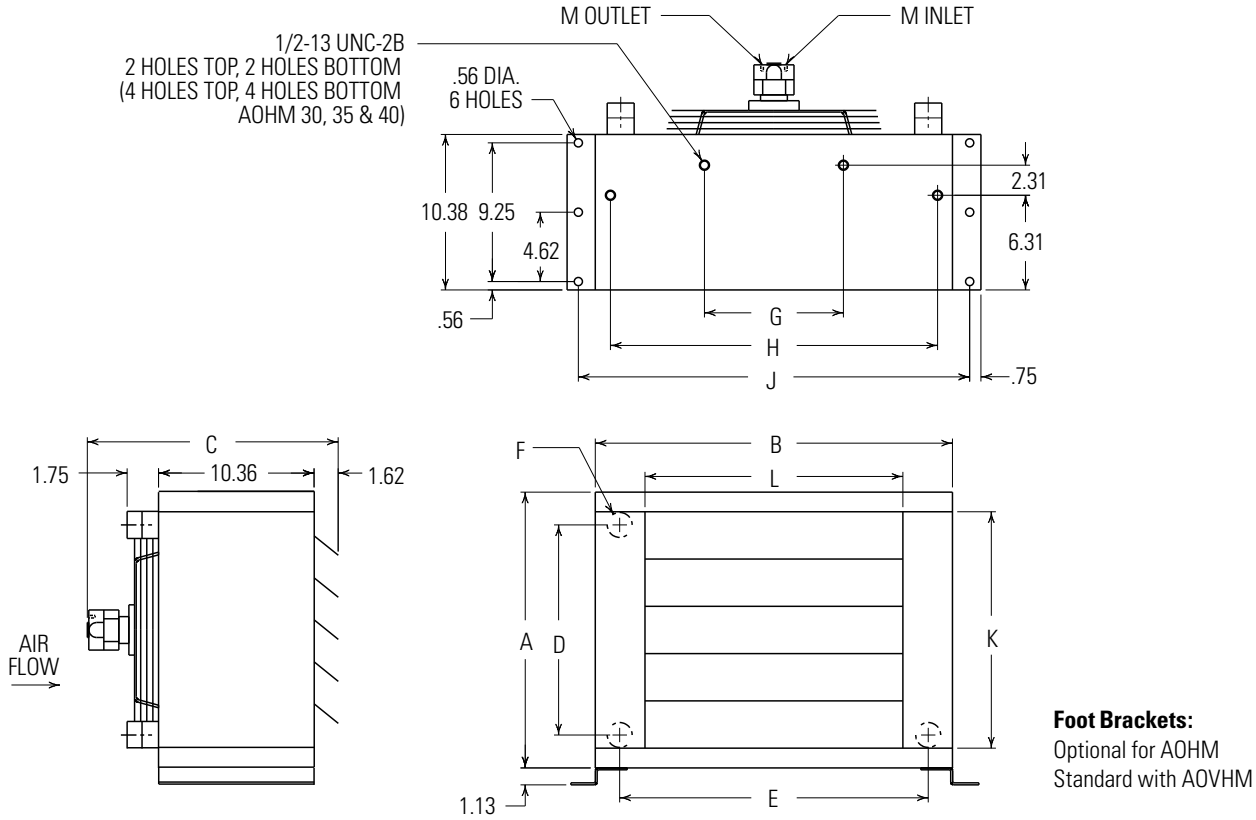
AOHMR - Relief Bypass Included
AOVHMR - Relief Bypass Included (available in 2 pass only)

*Other connection types available. Please consult factory for assistance.

****ADD FOR AOHMR & AOVHMR MODELS ONLY**

Dimensions

Fan Rotating Clockwise/Facing Motor Shaft



Foot Brackets:
Optional for AOHM
Standard with AOVHM

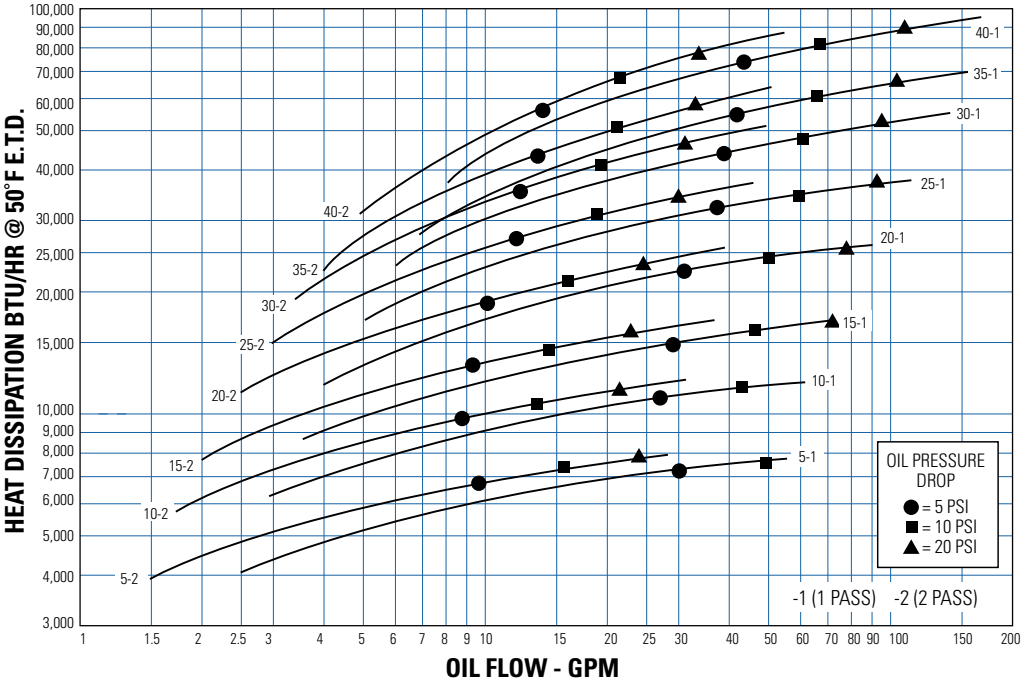
See dimensional chart for external NPT or optional internal SAE connection size.

MODEL	A	B	C	D	E	F		G	H	J	K	L	M (SAE)	NET WT (LBS)
						NPT	SAE							
AOHM-5	11.81	14.81	16.70	7.69	11.69	1"	#16	–	12.94	16.81	9.19	8.31	#8	35
AOVHM-5						1 1/2"	#24							59
AOHM-10	13.12	19.00		8.88	15.88	1"	#16		17.12	21.00	10.50	12.50		50
AOVHM-10						1 1/2"	#24							76
AOHM-15	15.75	20.38	17.09	11.50	17.25	1"	#16		18.50	22.38	13.12	13.88		60
AOVHM-15						1 1/2"	#24							89
AOHM-20	18.38	23.81		14.00	20.56	1 1/4"	#20		21.81	25.81	15.75	17.19		75
AOVHM-20						2"	#32							108
AOHM-25	23.62	26.68		19.25	23.56	1 1/4"	#20		24.81	28.68	21.00	20.1[9]		110
AOVHM-25			17.25			2"	#32							143
AOHM-30	27.56	31.62	16.70	23.19	28.50	1 1/4"	#20	11.00	29.75	33.62	24.94	25.12		120
AOVHM-30			16.95			2"	#32							178
AOHM-35	30.19	33.81	16.70	25.81	30.69	1 1/4"	#20	11.00	31.94	35.81	27.56	27.31		135
AOVHM-35			17.22			2"	#32						#10	220
AOHM-40	36.75	41.62	16.70	32.38	38.50	1 1/4"	#20	13.25	39.75	43.62	34.12	35.12	#8	160
AOVHM-40			17.22			2"	#32						#10	286

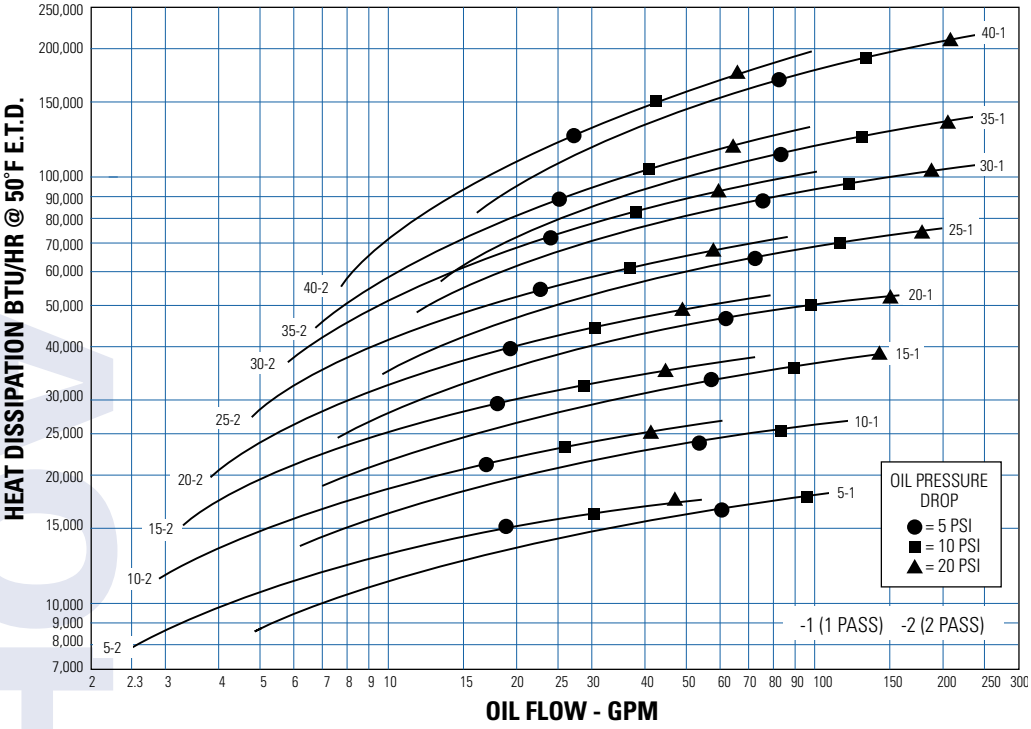
NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Performance Curves

AOHM Series



AOVHM Series



Selection Procedure

Performance Curves are based on 50 SSU oil entering the cooler 50°F higher than the ambient air temperature used for cooling. This is referred to as a 50°F E.T.D.

Step 1 **Determine the Heat Load.** Heat load may be expressed as either horsepower or BTU/Hr. To convert horsepower to BTU/Hr.:
BTU/HR = Horsepower x 2545

Step 2 **Determine Entering Temperature Difference.** The entering oil temperature is generally the maximum desired oil temperature.
Entering oil temperature – Ambient air temperature = E.T.D.

Step 3 **Determine the Corrected Heat Dissipation to use the curves.**
Corrected Heat Dissipation =
BTU/HR heat load x $\frac{50°F}{E.T.D.}$ x viscosity correction A.

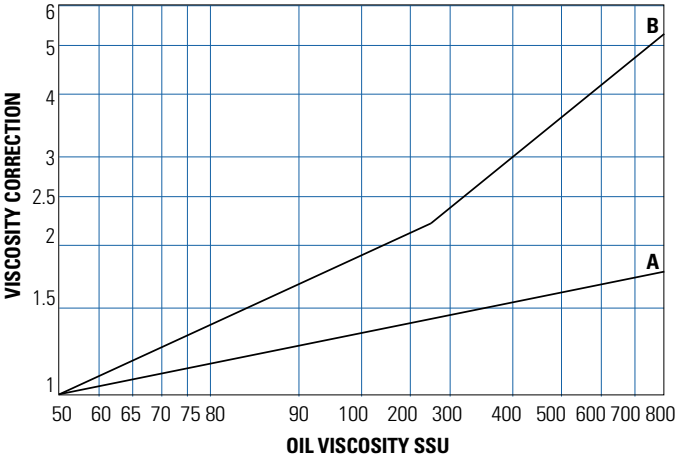
Step 4 **Enter curves** at oil flow through cooler and curve heat dissipation. Any curve above the intersecting point will work.

NOTE: *Performance curves shown are for 1 and 2 pass configuration.*

EXAMPLE: *35 - 2 is AOHM or AOVHM - 35*

Step 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI. Multiply pressure drop from curve by correction factor B found in oil viscosity correction curve.

OIL VISCOSITY CORRECTION MULTIPLIERS



Desired Reservoir Temperature

Oil Temperature: Oil coolers can be selected using entering or leaving oil temperatures.

Off-Line Recirculation Cooling Loop: Desired reservoir temperature is the oil temperature entering the cooler.

Return Line Cooling: Desired reservoir temperature is the oil temperature leaving the cooler. In this case, the oil temperature change must be determined so that the actual oil entering temperature can be found. Calculate the oil temperature change (oil △T) with this formula:
Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).

To calculate the oil entering temperature to the cooler, use this formula:
Oil Entering Temp. = Oil Leaving Temp + Oil △T.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	120°F - 180°F
Hydrostatic Drive Oil	160°F - 180°F
Engine Lube Oil	180°F - 200°F
Automatic Transmission Fluid	200°F - 300°F

Hydraulic Motor

MODEL SIZE	MAXIMUM FAN SPEED (RPM)		OIL FLOW REQUIRED (GPM)		MIN. OPERATING PRESSURE (PSI)		SOUND dB(A)*		MOTOR (in³/rev.) DISPLACEMENT		CFM	
	AOHM	AOVHM	AOHM	AOVHM	AOHM	AOVHM	AOHM	AOVHM	AOHM	AOVHM	AOHM	AOVHM
5	1725	3450	1.6	3.3	300	300	68	85	.22	.22	465	780
10							68	85			669	1110
15							69	91			956	1590
20							70	91			1460	2168
25	1140	1725	1.1	3.4	400	500	72	81	.22	.45	2160	3000
30							75	84			2990	4095
35				5.2	900	1000	76	89		.70	4370	5921
40							78	91			5450	9609

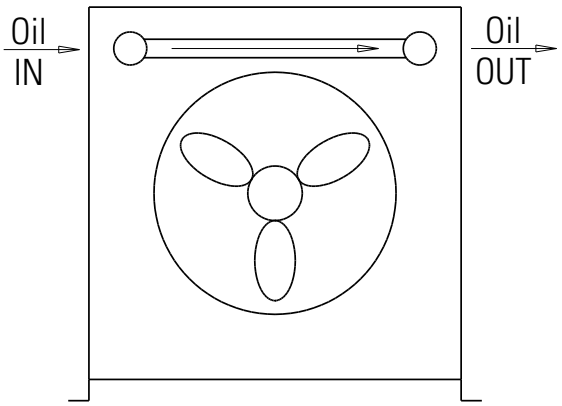
Notes: Maximum pressure is 2000 psi. Stated minimum operating pressure is at inlet port of motor. 1000 psi allowable back pressure.
**Catalog db(A) sound levels are at seven (7) feet. dB(A) sound levels increase by six (6) dB(A) for halving this distance and decrease by (6) dB(A) for doubling this distance.*

Built-In Relief Bypass

AOHMR Series

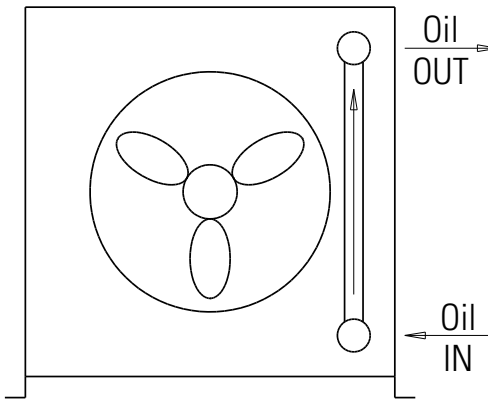
One Pass (Medium to High Oil Flows)

Model Number	Flow Range GPM (USA)
AOHMR - 5-1	2 - 80
AOHMR - 10-1	3 - 80
AOHMR - 15-1	4 - 80
AOHMR - 20-1	5 - 80
AOHMR - 25-1	6 - 100
AOHMR - 30-1	7 - 100
AOHMR - 35-1	8 - 112
AOHMR - 40-1	9 - 118



Two Pass (Low to Medium Oil Flows)

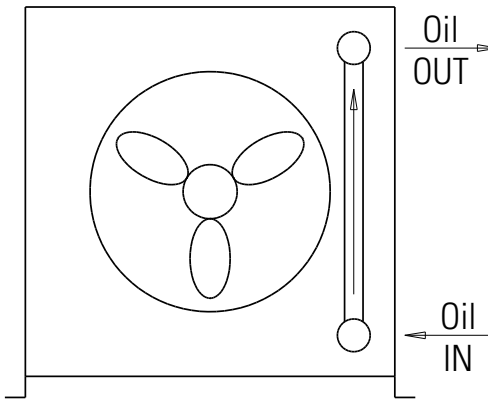
Model Number	Flow Range GPM (USA)
AOHMR - 5-2	2 - 25
AOHMR - 10-2	2 - 30
AOHMR - 15-2	2 - 40
AOHMR - 20-2	2 - 30
AOHMR - 25-2	2 - 40
AOHMR - 30-2	2 - 40
AOHMR - 35-2	3 - 40
AOHMR - 40-2	4 - 40



AOVHMR Series

Two Pass (Low to Medium Oil Flows)

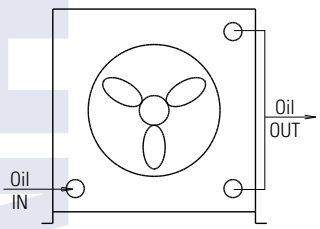
Model Number	Flow Range GPM (USA)
AOVHMR - 5-2	4 - 50
AOVHMR - 10-2	4 - 60
AOVHMR - 15-2	4 - 60
AOVHMR - 20-2	4 - 80
AOVHMR - 25-2	4 - 80
AOVHMR - 30-2	4 - 80
AOVHMR - 35-2	6 - 80
AOVHMR - 40-2	8 - 80



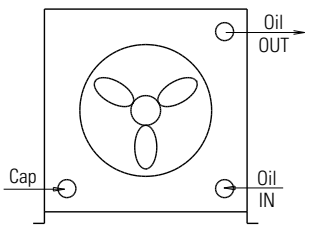
Bypass valve is available for 2 pass AOVHMR models only.

Installation Piping Diagrams

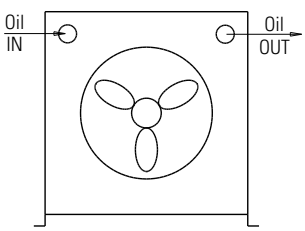
One Oil Pass



Two Oil Passes



One Oil Pass w/Bypass



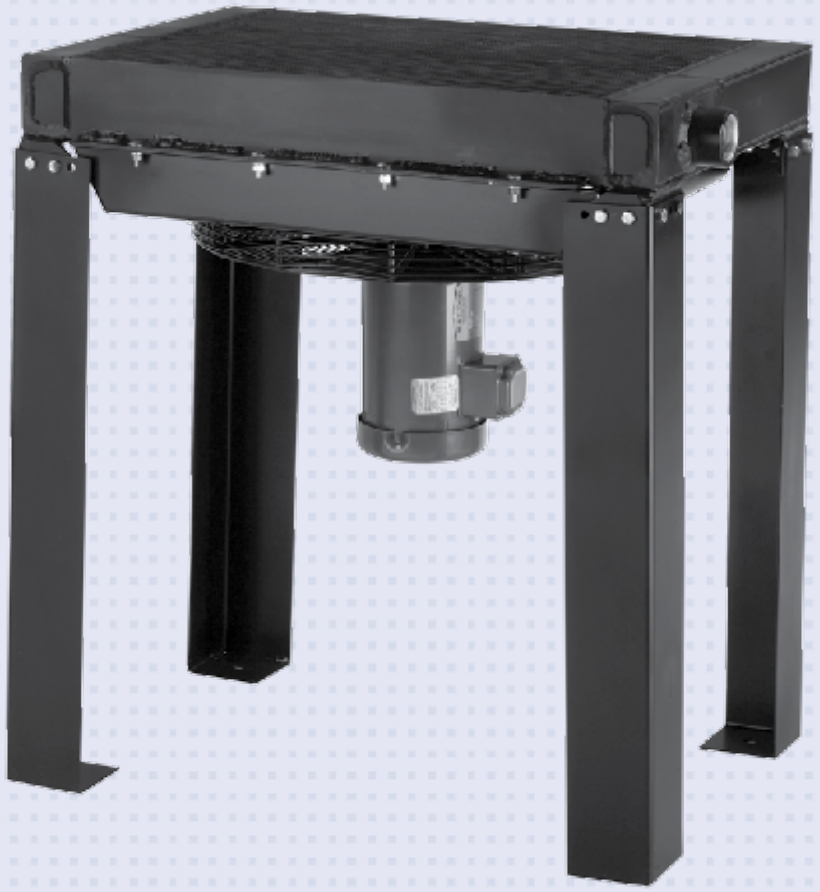
Notes

BRAZED ALUMINUM CONSTRUCTION

HYDRAULIC OR COMPRESSOR OIL COOLING

Features

- **Large Oil Flow**
- **High Performance**
- **Industrial Duty**
- **Brazed Aluminum Bar and Plate Core**
- Compact all aluminum core assembly
- Ideal for converting water cooled equipment to air cooled
- Eliminates high water and sewer costs
- Eliminates corrosion problems associated with water cooled units
- Vertical air flow works well for heat recovery
- State-of-the-art heat transfer technology
- Hydraulic motors available
- Optional SAE Ports
- Marine corrosion control coatings available
- High performance air side fin design
- Detachable legs



Ratings

Maximum Operating Pressure
250 psi (17 BAR)

Maximum Operating Temperature
300° F (150° C)

Materials

Legs Steel with baked enamel finish

Shroud Steel

Standard Core Brazed Aluminum Bar and Plate
- Tanks – 5052 Aluminum
- Nose Bar & Little Bar – 3003-H Aluminum
- Air Fin, Plate, Turbulator & End Plate – 3003-O Aluminum

Fan Aluminum Hub, Plastic Blades

Motor TEFC

Fluid Compatability

Petroleum/mineral oils

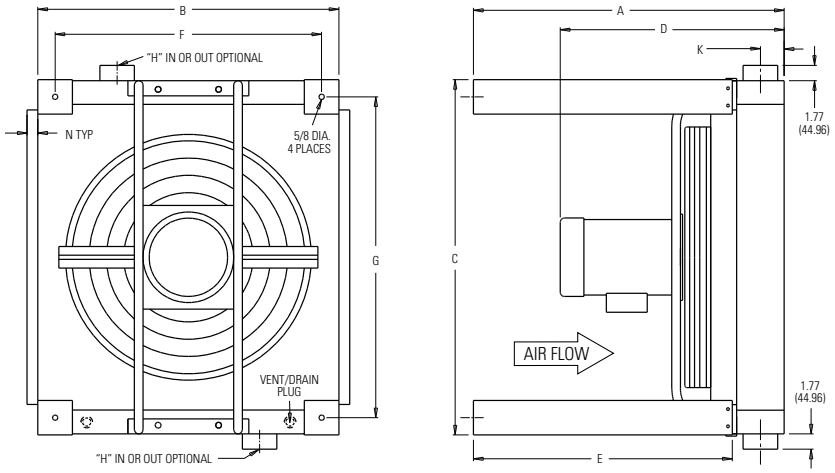
Oil/water emulsion

Water/ethylene glycol

How to Order

AOL	–		–		–		–	
Model Series		**Model Size Selected**		**Connection Type**		**Specify Motor Required**		**Noise Level**
AOL - Standard		**400** **725** **950** **1200** **1600** **2000** **2500** **3000** **3500**		**Blank** - NPT **S** - SAE		**0** - No Motor **2** - Single Phase **3** - Three Phase **6** - 575 Volt **9** - Hydraulic **18** - IEC Three Phase		**Blank** - Standard Noise Level **LN** - Low Noise Level

Dimensions



Model	A	B	C	D Approx.	E	F	G	H NPT	H SAE	J	K	L	Net Weight Lbs.	Shipping Weight Lbs.
AOL-400	34.20 (868.68)	17.96 (456.18)	22.69 (576.33)	20.86 (529.84)	30.00 (762.00)	13.96 (354.58)	18.69 (474.73)	2.00	#32 SAE 2-1/2-12 UN-2B	5.93 (150.62)	1.85 (46.99)	1.25 (31.75)	109 (49.44)	148 (67.13)
AOL-725	34.20 (868.68)	22.37 (568.20)	30.57 (776.48)	20.86 (529.84)	30.00 (762.00)	18.37 (466.60)	26.57 (674.88)	2.00		5.88 (149.35)	1.85 (46.99)	1.25 (31.75)	151 (68.49)	170 (77.11)
AOL-950	36.01 (914.65)	26.78 (680.21)	37.25 (946.15)	23.62 (599.95)	30.00 (762.00)	22.78 (578.61)	33.25 (844.55)	2.00		6.82 (173.23)	2.76 (70.10)	1.25 (31.75)	221 (100.24)	300 (136.08)
AOL-1200	36.01 (914.65)	26.78 (680.21)	41.20 (1046.48)	25.51 (647.95)	30.00 (762.00)	22.78 (578.61)	37.20 (944.88)	2.00		6.00 (152.40)	2.76 (70.10)	1.25 (31.75)	296 (134.26)	430 (195.04)
AOL-1600	36.01 (914.65)	34.89 (886.21)	41.20 (1046.48)	27.51 (698.75)	30.00 (762.00)	30.89 (784.61)	37.20 (944.88)	2.50	2-1/2 SAE 4 Bolt FLG	8.00 (203.20)	2.76 (70.10)	1.25 (31.75)	355 (161.03)	515 (233.60)
AOL-2000	36.01 (914.65)	37.88 (962.15)	51.05 (1296.67)	26.25 (666.75)	30.00 (762.00)	33.88 (860.55)	47.05 (1195.07)	2.50		8.00 (203.20)	2.76 (70.10)	1.25 (31.75)	482 (218.63)	582 (263.99)
AOL-2500	36.01 (914.65)	43.70 (1109.98)	49.08 (1246.63)	28.51 (724.15)	30.00 (762.00)	39.70 (1008.38)	45.08 (1145.03)	3.00	3" SAE 4 Bolt FLG.	8.00 (203.20)	2.76 (70.10)	1.25 (31.75)	555 (251.74)	655 (297.10)
AOL-3000	36.01 (914.65)	52.52 (1334.01)	51.05 (1296.95)	30.51 (774.95)	30.00 (762.00)	48.52 (1232.41)	47.05 (1206.50)	3.00		8.00 (203.20)	2.76 (70.10)	1.25 (31.75)	724 (328.40)	825 (374.21)
AOL-3500	36.01 (914.65)	56.30 (1430.02)	51.05 (1296.95)	30.51 (774.95)	30.00 (762.00)	52.30 (13328.42	47.05 (1206.50)	3.00		8.00 (203.20)	2.76 (70.10)	1.25 (31.75)	760 (344.73)	860 (390.09)

Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches and (millimeters).

Selection Procedure

Performance Curves based on 100°F (55.56°C) E.T.D. or Entering Temperature Difference (E.T.D = Entering oil temperature minus ambient air temperature). SAE #10 oil @ 200°F (93.33°C).

Oil pressure drop coding:

- **X** = 5 PSI (.345 BAR)
- ● = 10 PSI (.689 BAR)
- ◆ = 15 PSI (1.03 BAR)
- ▲ = 20 PSI (1.38 BAR)
- ■ = 30 PSI (2.10 BAR)

E.T.D. temperature correction formula:

ENGLISH Version

$$HP_{Curve} = HP_{To\ Be\ Removed} \times \frac{100}{Desired\ E.T.D}$$

METRIC Version

$$\frac{KW}{°C} = \frac{Heatload\ (KW)}{Desired\ E.T.D.\ (°C)}$$

Conversion

$$Hp = \frac{KW}{°C} = X\ .745\ X\ E.T.D.\ (°F)$$

Notes

1. A three-way thermostatic valve is recommended to bypass the cold oil around the heat exchanger during start up.
2. Support piping as needed. Flexible connectors must be properly installed to validate warranty.
3. Coolers should not operate in ambient temperatures below 35°F (1°C). Consult factory for recommendations.
4. The fan cannot be cycled.
5. AOL coolers operated outdoors must be protected from weather. Consult factory for recommendations.
6. If duct work or additional static resistance is added to the cooler airstream, an auxiliary air mover may be required.
7. Can be mounted for horizontal air flow, with oil in at bottom port.

Maintenance

Periodic cleaning of the fins with compressed air is needed to remove the accumulation of dirt and dust. If the inside of the tubes need to be cleaned of oil and carbon, use a chlorinated solvent. Do not use strong solvents. Do not use acids or caustic cleaners.

Specifications

Electric Motor & Fan Data[1] (60 Hz Nema Frame)

Model	Fan CMM	Fan CFM	Motor H.P.	Voltage	Phase	Full Load Amps 230V	Frequency (Hz)	RPM	Nema Frame	Thermal Overload	Sound dB(A) at 3 ft.
AOL-400	62.30	2200	1.0	115/208-230	1	6.0	60[2]	3450	56C	No	97
	51.68/62.30	1825/2200	1.0	208-230/460[3]	3	3.6/3.2	50/60	2850/3450	56C	No	97
AOL-725	101.94	3600	1.5	115/208-230	1	8.5	60[2]	3450	56C	No	100
	84.95/102.94	3000/3600	1.5	208-230/460[4]	3	4.8/4.2	50/60	2850/3450	56C	No	100
AOL-950	133.09	4700	1.5	115/208-230	1	8.6	60[2]	1740	145TC	No	92
	133.09	4700	1.5	208-230/460	3	4.6	60[2]	1740	145TC	No	92
AOL-1200	198.22	7000	5.0	230	1	23.00	60[2]	1740	184TC	No	94
	198.22	7000	3.0	208-230/460	3	8.8	60[2]	1740	182TC	No	96
AOL-1600	223.70	7900	5.0	208-230/460	3	13.4	60[2]	1740	184TC	No	98
AOL-2000	311.49	14000	7.5	230/460	3	19.6	60[2]	1740	213TC	No	98
AOL-2500	396.44	14000	7.5	230/460	3	19.6	60[2]	1740	213TC	No	98
AOL-3000	495.54	17500	10.0	230/460	3	24.8	60[2]	1740	215TC	No	102
AOL-3500	495.54	17500	10.0	230/460	3	24.8	60[2]	1740	215TC	No	102

[1] Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.
[2] May also be operated at 50 hz. Consult factory for details.
[3] 50 Hz voltage: 190-200-208-220/380-400-415-440
[4] 50 Hz voltage: 190-208/380-415
All motors shown are TEFC—Other motor options available upon request.

Electric Motor Information (50 Hz IEC Frame)

Model	CMM	CFM	KW	Voltage	Phase	Frequency	RPM	Frame	Sound dB(A) at 1 meter
AOL-400	52.4	1850	.75	220/240/380/415	3	50 Hz	3000	80	81
AOL-725	85.0	3001	1.10	220/240/380/415	3	50 Hz	3000	80	80
AOL-950	108.2	3821	1.50	220/240/380/415	3	50 Hz	1500	90	78
AOL-1200	165.1	5834	2.20	220/240/380/415	3	50 Hz	1500	100	83
AOL-1600	186.4	6584	3.00	220/240/380/415	3	50 Hz	1500	100	85
AOL-2000	331.3	11700	4.00	220/240/380/415	3	50 Hz	1500	112	88
AOL-2500	331.3	11700	4.00	220/240/380/415	3	50 Hz	1500	112	88
AOL-3000	410.6	14500	7.50	220/240/380/415	3	50 Hz	1500	132	90
AOL-3500	410.6	14500	7.50	220/240/380/415	3	50 Hz	1500	132	90

All IEC frame motors have CE mark.

Electric Motor Information (AOL-Low Noise)

Model	HP	Nema Frame	LN RPM	LN CFM	LN CMM	Voltage	Frequency (Hz)	Sound dB(A) at 3 ft.
AOL-400-1PH-LN	1	56C	1725	1100	31.15	115/230	60	72
AOL-400-3PH-LN	1	56C	1725	1100	31.15	230/460	60	72
AOL-725-1PH-LN	1.50	56C	1725	1780	50.40	115/230	60	82
AOL-725-3PH-LN	1.50	56C	1725	1780	50.40	230/460	60	82
AOL-950-3PH-LN	1.50	145TC	1160	3150	89.20	230/460	60	76
AOL-1200-3PH-LN	1.50	182TC	1160	4690	132.81	230/460	60	75
AOL-1600-3PH-LN	2	184TC	1160	6510	184.34	230/460	60	78
AOL-2000-3PH-LN	5	213TC	1160	8700	246.36	230/460	60	85
AOL-2500-3PH-LN	5	213TC	1160	11700	331.31	230/460	60	85
AOL-3000-3PH-LN	5	215TC	1160	13500	382.28	230/460	60	93
AOL-3500-3PH-LN*	10	254UC	1160	16200	458.73	230/460	60	91

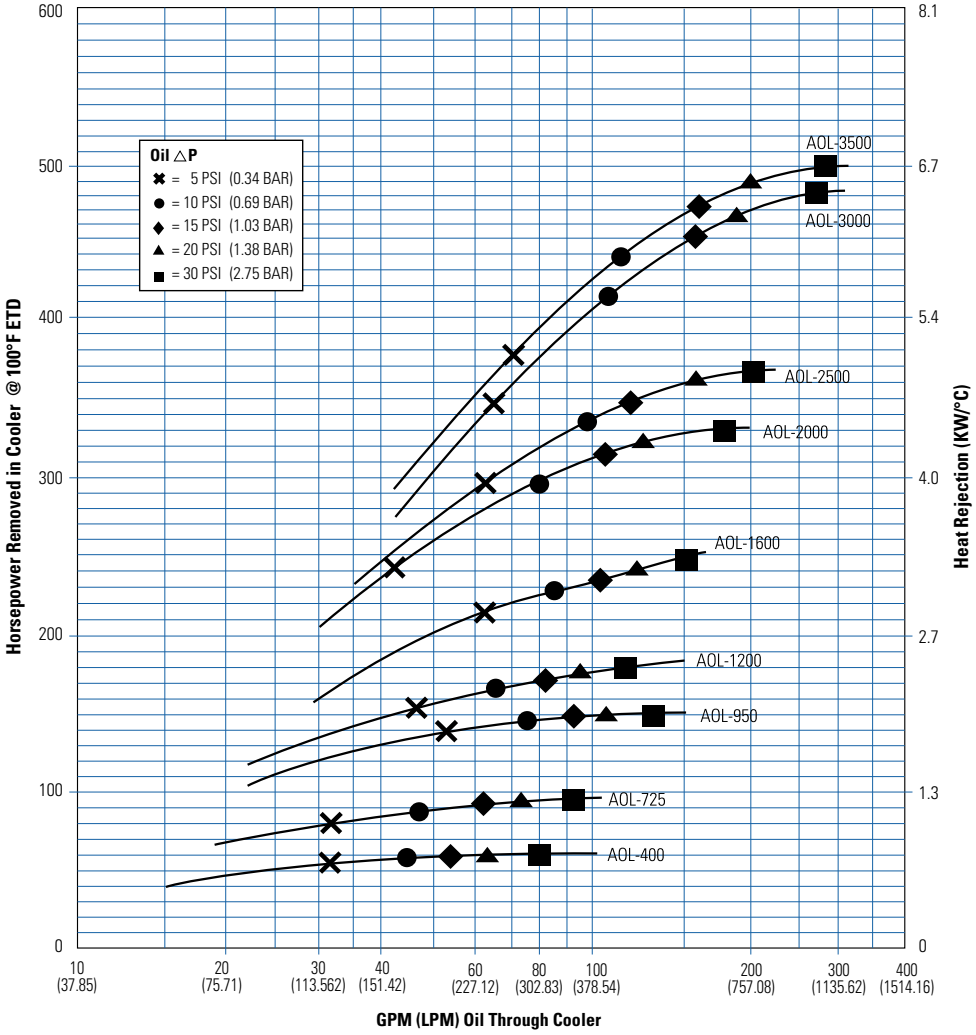
Available in 60 Hz Nema Frame only.

Hydraulic Motor Information

Model	Oil Flow Required GPM (LPM)	Min. Pressure Required PSI (BAR)	Motor IN^3/REV (CM^3/REV) Displacement	Sound dB(A) at 3 ft.
AOL-400	3.3 (12.49)	425 (29.31)	0.22 (3.6)	97
AOL-725	3.3 (12.49)	675 (46.54)	0.22 (3.6)	100
AOL-950	10.1 (38.23)	300 (20.68)	1.4 (22.94)	92
AOL-1200	10.1 (38.23)	700 (48.26)	1.4 (22.94)	94
AOL-1600	10.1 (38.23)	1100 (75.84)	1.4 (22.94)	98
AOL-2000	10.1 (38.23)	1650 (113.76)	1.4 (22.94)	98
AOL-2500	10.1 (38.23)	1650 (113.76)	1.4 (22.94)	98
AOL-3000	10.1 (38.23)	2000 (137.90)	1.4 (22.94)	102
AOL-3500	10.1 (38.23)	2000 (137.90)	1.4 (22.94)	102

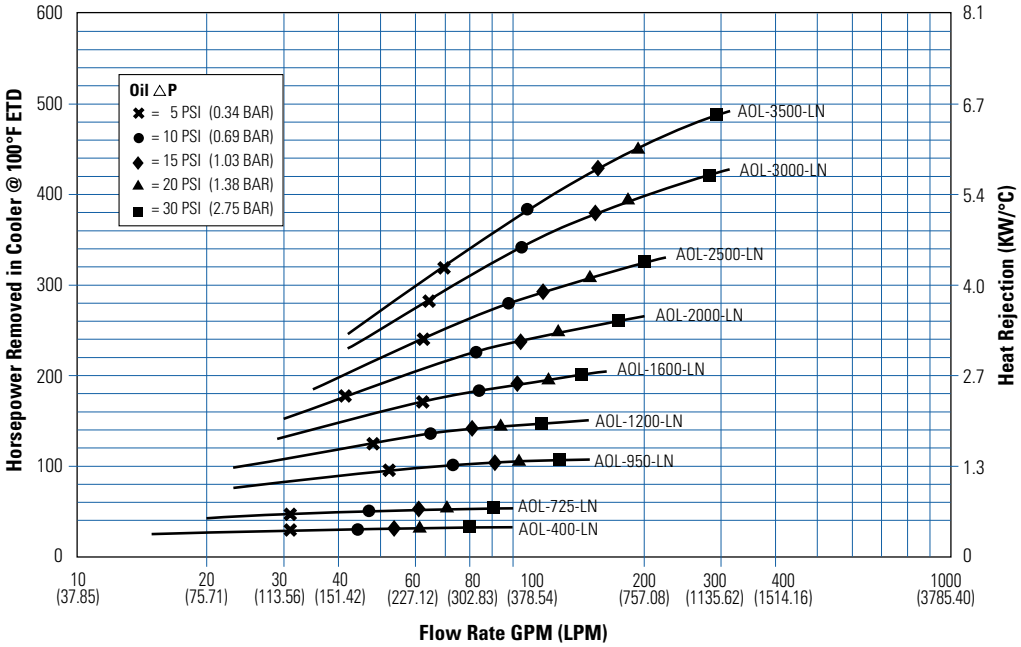
Notes: Maximum Pressure is 2000 psi. Stated Minimum Operating Pressure is at Inlet Port of Motor. 1000 psi Allowable Back Pressure.

Performance Curves



Note: Derate heat rejection values 15% if using 50Hz motors.

Low Noise Option

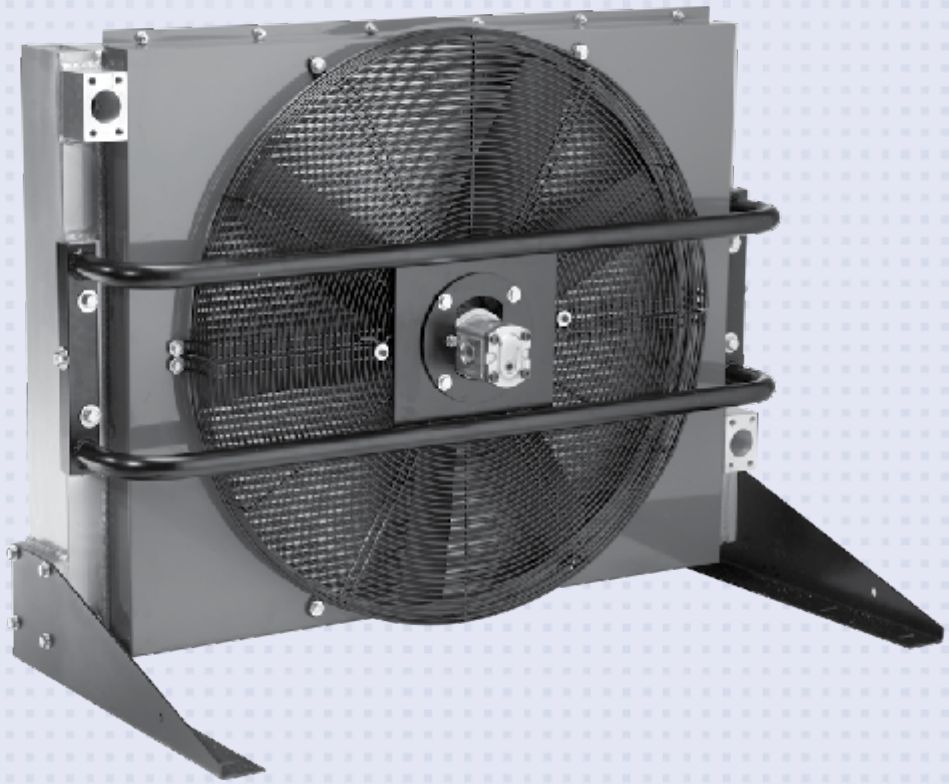


Available in 60 Hz Nema Frame only.

BRAZED ALUMINUM CONSTRUCTION

Features

- **Bar and Plate Brazed Aluminum Core**
- **Rugged, lightweight, and compact**
- **Provides the best heat transfer per given envelope size while minimizing pressure drop**
- **Air-side fin design minimizes fouling and static pressure ensuring long-term, reliable performance**
- **Welded fittings/ports and manifolds ensure structural integrity**
- **Standard SAE ports – NPT and BSPP ports available**
- **Customized units are available to meet your specific performance requirements**
- T-BAR core optional for high viscosity oils or other highly fouling fluids. *See T-Bar Performance Curve
- Low Noise Option Available



Ratings

Maximum Operating Pressure
250 psi (17 BAR)

Maximum Operating Temperature
300° F (150° C)

Materials

Mounting Feet Steel

Standard Core Brazed Aluminum Bar and Plate
- Tanks – 5052 Aluminum
- Nose Bar & Little Bar – 3003-H Aluminum
- Air Fin, Plate, Turbulator & End Plate – 3003-O Aluminum

Fanguard Steel

Connectors Aluminum

Fan Aluminum Hub, Plastic Blades

Shroud Steel

Motor TEFC & IEC

Fluid Compatability

Petroleum/mineral oils

Oil/water emulsion

Water/ethylene glycol

How to Order

Model Series	**Model Size Selected**	**Connection Type***	**Specify Motor Required**	**Core**	**Noise Level**
BOL	**4** **8** **16** **30** **400** **725** **950** **1200** **1600** **2000**	**1** - NPT **2** - SAE **3** - BSPP	**2** - Single Phase **3** - Three Phase **6** - 575 Volt **9** - Hydraulic **18** - IEC Three Phase	**Blank** - Standard Bar & Plate **TB** - T-BAR Core*	**Blank** - Standard Noise Level **LN** - Low Noise Level

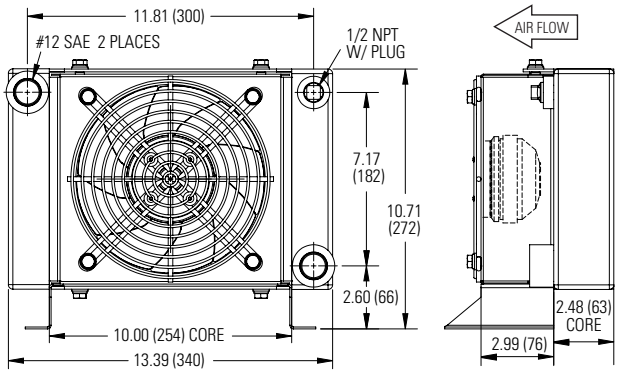
*T-BAR Core option provides a T-BAR core in BOL frame. Used for high fouling or high viscosity fluids. Performance is typically 15-25% less than the bar and plate core. Consult factory for details.

OPTIONAL T-BAR CORE SECTION CUTAWAY

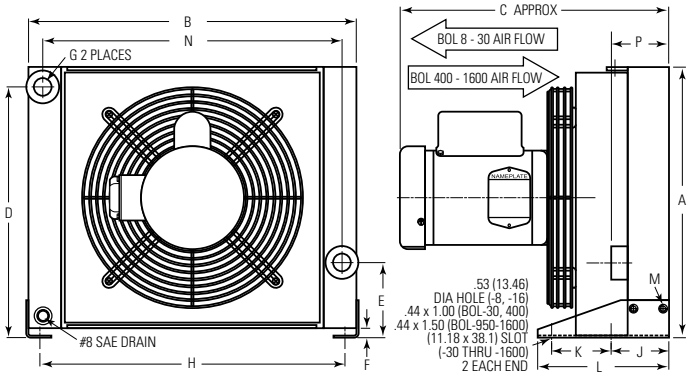
TTPSales@thermasys.com 262.554.8330 www.thermaltransfer.com

Dimensions

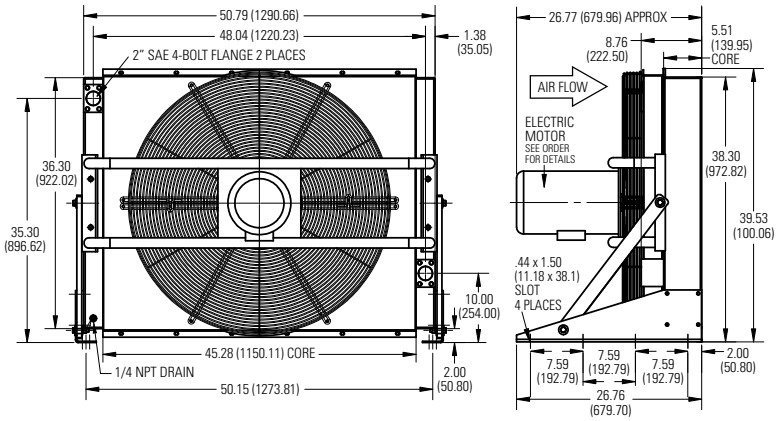
BOL-4



BOL-8 through BOL-1600



BOL-2000



Model	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Approx. Ship Wt. lbs (Kg)
BOL-4	See diagram above			—	—	—	—	—	—	—	—	—	—	—	18 (8.16)
BOL-8	12.44 (315.98)	15.75 (400.05)	14.72 (373.89)	11.30 (287.62)	3.27 (83.06)	.55 (13.97)	#12 SAE	14.53 (369.06)	3.07 (77.98)	3.75 (88.90)	7.36 (186.94)	M8 Bolt (2PL)	14.01 (355.85)	3.48 (88.40)	45 (20.4)
BOL-16	16.24 (412.50)	19.69 (500.13)	16.16 (410.46)	15.06 (382.52)	4.51 (114.56)	.57 (14.48)	#12 SAE	18.30 (464.82)	3.35 (85.09)	3.74 (95.00)	7.87 (199.90)	M8 Bolt (2PL)	17.95 (455.93)	3.46 (87.88)	55 (24.94)
BOL-30	20.69 (525.53)	26.38 (670.06)	18.23 (463.04)	19.49 (495.05)	5.26 (133.60)	1.32 (33.53)	#20 SAE	24.74 (628.40)	4.25 (107.95)	5.00 (127.00)	10.00 (254.00)	M10 Bolt (4PL)	24.34 (618.24)	5.28 (134.11)	125 (56.70)
BOL-400	19.83 (503.68)	22.45 (570.23)	18.80 (477.52)	17.31 (439.67)	6.50 (165.10)	2.00 (50.80)	#20 SAE	22.30 (566.42)	4.25 (107.95)	5.00 (127.00)	10.00 (254.00)	M10 Bolt (4PL)	20.08 (510.03)	5.20 (132.08)	148 (67.13)
BOL-725	24.37 (619.00)	30.32 (770.13)	18.60 (472.44)	21.60 (548.64)	6.50 (165.10)	2.00 (50.80)	#20 SAE	30.17 (766.32)	4.25 (107.95)	5.00 (127.00)	10.00 (254.00)	M10 Bolt (4PL)	27.95 (709.93)	5.20 (132.08)	170 (77.11)
BOL-950	28.82 (732.03)	37.03 (940.56)	22.69 (576.33)	24.55 (623.57)	9.50 (241.30)	2.00 (50.80)	2" SAE 4-Bolt Flange	35.89 (911.61)	6.05 (153.67)	9.20 (233.68)	16.00 (406.40)	M10 Bolt (4PL)	34.26 (870.20)	7.01 (178.05)	300 (136.08)
BOL-1200	28.82 (732.03)	40.96 (1040.38)	24.07 (611.38)	24.55 (623.57)	5.50 (139.70)	2.00 (50.80)		40.31 (1023.87)	6.05 (153.67)	9.20 (233.68)	16.00 (406.40)	M10 Bolt (4PL)	38.19 (970.03)	7.01 (178.05)	430 (195.04)
BOL-1600	36.89 (937.00)	40.96 (1040.38)	25.45 (646.43)	32.62 (828.55)	9.50 (241.30)	2.00 (50.80)		40.31 (1023.87)	6.05 (153.67)	9.20 (233.68)	16.00 (406.40)	M10 Bolt (4PL)	38.19 (970.03)	7.01 (178.05)	515 (233.60)
BOL-2000	See diagram above			—	—	—	—	—	—	—	—	—	—	—	582 (264.00)

Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches and (millimeters).

Specifications

Electric Motor Information (60 Hz Nema Frame)

Model	CMM	CFM	Motor HP	Voltage	Phase	Full Load Amps 230V	Frequency	RPM	Frame	Thermal Overload	Sound dB(A) at 3ft
BOL-4	31.14	1203	1/4	230	1	—	60 Hz	2850	—	—	73
BOL-8	22.65	800	1/3	115/230	1	3.0	60 Hz	3450	48C	No	80
BOL-8	22.65	800	1/3	208-230/460	3	1.4	60 Hz	3450	48C	No	80
BOL-16	40.35	1425	1/2	115/230	1	3.7	60 Hz	3450	48C	No	85
BOL-16	40.35	1425	1/2	208-230/460	3	2.2	60 Hz	3450	48C	No	85
BOL-30	62.29	2200	1/2	115/230	1	3.7	60 Hz	1725	56C	No	85
BOL-30	62.29	2200	1/2	208-230/460	3	2.0	60 Hz	1725	56C	No	85
BOL-400	62.29	2200	1	115/230	1	6.0	60 Hz	3450	56C	No	97
BOL-400	62.29	2200	1	208-230/460	3	3.2	60 Hz	3450	56C	No	97
BOL-725	101.94	3600	1-1/2	115/230	1	8.5	60 Hz	3450	56C	No	100
BOL-725	101.94	3600	1-1/2	208-230/460	3	4.8	60 Hz	3450	56C	No	100
BOL-950	133.10	4700	1-1/2	115/230	1	8.6	60 Hz	1725	145TC	No	92
BOL-950	133.10	4700	1-1/2	208-230/460	3	4.6	60 Hz	1725	145TC	No	92
BOL-1200	198.22	7000	3	208-230/460	3	8.8	60 Hz	1725	182TC	No	94
BOL-1600	223.75	7900	5	208-230/460	3	13.4	60 Hz	1725	184TC	No	96
BOL-2000	285.00	11000	7.5	230/460	3	24.8	60 Hz	1725	213TC	No	98

Electric Motor Information (50 Hz IEC Frame)

Model	CMM	CFM	KW	Voltage	Phase	Frequency	RPM	Frame	Sound dB(A) at 3ft
BOL-4	28.4	1003	.20	230	1	50 Hz	3000	—	73
BOL-8	18.9	667	.25	220/240/380/415	3	50 Hz	3000	63	71
BOL-16	33.7	1188	.37	220/240/380/415	3	50 Hz	3000	71	77
BOL-30	52.4	1850	.37	220/240/380/415	3	50 Hz	1500	71	73
BOL-400	52.4	1850	.75	220/240/380/415	3	50 Hz	3000	80	81
BOL-725	85.0	3000	1.10	220/240/380/415	3	50 Hz	3000	80	80
BOL-950	108.2	3821	1.50	220/240/380/415	3	50 Hz	1500	90	78
BOL-1200	165.1	5834	2.20	220/240/380/415	3	50 Hz	1500	100	83
BOL-1600	186.4	6584	3.00	220/240/380/415	3	50 Hz	1500	100	85
BOL-2000	331.3	11700	4.00	220/240/380/415	3	50 Hz	1500	112	88

All IEC frame motors have CE mark.

Hydraulic Motor Information

Model	Oil Flow Required GPM (LPM)	Min. Pressure Required PSI (BAR)	Motor IN^3/REV (CM^3/REV) Displacement	Sound dB(A) at 3 ft.
BOL-4	3.3 (12.49)	400 (27.58)	0.22 (3.6)	80
BOL-8	3.3 (12.49)	400 (27.58)	0.22 (3.6)	80
BOL-16	3.3 (12.49)	500 (34.47)	0.22 (3.6)	85
BOL-30	3.4 (12.87)	500 (34.47)	0.45 (7.3)	85
BOL-400	3.3 (12.49)	425 (29.30)	0.22 (3.6)	97

Model	Oil Flow Required GPM (LPM)	Min. Pressure Required PSI (BAR)	Motor IN^3/REV (CM^3/REV) Displacement	Sound dB(A) at 3 ft.
BOL-725	3.3 (12.49)	675 (27.58)	0.22 (3.6)	100
BOL-950	10.1 (38.23)	300 (34.47)	1.4 (22.9)	92
BOL-1200	10.1 (38.23)	700 (34.47)	1.4 (22.9)	94
BOL-1600	10.1 (38.23)	1100 (29.30)	1.4 (22.9)	96
BOL-2000	10.1 (38.23)	1650 (113.76)	1.4 (22.9)	98

Notes: Maximum Pressure is 2000 psi. Stated Minimum Operating Pressure is at Inlet Port of Motor. 1000 psi Allowable Back Pressure.

Selection Procedure

Step 1 **Determine Heat Load.** Typical Rule of Thumb, -size cooler for 1/3 of the input horsepower. Heat load may be expressed as either Horsepower or BTU/Hr or KW/°C.

HP=BTU/HR ÷ 2545

BTU/HR=HP x 2545

$$\text{BTU/HR} = \frac{\text{KW}}{\text{°C}} \times 1894.61 \times \text{E.T.D.(°F)}$$

Step 2 **Determine Entering Temperature Difference.** (Actual E.T.D.)

$$\text{E.T.D.} = \text{Entering oil temperature} - \text{Entering Ambient air temperature}$$

The entering oil temperature is generally the maximum desired system oil temperature.

Entering air temperature is the highest Ambient Air temperature the application will see.

Step 3 **Determine the Corrected Heat Dissipation to use the Curves**

ENGLISH Version

$$\text{Corrected Heat Rejection} = \text{(BTU/Hr) Heat Load} \times \frac{100°\text{F}}{\text{Desired E.T.D.}}$$

(BTU/HR) to use with selection chart

METRIC Version

$$\text{Corrected Heat Rejection} \quad \frac{\text{KW}}{\text{°C}} = \frac{\text{Heatload (kw)}}{\text{Desired E.T.D. (°C)}}$$

Step 4 **Select Model From Curves** Enter the Performance Curves at the bottom with the GPM oil flow and proceed upward to the adjusted Heat Rejection from Step 3. Any Model or Curve on or above this point will meet these conditions.

Step 5 **Calculate Oil Pressure Drop** Find the oil pressure drop correction factor and multiply it by the Oil Pressure Drop found on performance curve.

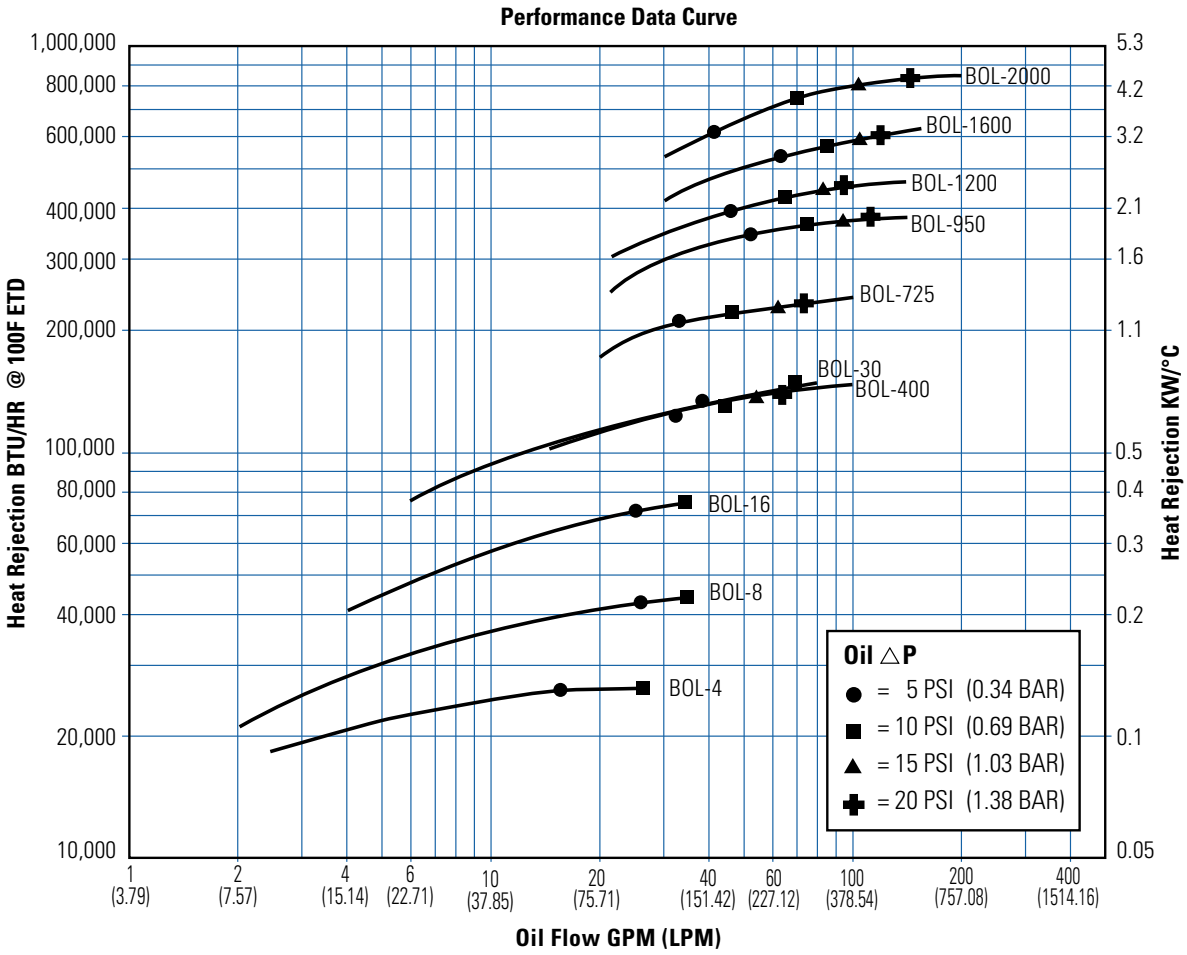
Listed Performance Curves are based on:

- 50 SSU (11 cSt) oil
- 100° F (55.56° C) Entering Temperature Difference (E.T.D.)

If your application conditions are different, then continue with the selection procedure.

Performance Curves

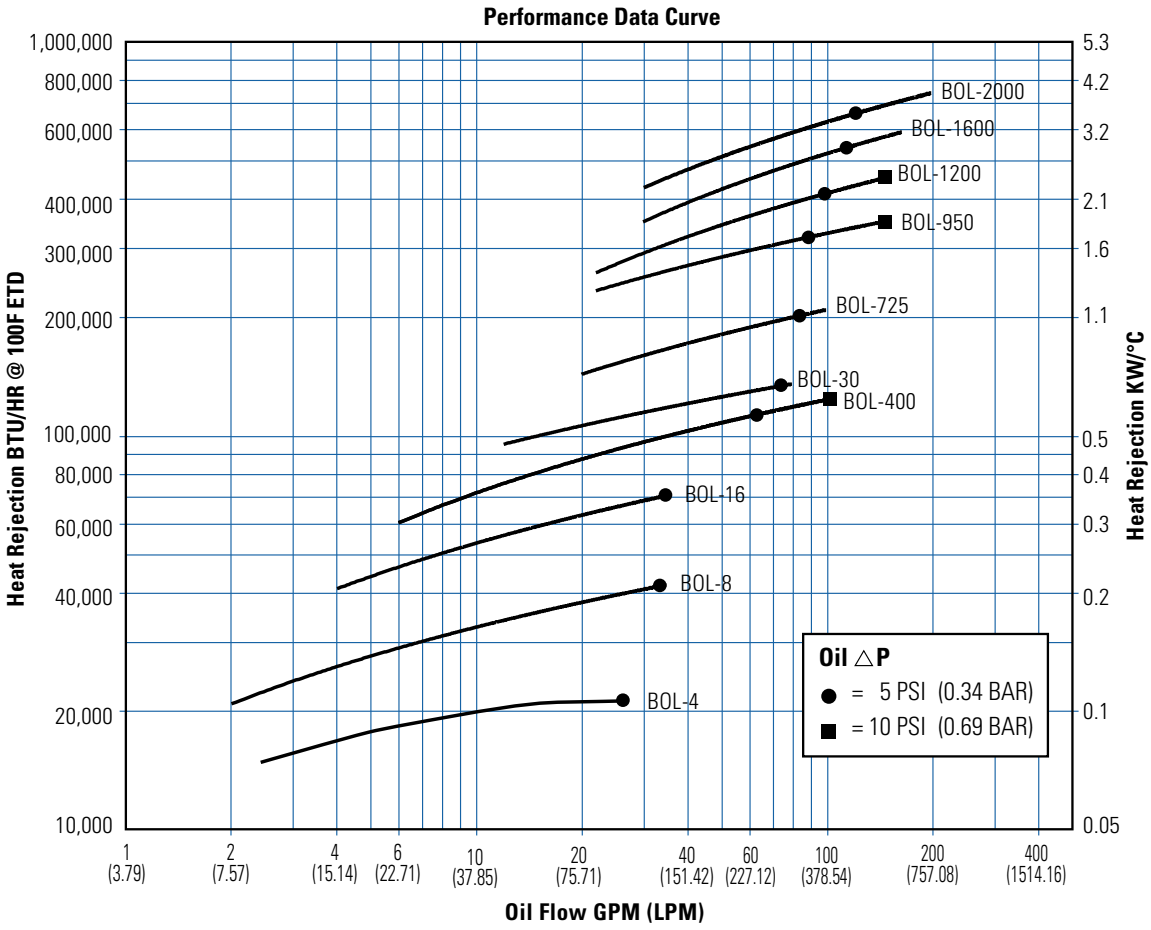
BOL Models with Standard P-BAR Core



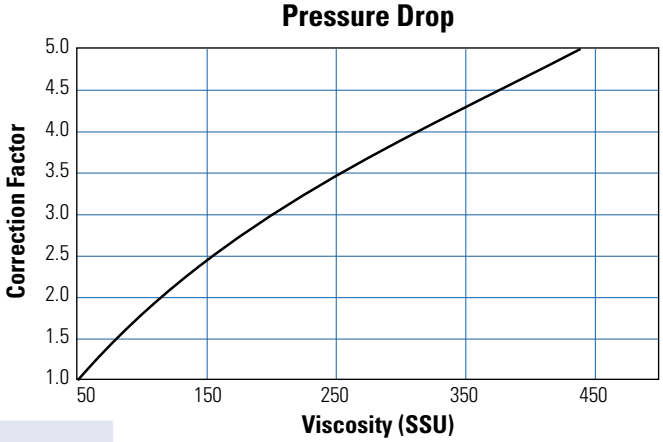
Note: Derate heat rejection values 15% if using 50Hz motors.

Performance Curves

BOL Models with Optional T-BAR Core



Note: Derate heat rejection values 15% if using 50Hz motors.



Oil Temperature

Typical operating temperature ranges are:

Hydraulic Motor Oil	120°F - 180°F (49°C - 82.2°C)
Hydrostatic Drive Oil	160°F - 180°F (71°C - 82.2°C)
Engine Lube Oil	180°F - 200°F (82.2°C - 93.3°C)
Automatic Transmission Fluid	200°F - 300°F (93.3°C - 149°C)

Desired Reservoir Temperature

Oil Temperature: Oil coolers can be selected using entering or leaving oil temperatures.

Off-Line Recirculation Cooling Loop: Desired reservoir temperature is the oil temperature entering the cooler.

Return Line Cooling: Desired reservoir temperature is the oil temperature leaving the cooler. In this case, the oil temperature change must be determined so that the actual oil entering temperature can be found. Calculate the oil temperature change (oil △T) with this formula:

Oil △T = (BTU's/Hr.) / (GPM Oil Flow x 210).

To calculate the oil entering temperature to the cooler, use this formula:

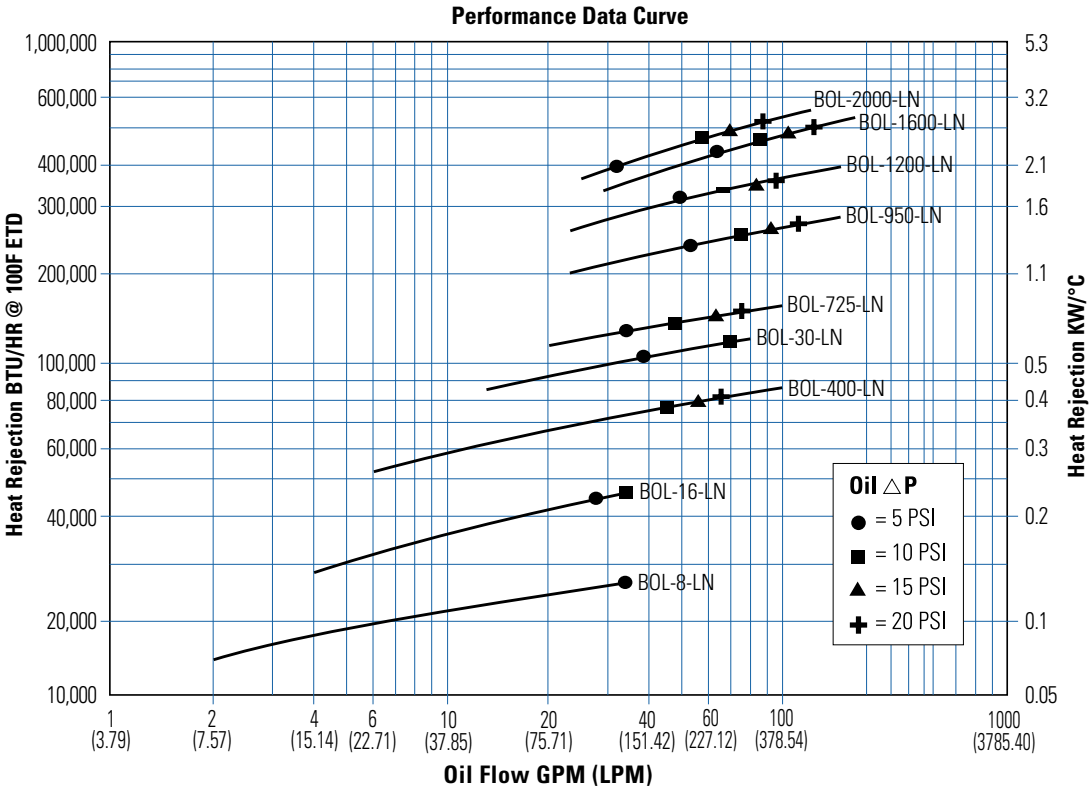
Oil Entering Temp. = Oil Leaving Temp + Oil △T.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

Performance Curves

BOL Models with Low-Noise Option

The low noise option offers the BOL models with a reduced motor speed. This allows a lower sound level output for noise-sensitive applications.



Available on 60 Hz Nema frame only.

Electric Motor Information

Model	HP	Frame	Low Noise RPM	Low Noise CFM	Low Noise CMM	Voltage	Frequency (HZ)
8-1PH	0.33	48	1725	400	11.33	115/230	60
8-3PH	0.33	48	1725	400	11.33	208-230/460	60
16-1PH	0.50	48	1725	704	19.93	115/230	60
16-3PH	0.50	48	1725	704	19.93	208-230/460	60
30-1PH	0.50	56C	1160	1470	41.62	115/230	60
30-3PH	0.50	56C	1160	1470	41.62	208-230/460	60
400-1PH	1.00	56C	1725	1100	31.19	115/230	60
400-3PH	1.00	56C	1725	1100	31.19	208-230/460	60
725-1PH	1.50	56C	1725	1780	50.40	115/230	60
725-3PH	1.50	56C	1725	1780	50.40	208-230/460	60
950-1PH	1.50	145TC	1160	3150	89.19	115/230	60
950-3PH	1.50	145TC	1160	3150	89.19	208-230/460	60
1200-3PH	1.50	182TC	1160	4690	132.81	208-230/460	60
1600-3PH	2.00	184TC	1160	6510	184.34	208-230/460	60
2000-3PH	5.00	213TC	1160	8700	000.00	230/460	60

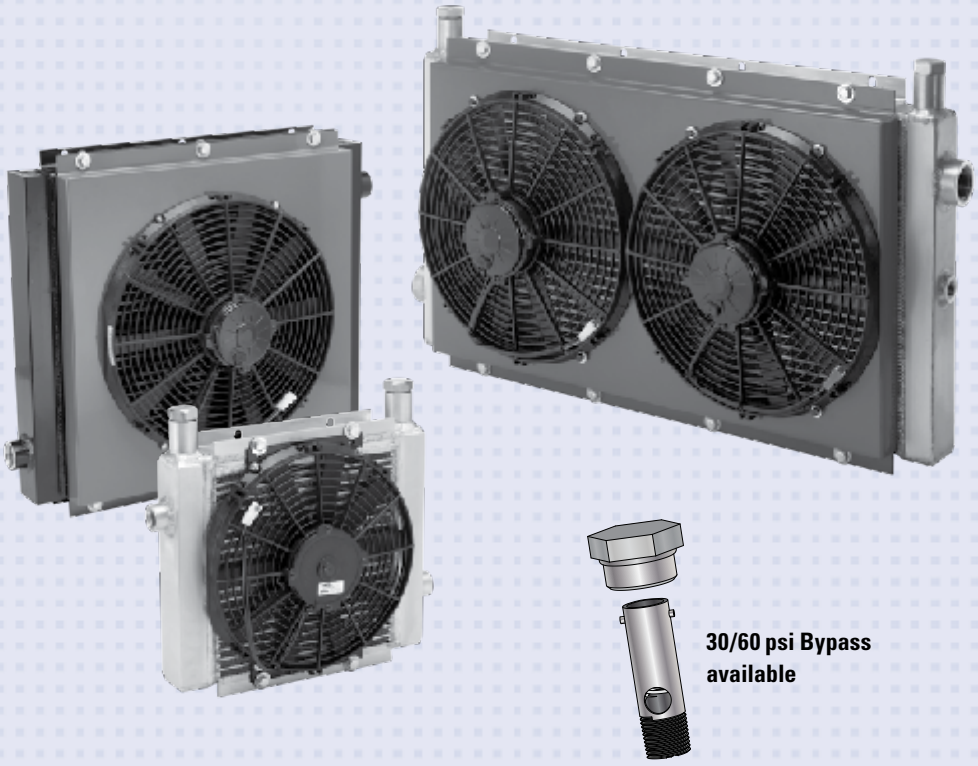
Sound Data

Model	DBA at 3 ft
BOL-8-LN	62
BOL-16-LN	69
BOL-30-LN	67
BOL-400-LN	72
BOL-725-LN	82
BOL-950-LN	76
BOL-1200-LN	75
BOL-1600-LN	78
BOL-2000-LN	85

BRAZED ALUMINUM CONSTRUCTION

Features

- **Bar and Plate Brazed Aluminum Core**
- **Rugged, lightweight, and compact**
- **Provides the best heat transfer per given envelope size while minimizing pressure drop**
- **Air-side fin design minimizes fouling and static pressure ensuring long-term, reliable performance**
- **Fan motor assembly has an IP68 with AMP-#180908 connection**
- **Welded aluminum fittings/ports and manifolds ensure structural integrity**
- **Standard SAE ports – NPT and BSPP ports available**
- **Customized units are available to meet your specific performance requirements**
- Additional capabilities for radiators, charge-air-coolers, condensers, and multi-circuit units



30/60 psi Bypass available

Ratings

Maximum Operating Pressure
250 psi (17 BAR)

Maximum Operating Temperature
300° F (150° C)

Fluid Compatability

Petroleum/mineral oils

Oil/water emulsion

Water/ethylene glycol

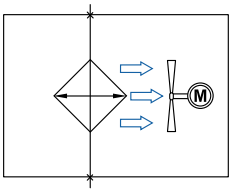
Materials

Core Brazed Aluminum Bar and Plate

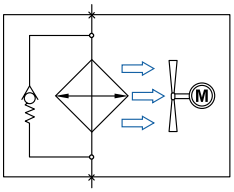
- Tanks – 5052 Aluminum
- Nose Bar & Little Bar – 3003-H Aluminum
- Air Fin, Plate, Turbulator & End Plate – 3003-O Aluminum

Connections Aluminum

Core Mounting Brackets Brazed Aluminum



Without Bypass



With Bypass

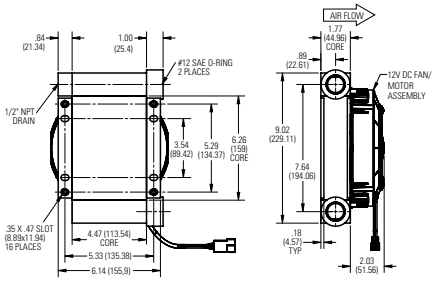
How to Order

Model Series	Model Size Selected	Connection Type*	Specify Motor Required	Bypass*
MA (MAR)	3 3.5 4 12 18 32 48 232 248	1 - NPT 2 - SAE 3 - BSPP	4A - 12 VDC 4B - 24 VDC	30 - 30 PSI 60 - 60 PSI

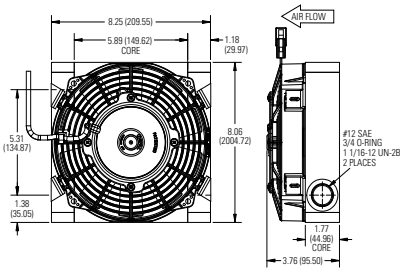
*Bypass available on MA-12, MA-18, MA-32, MA-48, MA-232, MA-248 only. (MAR)
MA-8, MA-14, MA-20, MA-66, MA-32 do not have fan option.
MA 3.5 available with fan only.

Dimensions - Fan/Core

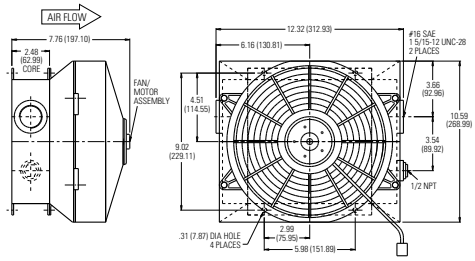
MA-3-4



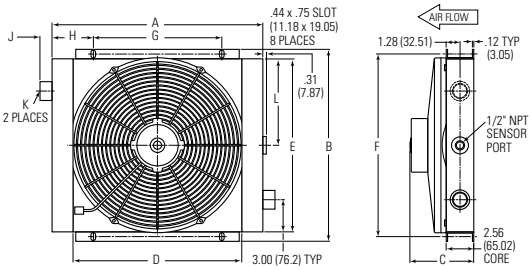
MA-3.5-4



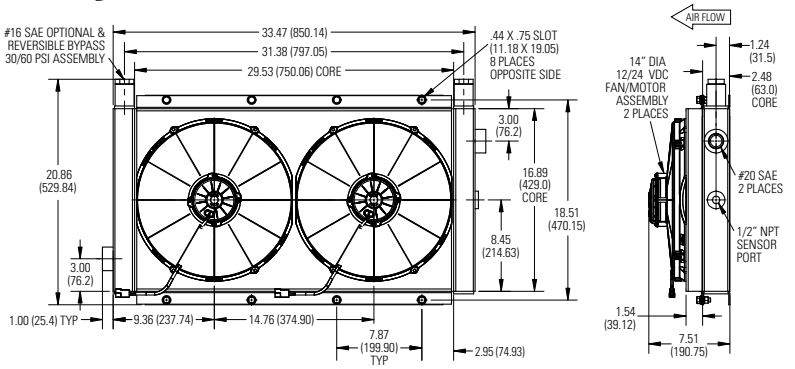
MA-4-4



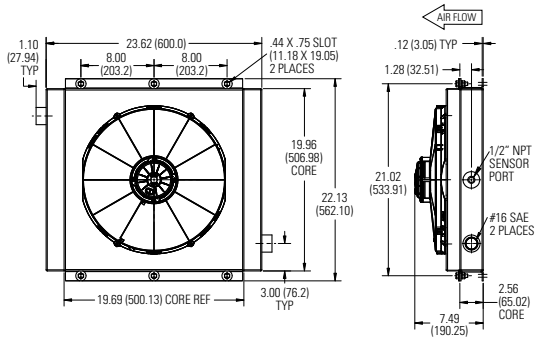
MA-12-4, MA-18-4, MA-32-4



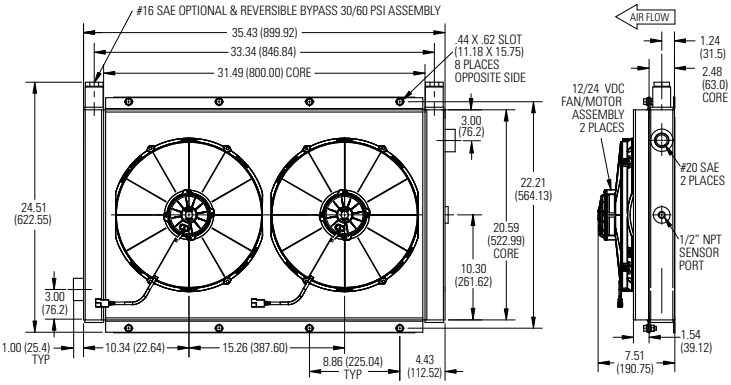
MA-232-4



MA-48-4



MA-248-4

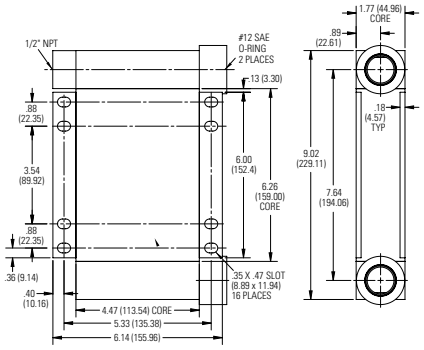


Model	A	B	C	D	E	F	G	H	J	K	L	DC Amp Draw 12V	DC Amp Draw 24V	CFM (CMM)	Approx. Ship Wt. lbs (Kg)
MA-3-4	See diagram above			—	—	—	—	—	—	—	—	5.7	3.6	300 (8.50)	6 (2.72)
MA-3.5-4	See diagram above			—	—	—	—	—	—	—	—	12.5	6.3	370 (10.48)	9 (4.08)
MA-4-4	See diagram above			—	—	—	—	—	—	—	—	12.5	6.3	363 (10.28)	16 (7.26)
MA-12-4	13.78 (350.01)	11.73 (297.44)	6.26 (159.00)	9.84 (249.94)	9.96 (252.98)	10.87 (276.10)	5.71 (145.00)	4.41 (112.01)	1.00 (25.40)	#12 SAE	4.98 (126.49)	12.5	6.3	521 (14.75)	19 (8.62)
MA-18-4	15.75 (400.05)	13.58 (344.93)	5.04 128.02)	11.81 (299.97)	11.81 (299.97)	12.80 (325.12)	5.87 (149.10)	4.96 (125.98)	1.00 (25.40)	#12 SAE	5.91 (150.11)	10.6	5.3	783 (22.17)	23 (10.43)
MA-32-4	19.69 (500.15)	18.43 (468.12)	5.95 (151.13)	15.75 (400.05)	16.14 (409.96)	17.32 (439.93)	12.00 (304.8)	3.86 (98.04)	1.14 (28.96)	#16 SAE	8.07 (204.98)	22.2	11.1	1368 (38.74)	28 (12.70)
MA-48-4	See diagram above			—	—	—	—	—	—	—	—	22.2	11.1	1637 (46.40)	45 (20.40)
MA-232-4	See diagram above			—	—	—	—	—	—	—	—	19.3*	9.7*	2234 (63.26)	65 (29.48)
MA-248-4	See diagram above			—	—	—	—	—	—	—	—	19.3*	9.7*	2904 (82.24)	90 (40.80)

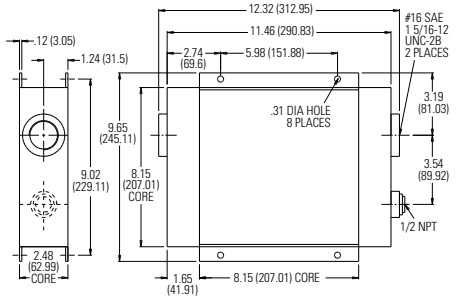
Note: We reserve the right to make reasonable design changes without notice. Dimensions are in inches and (millimeters).
**AMP draw listed as per FAN.*

Dimensions - Core Only

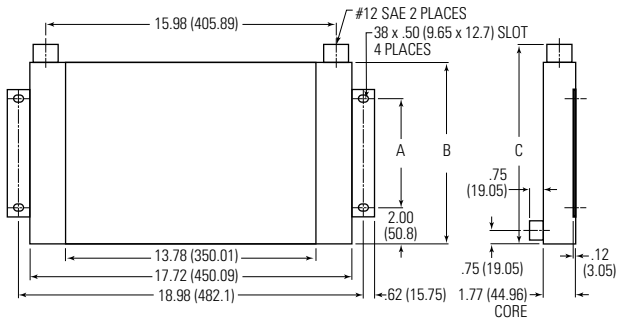
MA-3



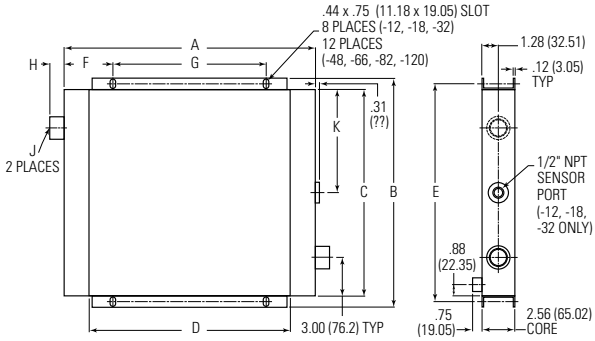
MA-4



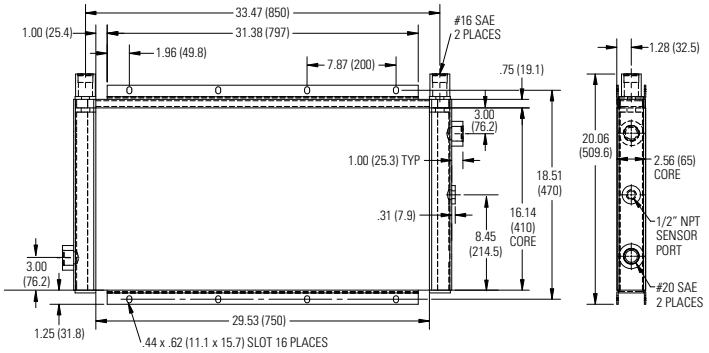
MA-8, MA-14, MA-20



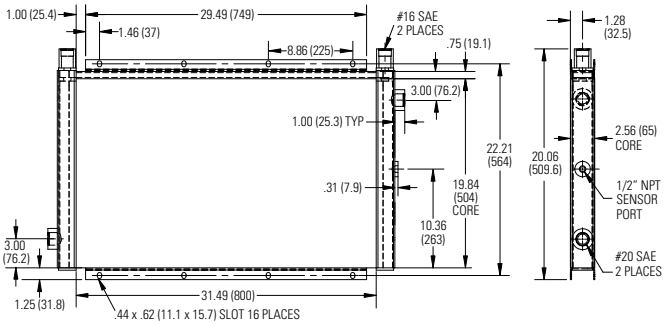
MA-12 thru MA-120



MA-232



MA-248



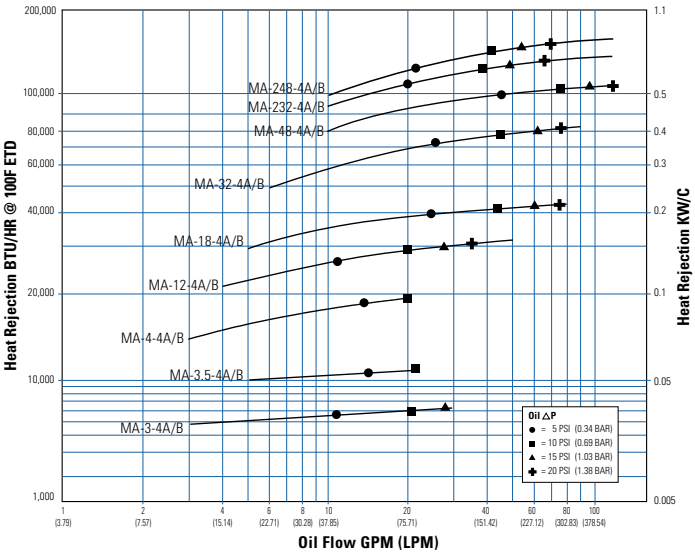
Model	A	B	C	D	E	F	G	H	J	K	Approx. Ship Wt. lbs (Kg)
MA-3	See diagram above			–	–	–	–	–	–	–	4 (1.81)
MA-4	See diagram above			–	–	–	–	–	–	–	7 (3.18)
MA-8	3.00 (76.2)	5.67 (144.02)	6.65 (168.9)	–	–	–	–	–	–	–	10 (4.54)
MA-12	13.78 (350.01)	11.73 (297.94)	9.96 (252.98)	9.84 (294.94)	10.87 (276.10)	4.41 (112.01)	4.96 (125.98)	1.00 (25.4)	#12 SAE	4.98 (126.49)	15 (6.8)
MA-14	6.00 (152.4)	10.00 (254.0)	10.98 (278.89)	–	–	–	–	–	–	–	14 (6.35)
MA-18	15.75 (400.05)	13.58 (344.93)	11.81 (299.97)	11.81 (299.97)	12.80 (325.12)	4.96 (125.98)	5.87 (149.10)	1.00 (25.4)	#12 SAE	5.91 (150.11)	18 (8.16)
MA-20	10.00 (254.0)	14.33 (363.98)	15.31 (388.87)	–	–	–	–	–	–	–	18 (8.16)
MA-32	19.69 (500.13)	18.43 (468.12)	16.14 (409.96)	15.75 (400.05)	17.32 (439.93)	3.86 (98.04)	12.00 (304.8)	1.14 (28.96)	#16 SAE	8.07 (204.98)	28 (12.7)
MA-48	23.62 (599.95)	22.13 (562.10)	19.84 (500.94)	19.69 (500.13)	21.02 (533.91)	3.82 (97.03)	8.00 (203.2)	1.14 (28.96)	#16 SAE	–	41 (18.60)
MA-66	27.56 (700.02)	25.83 (656.08)	23.54 (597.92)	23.62 (599.95)	24.72 (627.89)	3.78 (96.01)	10.00 (254.0)	1.58 (40.13)	#20 SAE	–	50 (22.68)
MA-82	31.50 (800.1)	27.68 (703.07)	25.39 (644.91)	27.56 (700.02)	26.57 (674.8)8	5.75 (146.05)	10.00 (254.0)	1.58 (40.13)	#24 SAE	–	65 (29.48)
MA-120	31.50 (800.1)	39.49 (1003.05)	37.20 (944.88)	27.56 (700.02)	38.39 (975.11)	5.75 (146.05)	10.00 (254.0)	1.58 (40.13)	#24 SAE	–	88 (39.92)
MA-232	See diagram above			–	–	–	–	–	–	–	55 (24.95)
MA-248	See diagram above			–	–	–	–	–	–	–	80 (36.29)

Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches and (millimeters).

Performance Curves

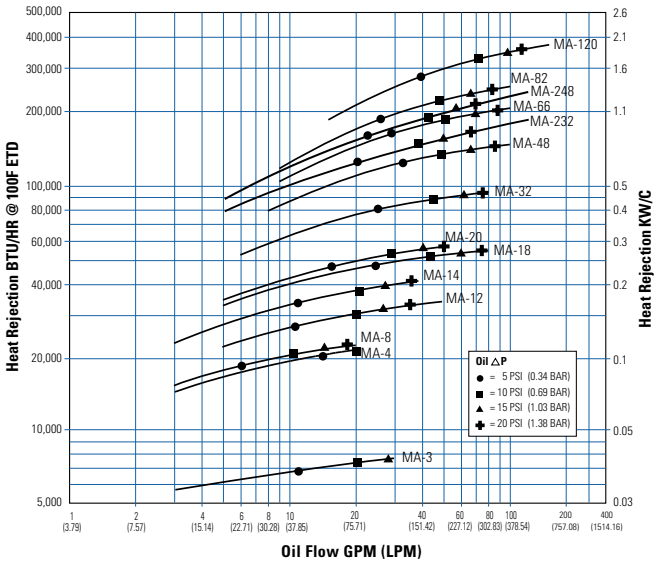
MA Models with DC Fan Assemblies

Performance Data Curve

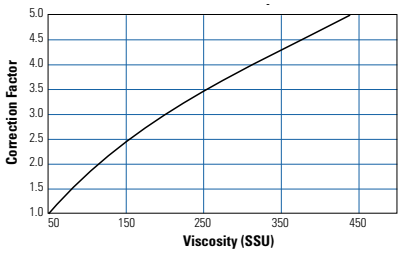


MA Models (No Fan, Core Only)

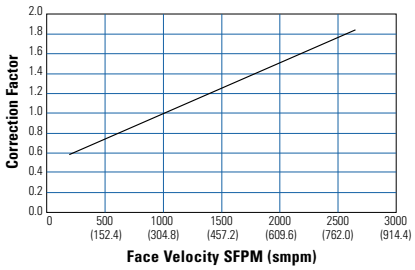
Performance Data Curve



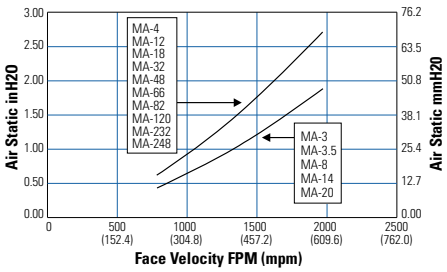
Oil Pressure Drop Correction



Air Static Correction



Air Static Pressure Drop



Selection Procedure

Step 1 **Determine Heat Load.** Typical Rule of Thumb, - size cooler for 1/3 of the input horsepower. Heat load may be expressed as either Horsepower or BTU/HR or KW/°C.

HP = BTU/HR ÷ 2545

BTU/HR = HP x 2545

$$BTU/HR = \frac{KW}{°C} \times 1895 \times E.T.D.(°F)$$

Step 2 **Determine Entering Temperature Difference.** (Actual E.T.D.)
(E.T.D.= Entering oil temperature – Entering Ambient air temperature)

The entering oil temperature is generally the maximum desired system oil temperature.

Entering air temperature is the highest Ambient Air temperature the application will see, plus – add any pre-heating of the air prior to its entering the cooler. Pay special attention if air is drawn from the engine compartment for cooling.

Step 3 **Find Air Velocity Correction Factor**
(Skip to Step 4 if using our DC Fan Assembly)

Calculate actual SFPM Air Velocity or SCFM (Standard Cubit Feet per Minute) for selection using the Face Area from the table.

$$SFPM\ Air\ Velocity^{*} = \frac{SCFM\ Air\ Flow}{Square\ Feet\ Cooler\ Face\ Area}$$

$$SMPM = \frac{SCMM}{Square\ Meter\ Cooler\ Face\ Area}$$

(SCFM Air Flow= SFPM Air Velocity x Square Feet Cooler Face Area)

*If the Air Velocity calculated is different than the value in Step 4, then recheck Corrected oil Pressure drop.

Step 4 **Determine the Corrected Heat Dissipation to use the Curves**

ENGLISH Version

$$\text{Corrected Heat Rejection} = \frac{\text{(BTU/Hr) Heat Load}}{\left[\frac{\text{Desired E.T.D}}{100°F} \times \text{Air Velocity Correction Factor}\right]}$$

(BTU/HR) to use with selection chart

(Air Factor value not needed if using provided DC Fan assembly; Omit in formula)

METRIC Version

$$\text{Corrected Heat Rejection}\left[\frac{KW}{°C}\right] = \frac{\text{Heatload (kw)}}{\text{Desired E.T.D (°C)} \times \text{Air Velocity Correction Factor}}$$

Step 5 **Select Model From Curves** Enter the Performance Curves at the bottom with the GPM oil flow and proceed upward to the adjusted Heat Rejection from Step 4. Any Model or Curve on or above this point will meet these conditions.

Step 6 **Calculate Oil Pressure Drop** Find the oil pressure drop correction factor and multiply it by the Oil Pressure Drop found on performance curve.

Listed Performance Curves are based on:

- 50 SSU (11 cSt) oil
- 1000 Standard Feet per Minute (SPFM) (304.8 MPM) Air Velocity
- 100° F (55.56° C) Entering Temperature Difference (E.T.D.)

If your application conditions are different, then continue with the selection procedure.

FEATURES

- **Young Radiator – OCS Model Interchange (approximate)**
- **American Industrial – AOCS Interchange (approximate)**
- **Hydraulic Circuits**
- **Machine Tool Cooling**
- **Gear Oil Cooling**
- **Lube Oil Cooling**
- **Process Cooling**
- **Torque Converters**
- **Marine Transmissions**
- Aerodynamically Designed Fan
- Brazed Aluminum Core
- Enclosed Fan Cooled Standard – TEFC

T-BAR™ • CORE INSIDE •

This Line Features

- High efficient, light weight, low fouling extruded core design
- Rugged construction with a patented T-Bar brazed aluminum core captured in steel framing
- Both mobile and industrial applications
- High flow capacity; with a flow range from 20-500 GPM
- Ability to handle high viscosity fluids i.e. gear oil cooling
- Available in 7 sizes with electric or hydraulic motor options
- Standard sizes available with short, lean lead time

Materials

Fan Blade Composite with cast aluminum hub

Cabinet Steel with baked enamel finish

Connections Aluminum – Female SAE

Motor Support Steel

Shroud Steel

Core Brazed Aluminum

Motor TEFC & Hydraulic motor

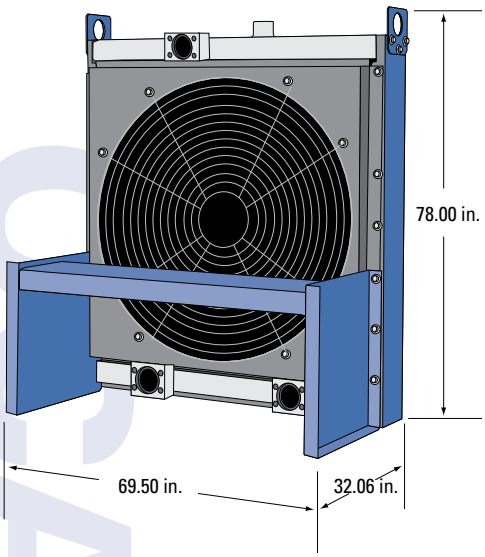
Ratings

Max Operating Pressure - 250 psi

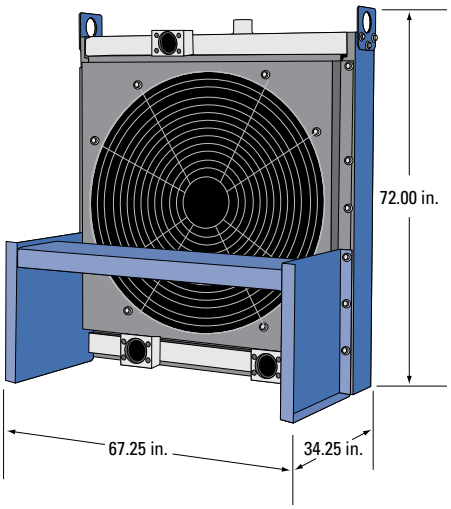
Max Operating Temperature - 350° F

Dimension Range

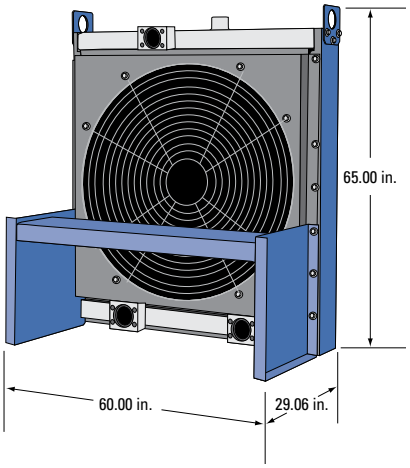
OCA-3100



OCA-2500



OCA-2000



How to Order

OCA	–		–		–		–		–	

Model Series
OCA - Standard

Model Size Selected

Connection Type
2 - SAE

[1] External Relief Bypass Kit
BLANK- NO BYPASS
30-30 PSI
60-60 PSI

Specify Motor Required
0 -NO-MOTOR
3 -THREE PHASE
6 -575 VOLT
9 -HYDRAULIC MOTOR
11 - THREE PH EXPLOSION PROOF
18 - THREE PH IEC

[2] Material Options
HC - HERESITE COATING (CORE)
G - GALVANIZED STEEL (CABINET)
SFG - STAINLESS STEEL (FAN GUARD)

Connection Conversion Kits - *order as separate line item*

	Part Number						
	OCA-450	OCA-600	OCA-1000	OCA-1500	OCA-2000	OCA-2500	OCA3100
2 Pass SAE (Flange Cover)	12076	12011	12012	12012	12012	12013	12013
1 Pass NPT	51166	51168	51170	51172	51174	51175	5178
2 Pass NPT[3]	51167	51169	51171	51173	51175	51177	51179
1 Pass BSPP	Consult Factory						
2 Pass BSPP[3]	Consult Factory						
Fill Plug (#20 SAE)[4]	50732						

[1] Available for 2 Pass unit only. Pressure tolerance is (+5 PSI/-0 PSI). Consult factory for details.

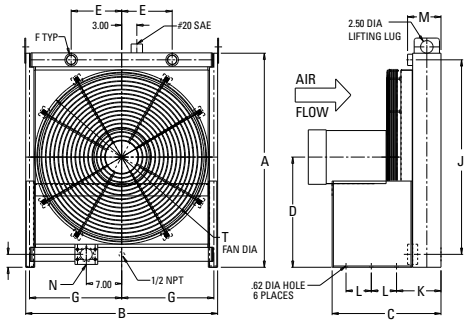
[2] Use HC-G-SFG if all three add-ons are desired.

[3] Two Pass adapter kits already include cover plate.

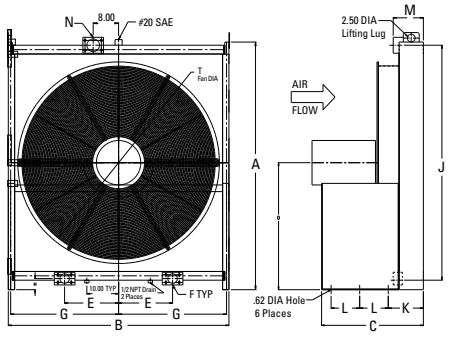
[4] Ports do not come plugged unless specified at time of order.

Dimensions

OCA-450 & 600

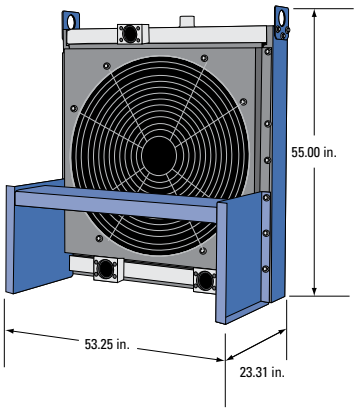


OCA-1000 Through OCA-3100

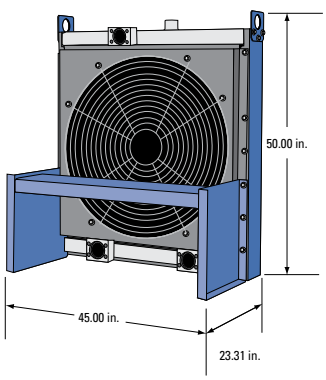


MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	T	Shipping WT (lbs)	DBA at 3 ft
OCA-450	36.38	33.00	21.56	18.50	8.00	#24	15.75	4.12	28.75	8.81	5.00	6.62	2.00	24.00	400	81
OCA-600	42.38	38.00	21.56	21.81	10.00	#24	18.25	2.56	35.50	8.81	5.00	6.62	2.50	32.00	497	84
OCA-1000	50.00	45.00	24.56	26.25	10.50	2.00	21.75	4.19	45.50	7.81	7.50	7.50	3.00	36.00	690	88
OCA-1500	55.00	53.25	23.31	28.50	12.50	2.00	25.75	4.31	49.75	7.79	7.00	8.50	3.00	42.00	832	92
OCA-2000	65.00	60.00	29.06	33.00	15.00	3.00	29.00	4.00	58.00	11.06	7.50	8.56	3.00	48.00	1223	96
OCA-2500	72.00	67.25	34.25	37.00	17.00	3.00	32.88	3.25	67.50	11.06	7.50	9.50	4.00	54.00	1723	96
OCA-3100	78.00	69.50	32.06	40.00	17.00	3.00	34.00	3.00	74.00	11.06	9.00	9.50	4.00	60.00	1806	96

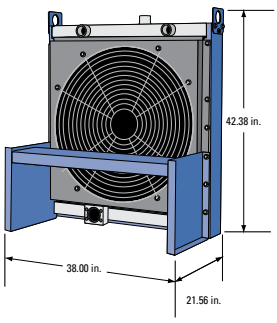
OCA-1500



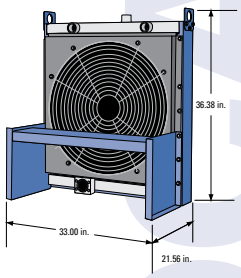
OCA-1000



OCA-600

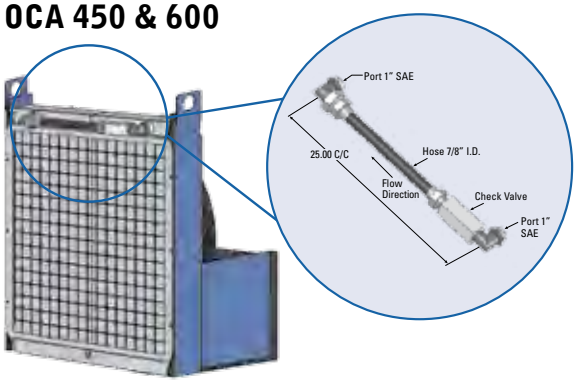


OCA-450

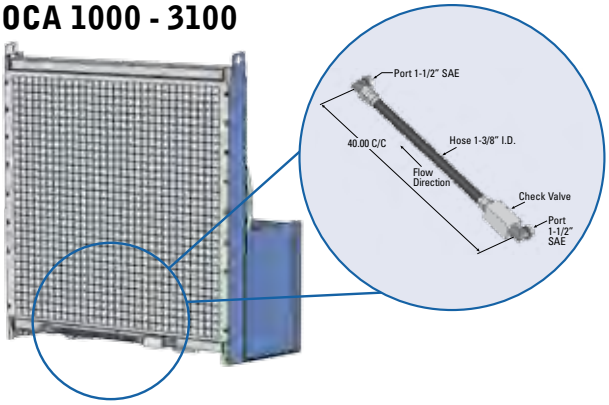


External Bypass Option (Extra port is removed for bypass options)

OCA 450 & 600

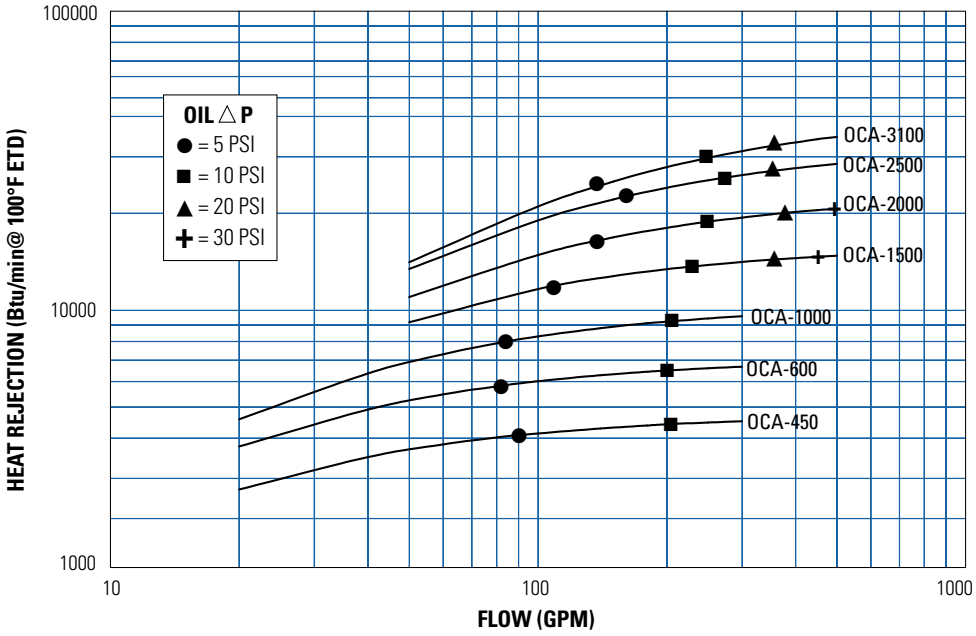


OCA 1000 - 3100

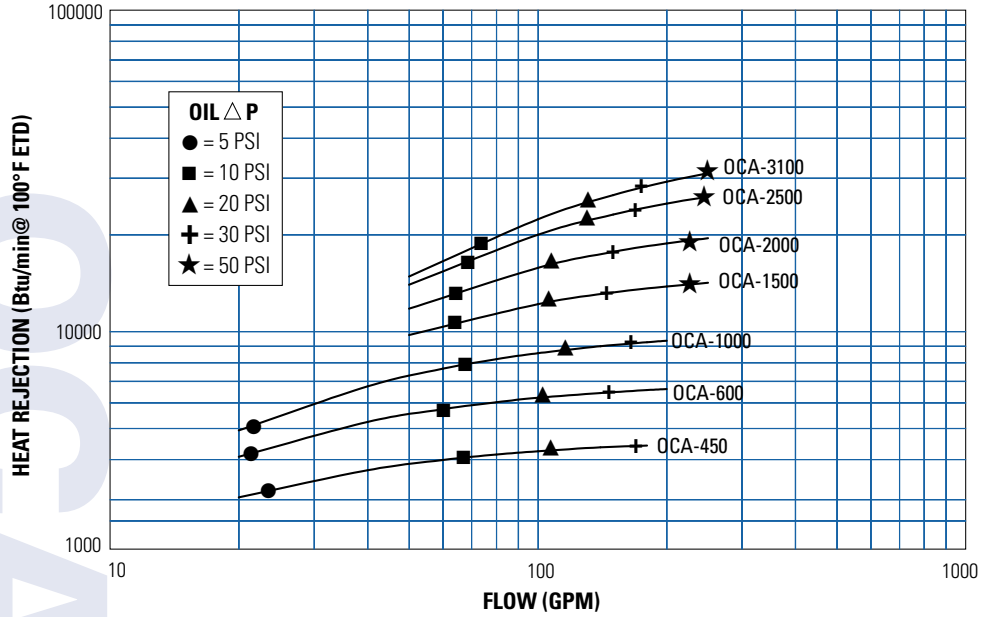


Performance Curves

One Pass Oil

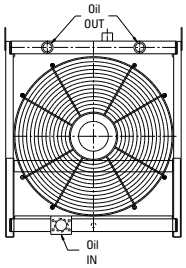


Two Pass Oil

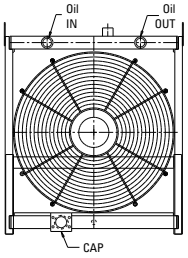


Oil Piping Diagram

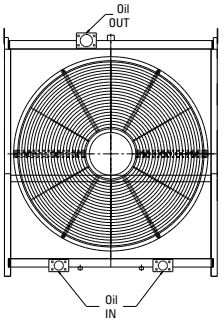
OCA 450 & 600 One Pass



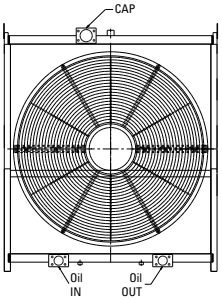
OCA 450 & 600 Two Pass



1000 - 3100 One Pass



1000 - 3100 Two Pass



Selection Procedure

Performance Curves are based on 50SSU oil entering the cooler 100°F higher than the ambient air temperature used for cooling. This is also referred to as a 100°F Entering Temperature Difference (ETD).

STEP 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower.
(Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
Convert HP to BTU/MIN: HP x 42.41 = BTU/MIN

STEP 2 **Determine Entering Temperature Difference (ETD).**
Desired oil entering cooler °F – Ambient air temp. °F = Actual ETD

STEP 3 **Determine Curve Horsepower Heat Load.**
Enter the information from above:
E.T.D. Temperature Correction Factor:

$$\text{Btu/Min}_{\text{corrected}} = \text{Input Btu/Min} \times \frac{100 \times Cv}{\text{Desired E.T.D.}}$$

Enter curves at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

STEP 5 **Determine Oil Pressure Drop from Curves:**
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI; ✢ = 30 PSI; ★ = 50 PSI.
Multiply pressure drop from curve by correction factor found in oil △P correction curve.

Example

FLUID = SAE 20 OIL
SYSTEM ELECTRIC NAMEPLATE HORSEPOWER = 300HP
ENTERING TEMPERATURE = 200°F
AMBIENT TEMPERATURE = 75°F
FLOW RATE = 200GPM

- Determine heat load.
  Generally, about 25% to 33% of the system horsepower is removed.

  300hp x 0.33 = 99hp
- Since the graphs have the heat load in terms of BTU/min, the units must be converted.

  99hp x 42.4167 = 4,199 BTU/min
- Calculate the entering temperature difference (E.T.D.). The E.T.D. is the inlet oil temperature minus the entering air temperature.

  ETD=200-75 =125
- Calculate the corrected curve heat load.
  Corrected curve heat load = actual heat load x (100/ETD) x Cv (viscosity correction factor obtained from the Cv table).

  4,199 BTU/min x (100/125) x 1.02= 3,426 BTU/min
- Find the intersection point between the corrected heat load and flow rate on the performance curves. Any curve above this point will work for this application. Usually the smallest cooler is most desired. In this case the intersecting point on the single pass graph indicates that the OCA-450 will suffice.
- The pressure drop should be found next. Find the point on the curve that is directly above the intersecting point. This point on the curve indicates the pressure drop.

  △P ≈ 6psi
- These curves are made for SAE 10 oil entering at 200°F. Therefore, the pressure drop needs to be corrected. The 1.24 is the pressure drop correction factor obtained in the Cp table.
- $P_{CORRECTED}$ = 6 x 1.24= 7.44 psi

C_V VISCOSITY CORRECTION FACTORS

Entering Liquid Temp	SAE 5	SAE 10	SAE 20	SAE 30	SAE 40	ISO 22	ISO 32	ISO 46	ISO 68	ISO 100	ISO 150	ISO 220	ISO 320	MIL-L 7808	Ester Polyglycol	Phosphate	50%EG
100	1.12	1.16	1.26	1.39	1.46	1.09	1.15	1.19	1.27	1.38	1.44	1.57	1.85	1.20	0.93	0.84	0.86
110	1.10	1.13	1.21	1.33	1.41	1.07	1.14	1.17	1.26	1.32	1.40	1.49	1.68	1.15	0.90	0.81	0.85
120	1.07	1.11	1.18	1.28	1.36	1.05	1.12	1.15	1.21	1.28	1.36	1.41	1.54	1.10	0.89	0.80	0.85
130	1.05	1.09	1.14	1.25	1.30	1.04	1.10	1.14	1.18	1.25	1.31	1.35	1.45	1.06	0.86	0.78	0.84
140	1.04	1.06	1.12	1.20	1.26	1.03	1.09	1.11	1.17	1.21	1.27	1.31	1.40	1.04	0.85	0.77	0.83
150	1.02	1.05	1.10	1.17	1.23	1.03	1.07	1.10	1.14	1.18	1.23	1.28	1.34	1.02	0.84	0.75	0.83
200	0.99	1.00	1.02	1.05	1.08	0.99	1.00	1.01	1.02	1.03	1.09	1.10	1.15	0.99	0.80	0.72	0.81
250	0.96	0.97	0.98	0.99	1.00	0.96	0.97	0.97	0.97	0.98	1.00	1.02	1.03	0.98	0.77	0.70	0.80

C_P PRESSURE DROP CORRECTION FACTORS

Entering Liquid Temp	SAE 5	SAE 10	SAE 20	SAE 30	SAE 40	ISO 22	ISO 32	ISO 46	ISO 68	ISO 100	ISO 150	ISO 220	ISO 320	MIL-L 7808	Ester Polyglycol	Phosphate	50%EG
100	2.04	2.44	4.44	6.44	8.84	1.11	1.57	1.86	2.58	4.23	6.48	9.42	13.60	1.30	3.04	3.54	0.770
110	1.74	2.14	3.64	5.14	6.74	1.08	1.49	1.76	2.39	3.77	5.74	8.37	11.67	1.24	2.44	2.94	0.760
120	1.54	1.84	3.04	4.24	5.64	1.06	1.42	1.64	2.19	3.30	5.95	7.27	9.77	1.18	2.14	2.54	0.749
130	1.44	1.64	2.64	3.44	4.54	1.03	1.34	1.53	1.98	2.84	4.18	6.23	7.84	1.12	1.94	2.24	0.738
140	1.34	1.54	2.27	2.94	3.74	1.01	1.27	1.42	1.79	2.42	3.51	5.24	6.15	1.07	1.94	2.04	0.726
150	1.24	1.34	1.94	2.54	3.14	0.99	1.21	1.34	1.65	2.08	2.94	4.39	4.81	1.02	1.74	1.94	0.716
200	0.97	1.00	1.24	1.44	1.64	0.93	1.03	1.12	1.22	1.37	2.63	1.78	1.99	0.94	1.24	1.34	0.675
250	0.85	0.86	0.96	1.01	1.09	0.89	0.97	1.00	1.07	1.15	1.25	1.26	1.27	0.87	1.04	1.09	0.596

Specifications

Electric Motor Data

(3 Phase TEFC)

Model	Motor HP	Phase	HZ	Voltage	RPM	Nema Frame	Full Load Amps	Net Weight
OCA-450	3	3	60	208-230/460	1725	182T	9.5-8.6/4.3	68
OCA-600	3	3	60	230/460	1160	213T	10/5	125
OCA-1000	5	3	60	230/460	1160	215T	16/8	138
OCA-1500	5	3	60	230/460	1160	215T	16/8	138
OCA-2000	10	3	60	230/460	1175	256T	28.8/14.4	269
OCA-2500	15	3	60	230/460	1175	284T	39.4/19.7	361
OCA-3100	20	3	60	230/460	1175	286T	52/26	368

(3 Phase Explosion Proof Class I Group D & Class II Group F&G)

Model	Motor HP	Phase	HZ	Voltage	RPM	Nema Frame	Full Load Amps	Net Weight
OCA-450	3	3	60	230/460	1750	182T	9.6/4.8	134
OCA-600	3	3	60	230/460	1160	213T	9.6/4.8	147
OCA-1000	5	3	60	230/460	1160	215T	16.2/8.1	161
OCA-1500	5	3	60	230/460	1160	215T	16.2/8.1	161
OCA-2000	10	3	60	230/460	1175	256T	28.8/14.4	357
OCA-2500	15	3	60	230/460	1170	284T	39/19.5	436
OCA-3100	20	3	60	230/460	1175	286T	51/25.5	522

(3 Phase 575V TEFC)

Model	Motor HP	Phase	HZ	Voltage	RPM	Nema Frame	Full Load Amps	Net Weight
OCA-450	3	3	60	575	1750	182T	3.4	68
OCA-600	3	3	60	575	1160	213T	4.1	111
OCA-1000	5	3	60	575	1160	215T	6.0	122
OCA-1500	5	3	60	575	1160	215T	6.0	122
OCA-2000	10	3	60	575	1180	256T	11.5	286
OCA-2500	15	3	60	575	1180	284T	15.0	425
OCA-3100	20	3	60	575	1175	286T	20.0	452

(3 Phase Metric/IEC)

Model	Motor KW/HP	Phase	HZ	Voltage	RPM	IEC Frame	Full Load Amps	Net Weight
OCA-450	2.2/3	3	60	208-230/460	1750	100	8.5-8.2/4.1	68
OCA-600	2.2/3	3	60	230/460	1160	132	9.6/4	110
OCA-1000	3.7/5	3	60	230/460	1160	132	17.6/8.8	123
OCA-1500	3.7/5	3	60	230/460	1160	132	17.6/8.8	123
OCA-2000	7.5/10	3	60	230/460	1180	160	28.4/14.2	247
OCA-2500	11/15	3	60	230/460	1180	180	42/21	361
OCA-3100	15/20	3	60	230/460	1175	180	52/26	368

Hydraulic Motor Data

Hydraulic Motors

Model	HP	Pressure (PSI)	Flow (GPM)	RPM	Displacement (CUIN/REV)
OCA-450	3	870	11.1	1750	1.37
OCA-600	3	1305	8.0	1160	1.37
OCA-1000	5	2030	8.0	1160	1.37
OCA-1500	5	2030	8.0	1160	1.37
OCA-2000	10	2090	8.2	1175	1.37
OCA-2500	15	2900	8.2	1175	1.71
OCA-3100	20	2320	13.3	1175	2.2

T-BAR™

• CORE INSIDE •

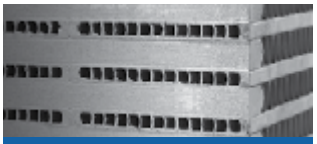
Advantages

T-BAR provides advantages and value far beyond typical aluminum core designs.

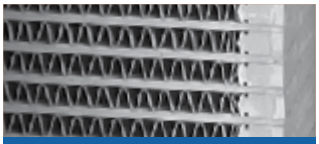
- **Extruded tubes for a leak free design**
- **Flows high viscosity fluids**
- **Low pressure drop due to absence of internal turbulator**
- **Resistance to fouling—transfer fluids without plugging**
- **Great for cooling cutting fluids or gear lube**
- **Resistant to salt spray and salt air**
- **Standard Zinc infused/coated core & fins for up to 10 times protection in salt conditions**
- **Domestic built**
- **Optional core for BOL model**

T-BAR is a flexible design, high performing, and a cost-effective aluminum solution.

Tubular Micro Channel Extrusion (T-BAR™)
T-BAR is manufactured with Alloy 1100 aluminum micro channel and bars, **with Zinc flame-sprayed extruded tubes and zinc alloy coated fins**, in our patented in-house tube-to-bar brazing process using a Nocolok CAB (Controlled Atmosphere Brazing) brazing technology furnace. Because our tubes are a solid extrusion, T-BAR is very robust — with no tube seams to fail and leak.



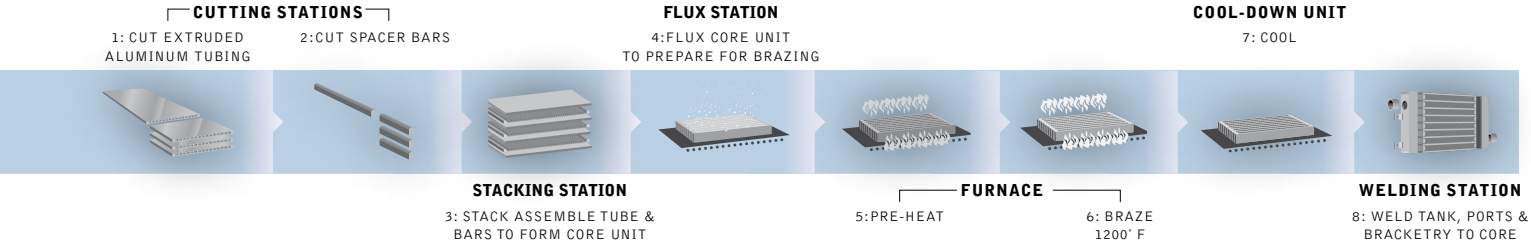
HIGH-PERFORMANCE



LOW-CLOGGING

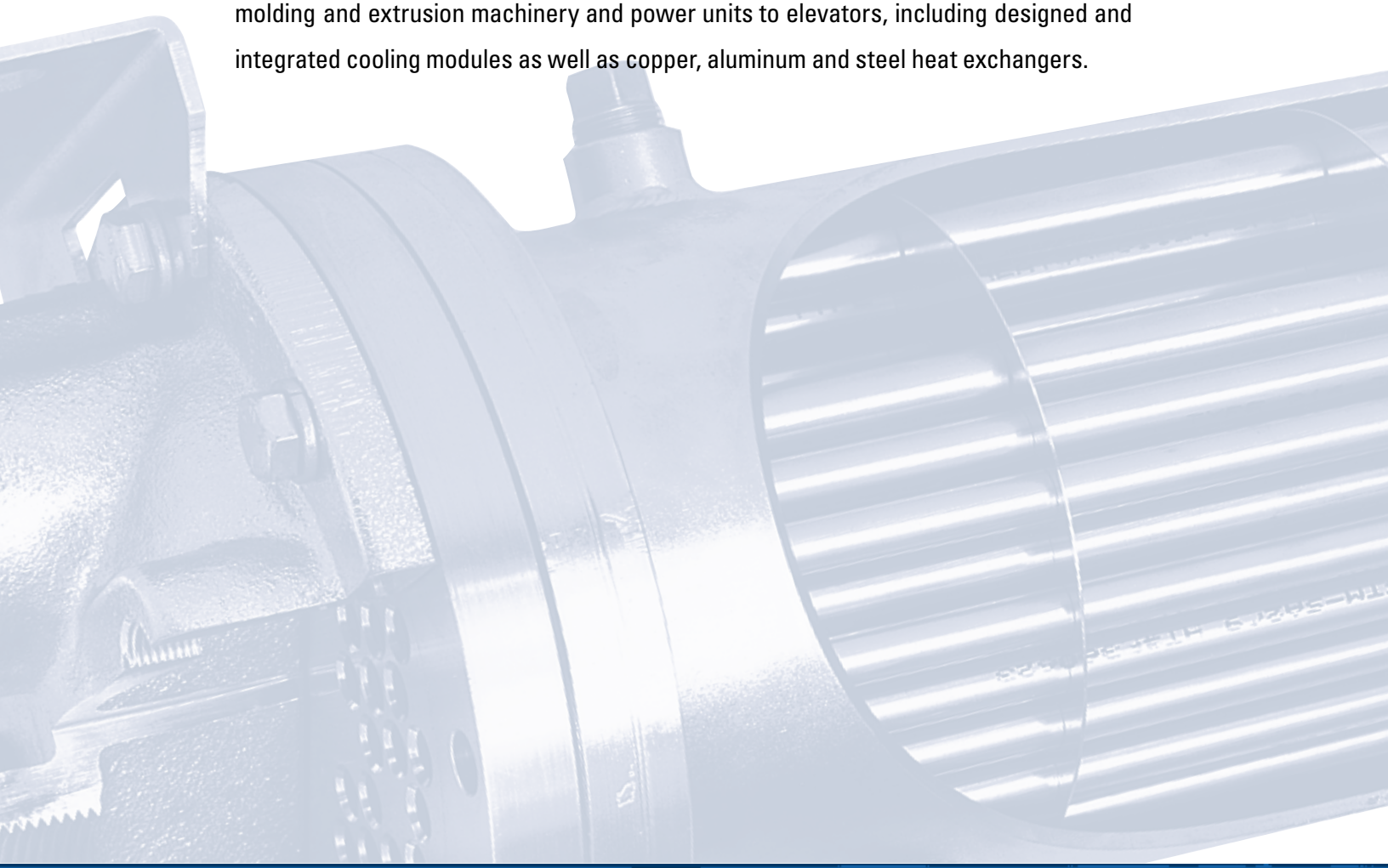
T-BAR CORE IN OCA ASSEMBLY

T-Bar Manufacturing Process



FLUID COOLING
WATER COOLED

Thermal Transfer Products manufactures highly engineered copper and steel cooling models constructed for optimum performance in industrial and process applications. Our cooling products are used in various applications, from hydraulic presses, injection molding and extrusion machinery and power units to elevators, including designed and integrated cooling modules as well as copper, aluminum and steel heat exchangers.



2

COPPER & STEEL CONSTRUCTION

Industrial

Shell & Tube

EK Series Lowest cost, compact size, optional bypass valve

K Series Low cost, compact size

EC Series Lowest cost, optional bypass valve

EKT Series In-tank design, low cost, compact, optional bypass valve

C & SSC Series Low cost, low-to-high flow applications, SSC- all 316L stainless steel construction

CA-2000 Series Rugged steel construction, custom design available, competitively priced

B Series Steel or non-ferrous construction, seawater service available

A Series Steel or non-ferrous construction, seawater service available

UC/UCV Series Removable bundle, UCV- rotated shell ports for condensate removal

Brazed Plate

BPS Series Compact, stainless steel construction

BP Series Compact, stainless steel construction

BPCH Series Compact, stainless steel construction liquid chillers

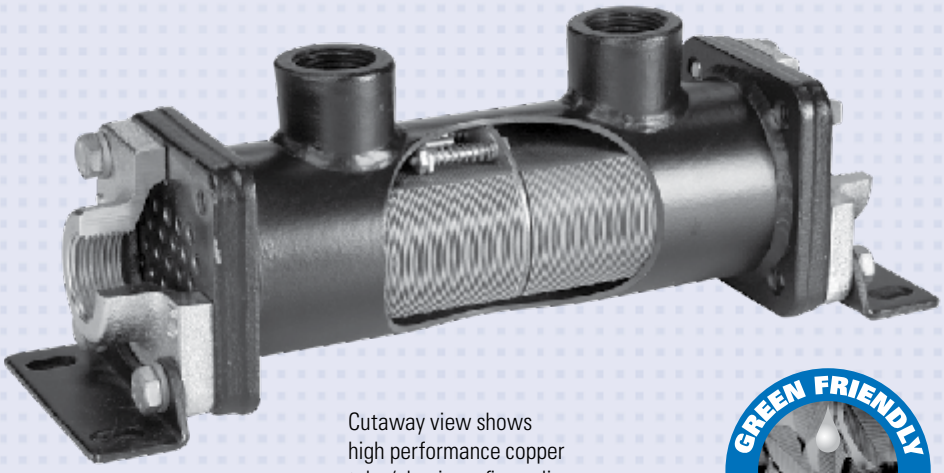
Thermal Transfer Products
A ThermaSys® Company

a global leader in manufacturing highly engineered heat transfer products

COPPER & STEEL CONSTRUCTION

Features

- **Compact Size**
- **High Efficiency Finned Bundle Design**
- **Low Cost**
- **Optional Patented Built-in Surge-Cushion® Relief Bypass**
- **3/16" Tube Size**
- Heat Removal up to 400 Horsepower (300 kW)
- Oil Flow rates up to 80 U.S. GPM (300 Liters/min.)
- Large Oil Connections for Minimum Entering and Exiting Flow Restriction
- Removable End Bonnets for easy tube cleaning
- Mounting Brackets Designed so that Cooler can be Rotated in 90° Increments
- High Pressure Ratings
- Complete Line of Accessories Available



Cutaway view shows high performance copper tube/aluminum fin cooling chamber with patented SURGE-CUSHION® relief bypass valve.

GREEN FRIENDLY
Requires Less Cooling Water

Ratings

Maximum Pressure/Shell side 500 psi
Maximum Pressure/Tubeshell side 150 psi
Maximum Temperature 250° F

Materials

Shell Steel
Tube Sheets Steel
Baffles Steel
Mounting Brackets Steel
Gaskets Nitrile Rubber/Cellulose Fiber
Nameplate Aluminum Foil
Tubes Copper
Fins Aluminum
End Caps Grey Iron

Surge-Cushion (Option)

The SURGE-CUSHION® is a protective device (patented) designed to internally bypass a portion of the oil flow during cold start conditions, or when sudden flow surges temporarily exceed the maximum flow allowed for a given cooler. This device may replace an external bypass valve, but it is not intended to bypass the total oil flow.

Maximum Flow Rates

Unit Size	Shell Side GPM	Tube Side GPM		
		One Pass	Two Pass	Four Pass
500	20	13	6	N/A
700	60	24	12	6
1000	80	56	28	14

Incorrect installation can cause premature failure.

How to Order

[ ] – [ ][ ][ ][ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Model Series
EK
EKS
EKM
EKF
EKFM

Model Size Selected

Baffle Spacing
EK-1036 & EK-1048 Models Only

Tubeside Passes
0 - One Pass
T - Two Pass
F - Four Pass

Surge Cushion
Blank - No Relief Bypass
R - Relief Bypass

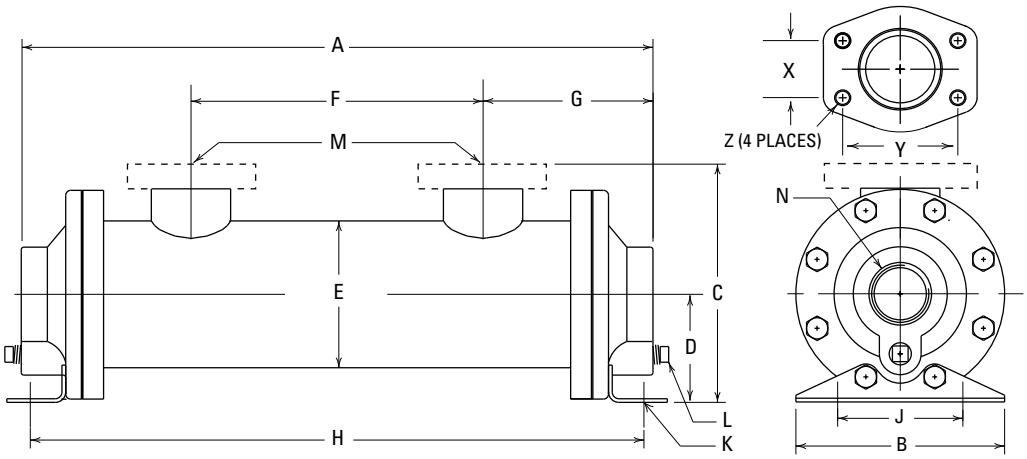
Cooling Tube Material
Blank - Copper
CN - CuNi

End Bonnet Material
Blank - Cast Iron
NP - Electroless Nickel Plate

EK = NPT Oil connections; NPT Water connections.
EKS = SAE O-Ring Oil connections; NPT Water connections.
EKM = BSPP Oil connections; BSPP Water connections.
EKF = SAE 4 Bolt Flange (Tapped SAE) Oil connections; NPT Water connections.
EKFM = SAE 4 Bolt Flange (Tapped Metric) Oil connections; BSPP Water connections.

Dimensions

One Pass



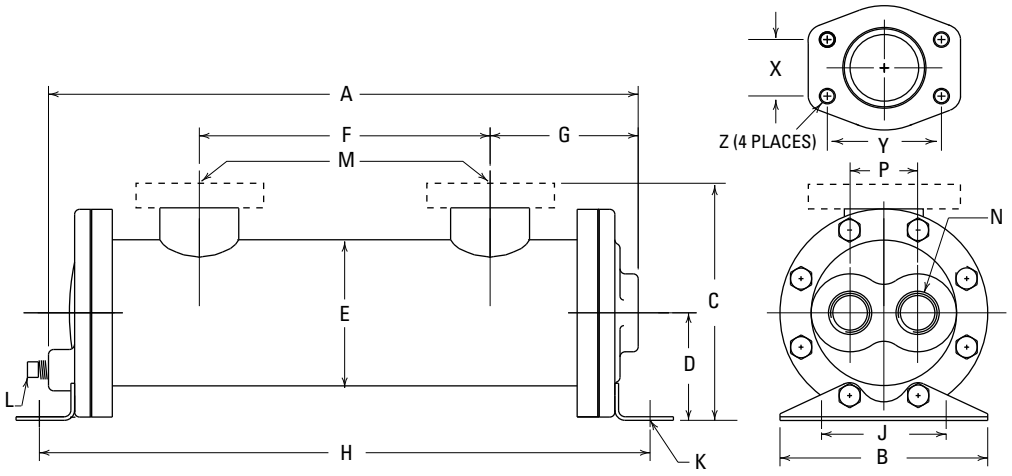
Flange Size	1-1/2	2
X	1.41	1.69
Y	2.75	3.06
EKF Z	1/2 - 13 UNC-28	
EKFM Z	M-12	

MODEL	A	B	C		D	E	F	G	H	J	K	L	M				N
			NPT / BSPP SAE O-RING	SAE FLANGE								NPT BSPP	NPT	SAE O-RING	SAE FLANGE	BSPP	NPT BSPP
EK-505	7.38	3.5 MAX. WIDTH	3.74	N/A	1.62	2.55 DIA.	2.19	2.59	7.44	2.50	.34 x .62 SLOT	N/A	1/2	#8 3/4-16 UNF-2B	N/A	1/2	3/4
EK-508	10.38		3.90				3.85	3.26	10.44				3/4	#12 $1^{1}/_{16}$-12 UN-2B		3/4	
EK-510	12.38						5.85		12.44								
EK-512	14.38						7.85		14.44								
EK-514	16.38						9.85		16.44								
EK-518	20.38						13.85		20.44								
EK-524	26.38						19.85		26.44								
EK-536	38.38						31.85		38.44								
EK-708	11.12	5.0 MAX. WIDTH	5.47	5.71	2.59	3.52 DIA.	3.00	4.07	10.71	3.00	.44 x .75 SLOT	1/4	$1^{1}/2$	#24 $1^{7}/_{8}$-12 UN-2B	$1^{1}/2$	$1^{1}/2$	$1^{1}/_{4}$
EK-712	15.12						7.00		14.71								
EK-714	17.12						9.00		16.71								
EK-718	21.12						13.00		20.71								
EK-724	27.12						19.00		26.71								
EK-736	39.12						31.00		38.71								
EK-1012	15.33	6.5 MAX. WIDTH	7.64	8.28	4.00	5.05 DIA.	6.18	4.57	15.45	4.00	.44 x 1.00 SLOT		2		2	$1^{1}/2$	$1^{1}/_{2}$
EK-1014	17.33						8.18		17.45								
EK-1018	21.33						12.18		21.45								
EK-1024	27.33						18.18		27.45								
EK-1036	39.33						30.18		39.45								
EK-1048	51.33						42.18		51.45								

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Dimensions

Two Pass



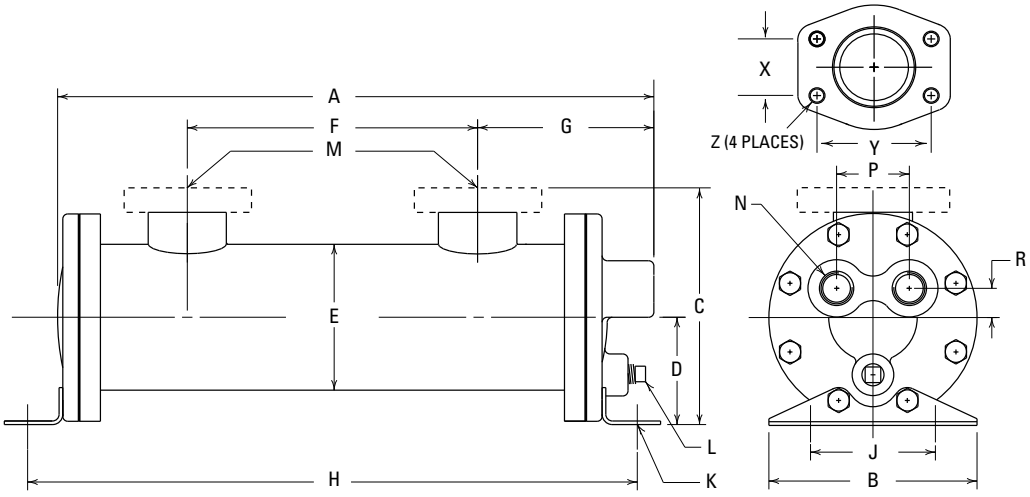
Flange Size	1-1/2	2
X	1.41	1.69
Y	2.75	3.06
EKF Z	1/2 - 13 UNC-28	
EKFM Z	M-12	

MODEL	A	B	C		D	E	F	G	H	J	K	L	M				N	P
			NPT / BSPP SAE O-RING	SAE FLANGE								NPT BSPP	NPT	SAE O-RING	SAE FLANGE	BSPP	NPT BSPP	
EK-505	7.38	3.5 MAX. WIDTH	3.74	N/A	1.62	2.55 DIA.	2.19	2.59	7.44	2.50	.34 x .62 SLOT	N/A	1/2	#8 3/4-16 UNF-2B	N/A	1/2	3/8	1.12
EK-508	10.38		3.90				3.85	3.26	10.44				3/4	#12 $1^{1}/_{16}$-12 UN-2B		3/4		
EK-510	12.38						5.85		12.44									
EK-512	14.38						7.85		14.44									
EK-514	16.38						9.85		16.44									
EK-518	20.38						13.85		20.44									
EK-524	26.38						19.85		26.44									
EK-536	38.38						31.85		38.44									
EK-708	10.19	5.0 MAX. WIDTH	5.47	5.71	2.59	3.52 DIA.	3.00	3.57	10.71	3.00	.44 x .75 SLOT	1/4	$1^{1}/_{2}$	#24 $1^{7}/_{8}$-12 UN-2B	$1^{1}/_{2}$	$1^{1}/_{2}$	3/4	1.62
EK-712	14.19						7.00		14.71									
EK-714	16.19						9.00		16.71									
EK-718	20.19						13.00		20.71									
EK-724	26.19						19.00		26.71									
EK-736	39.19						31.00		38.71									
EK-1012	14.58	6.5 MAX. WIDTH	7.64	8.28	4.00	5.05 DIA.	6.18	4.45	15.45	4.00	.44 x 1.00 SLOT		2		2		1.0	2.38
EK-1014	16.58						8.18		17.45									
EK-1018	20.58						12.18		21.45									
EK-1024	26.58						18.18		27.45									
EK-1036	38.58						30.18		39.45									
EK-1048	50.58						42.18		51.45									

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Dimensions

Four Pass



Flange Size	1-1/2	2
X	1.41	1.69
Y	2.75	3.06
EKF Z	1/2 - 13 UNC-28	
EKFM Z	M-12	

MODEL	A	B	C		D	E	F	G	H	J	K	L	M				N	P	R
			NPT / BSPP SAE O-RING	SAE FLANGE								NPT BSPP	NPT	SAE O-RING	SAE FLANGE	BSPP	NPT BSPP		
EK-708	10.37	5.0 MAX. WIDTH	5.47	5.71	2.59	3.52 DIA.	3.00	4.25	10.71	3.00	.44 x .75 SLOT	1/4	1 1/2	#24 17/8-12 UN-2B	1 1/2	1 1/2	1/2	1.75	.70
EK-712	14.37						7.00		14.71										
EK-714	16.37						9.00		16.71										
EK-718	20.37						13.00		20.71										
EK-724	26.37						19.00		26.71										
EK-736	38.37						31.00		38.71										
EK-1012	14.33	6.5 MAX. WIDTH	7.64	8.28	4.00	5.05 DIA.	6.18	4.45	15.45	4.00	.44 x 1.00 SLOT		2		2		3/4	2.50	.89
EK-1014	16.33						8.18		17.45										
EK-1018	20.33						12.18		21.45										
EK-1024	26.33						18.18		27.45										
EK-1036	38.33						30.18		39.45										
EK-1048	50.33						42.18		51.45										

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the incoming water temperature (40°F approach temperature).

Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.**
Desired oil leaving cooler °F − Water Inlet temp. °F = Actual Approach

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
HP heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves.** Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI.

Oil Temperature

Oil coolers can be selected by using entering or leaving oil tempertures.

Typical operating temperature ranges are:

Hydraulic Motor Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F
Lube Oil Circuits	110°F - 130°F
Automatic Transmission Fluid	200°F - 300°F

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (Oil △T) with this formula:

Oil △T=(BTU's/Hr.)/GPM Oil Flow x 210).

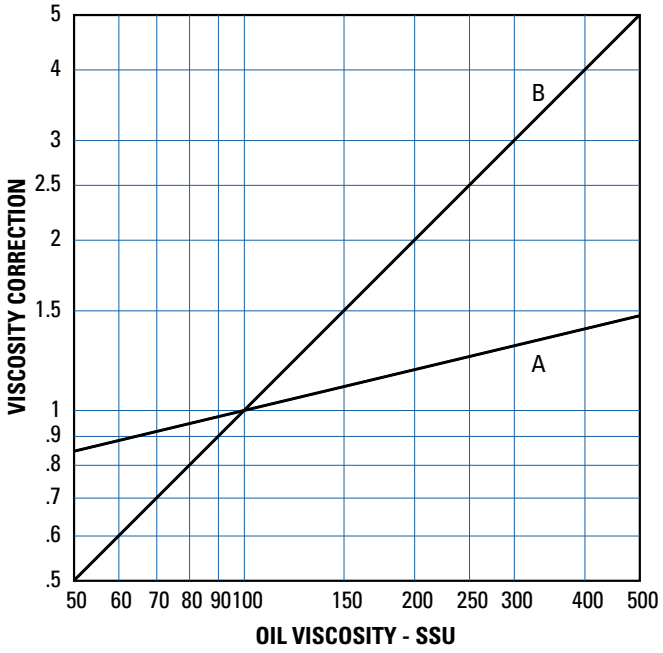
To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temperature = Oil Entering Temperature - Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

OIL VISCOSITY CORRECTION MULTIPLIERS



Recirculation Loop

Water Cooled Hydraulic Oil Coolers

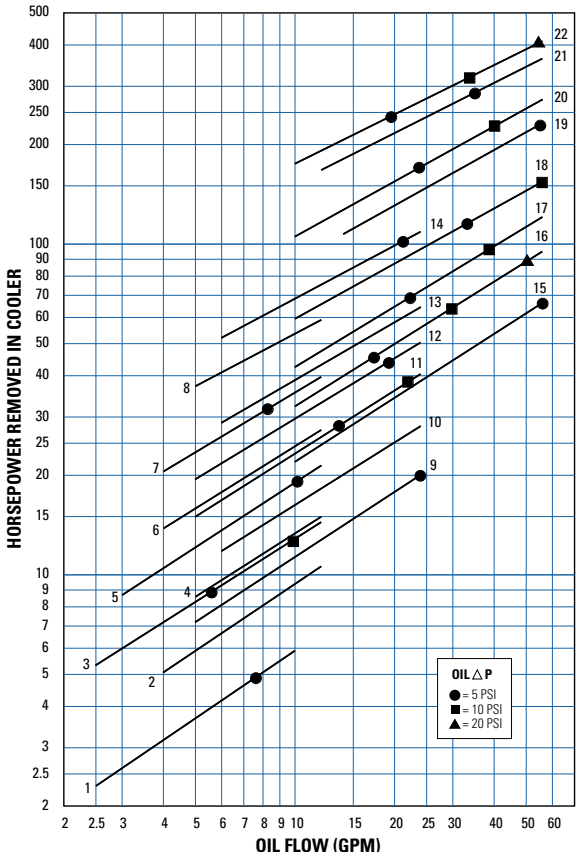
BASIS:

- 40°F Entering temperature difference (Maintain reservoir 40°F above the incoming water temperature)
- Heat removal 30% of input horsepower
- Hydraulic system flow (GPM) x 3 = Gallons; reservoir size
- 1 GPM cooler flow per HP heat to be removed
- Turn-over reservoir 3-4 times per hour
- Maximum flows

System Horsepower	HP Heat Load	Minimum Required GPM Oil Flow	Minimum Required GPM Water Flow	Heat Exchanger Model Number
3	.9	1	1	EK-505-T
5	1.5	2		
7.5	2.25			EK-512-T
10	3	3	1.5	
15	4.5	4.5	2	
20	6	6	3	
25	7.5	7.5	4	EK-712-T
30	9	9	4.5	
40	12	12	6	
50	15	15	7.5	EK-1012-T
60	18	18	9	
75	22.5	23	12	
100	30	30	15	

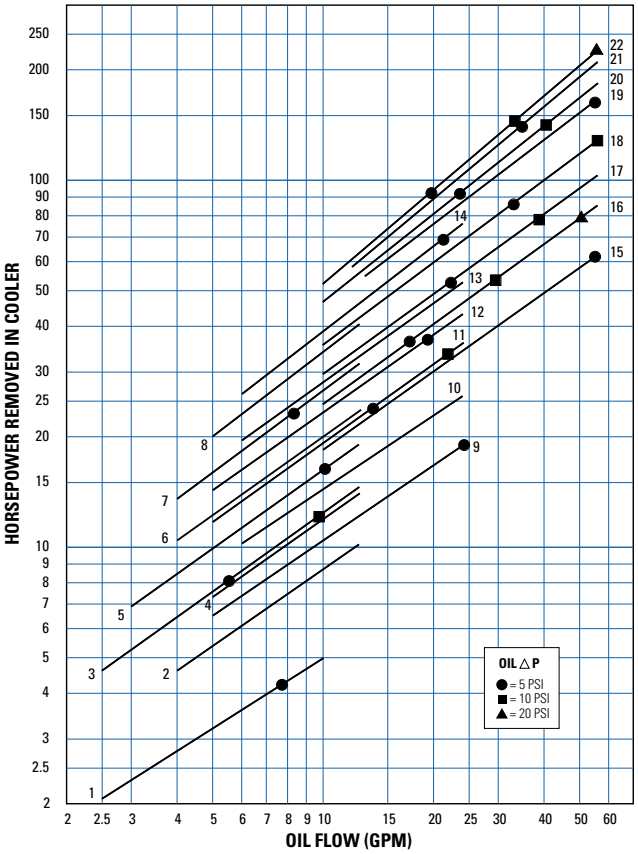
Performance Curves

1:1 Oil to Water Ratio – High Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EK-505-0	6	7
2	EK-508-0	7	8
3	EK-510-0	8	9
4	EK-512-0	9	10
5	EK-514-0	10	11
6	EK-518-0	11	12
7	EK-524-0	13	14
8	EK-536-0	17	18
9	EK-708-0	15	16
10	EK-712-0	18	19
11	EK-714-0	19	20
12	EK-718-0	22	23
13	EK-724-0	26	28
14	EK-736-0	34	36
15	EK-1012-0	35	37
16	EK-1014-0	38	40
17	EK-1018-0	42	45
18	EK-1024-0	50	55
19	EK-1036-9-0	67	85
20	EK-1036-6-0	67	85
21	EK-1048-8-0	78	95
22	EK-1048-6-0	78	95

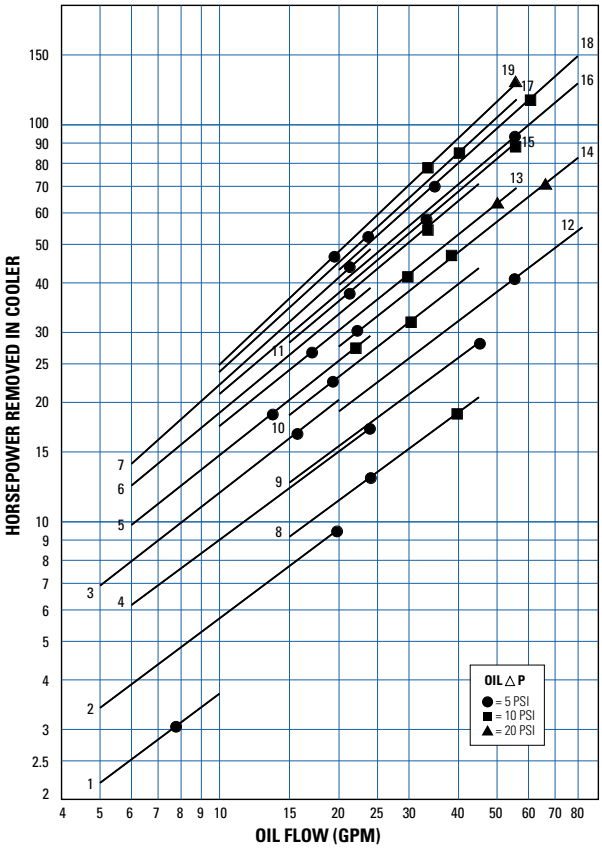
2:1 Oil to Water Ratio – Medium Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EK-505-T	6	7
2	EK-508-T	7	8
3	EK-510-T	8	9
4	EK-512-T	9	10
5	EK-514-T	10	11
6	EK-518-T	11	12
7	EK-524-T	13	14
8	EK-536-T	17	18
9	EK-708-T	15	16
10	EK-712-T	18	19
11	EK-714-T	19	20
12	EK-718-T	22	23
13	EK-724-T	26	28
14	EK-736-T	34	36
15	EK-1012-T	35	37
16	EK-1014-T	38	40
17	EK-1018-T	42	45
18	EK-1024-T	50	55
19	EK-1036-9-T	67	85
20	EK-1036-6-T	67	85
21	EK-1048-8-T	78	95
22	EK-1048-6-T	78	95

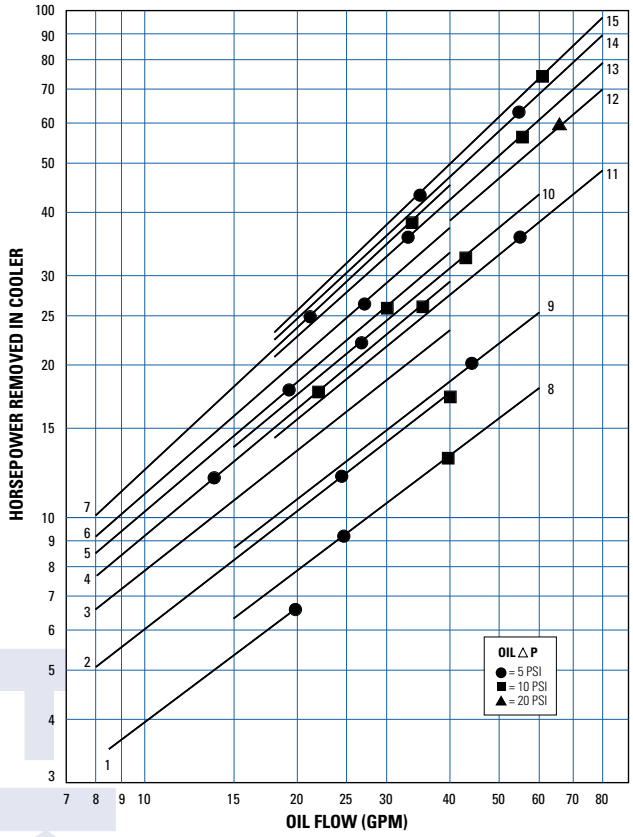
Performance Curves

4:1 Oil to Water Ratio – Low Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EK-505-T	6	7
2	EK-508-T	7	8
3	EK-518-T	11	12
4	EK-708-F	15	16
5	EK-714-F	19	20
6	EK-724-F	26	28
7	EK-736-F	34	36
8	EK-708-T	15	16
9	EK-712-T	18	19
10	EK-718-T	22	23
11	EK-736-T	34	36
12	EK-1012-T	35	37
13	EK-1014-T	38	40
14	EK-1018-T	42	45
15	EK-1024-T	50	55
16	EK-1036-9-T	67	85
17	EK-1036-6-T	67	85
18	EK-1048-8-T	78	95
19	EK-1048-6-T	78	95

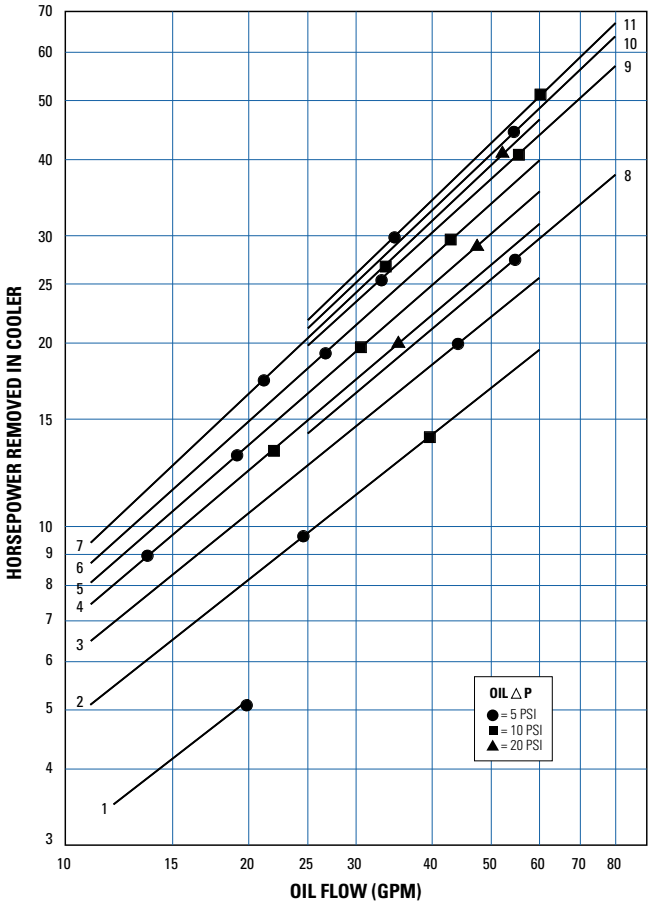
7:1 Oil to Water Ratio – Lower Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EK-508-T	7	8
2	EK-708-F	15	16
3	EK-712-F	18	19
4	EK-714-F	19	20
5	EK-718-F	22	23
6	EK-124-F	26	28
7	EK-736-F	34	36
8	EK-708-T	15	16
9	EK-712-T	18	19
10	EK-724-T	26	28
11	EK-1012-T	35	37
12	EK-1018-T	42	45
13	EK-1024-T	50	55
14	EK-1036-9-T	67	85
15	EK-1048-8-T	78	95

Performance Curves

10:1 Oil to Water Ratio – Lowest Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EK-508-T	7	8
2	EK-708-F	15	16
3	EK-712-F	18	19
4	EK-714-F	19	20
5	EK-718-F	22	23
6	EK-724-F	26	28
7	EK-736-F	34	36
8	EK-1012-F	35	37
9	EK-1014-F	50	55
10	EK-1036-9-F	67	85
11	EK-1048-8-F	78	95

Recirculation Loop

Water Cooled Hydraulic Oil Coolers

BASIS:

- 40°F Entering temperature difference (Maintain reservoir 40°F above the incoming water temperature)
- Heat removal 30% of input horsepower
- Hydraulic system flow (GPM) x 3 = Gallons; reservoir size
- 1 GPM cooler flow per HP heat to be removed
- Turn-over reservoir 3-4 times per hour
- Maximum flows

System Horsepower	HP Heat Load	Minimum Required GPM Oil Flow	Minimum Required GPM Water Flow	Heat Exchanger Model Number
3	.9	1	1	EK-505-T
5	1.5	2		
7.5	2.25			EK-512-T
10	3	3	1.5	
15	4.5	4.5	2	
20	6	6	3	
25	7.5	7.5	4	EK-712-T
30	9	9	4.5	
40	12	12	6	
50	15	15	7.5	EK-1012-T
60	18	18	9	
75	22.5	23	12	
100	30	30	15	

COPPER & STEEL CONSTRUCTION

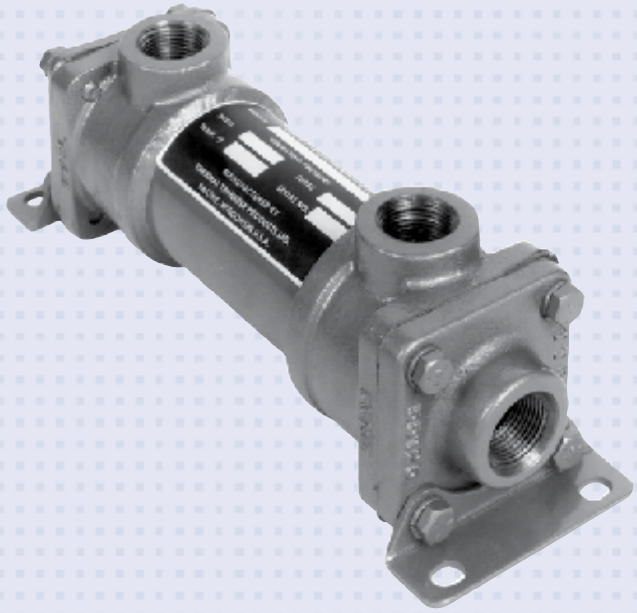
Features

- **Modine Interchange**
- **Finned Tube Bundle**
- **3/16" Tube Size**
- **Use EK for New Application**
- **Cast Iron Hubs**
- **Steel Shell**

OPTIONS

SAE Internal "O" Ring Ports

Shell Side



Ratings

Pressure Ratings (psi) K-500 & K-700 Series

Operating	Test
500	550 Shells
150	225 Tubes

Pressure Ratings (psi) K-1000 Series

Operating	Test
400	450 Shells
150	225 Tubes

Operating Temperature 350° F

Materials

Shell Steel

Tubes Copper

Baffles Steel

Mounting Brackets Steel

Gaskets Non Asbestos Nitrile Rubber/ Cellulose Fiber

Nameplate Aluminum Foil

Fins Aluminum

End Hubs Cast Malleable Iron

End Bonnets Cast Iron

Headers Cast Malleable Iron

How to Order

[ ] – [ ][ ][ ][ ] – [ ]

Model Series
K
KN

Model Size Selected

Tubeside Passes

"K" Prefix designates N.P.T. shell configurations. "KN" Prefix designates SAE internal thread O-ring shell connections.

Unit Coding Example **K-714-T**

Extended Surface Design

Shell Diameter

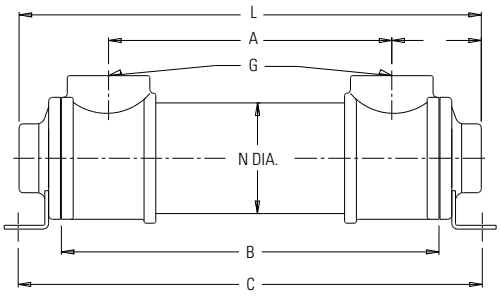
Effective Tube Length

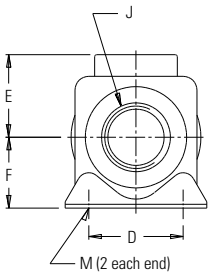
Tube Side Passes

Dimensions

One Pass

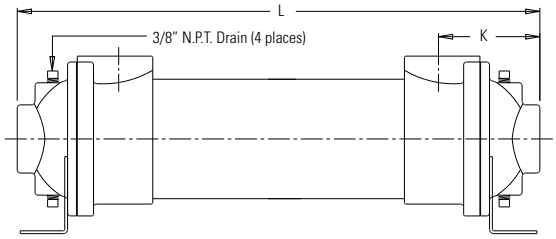
K-500 & K-700 Series

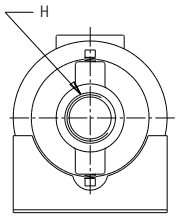




Model	L	H NPT	K
K-508-0	10.19	.75	2.22
K-512-0	14.19		
K-514-0	20.19		
K-708-0	10.69	1.25	2.84
K-712-0	14.69		
K-714-0	16.69		
K-718-0	20.69		
K-1012-0	17.12	2.00	4.31
K-1014-0	19.12		
K-1018-0	23.13		
K-1024-0	29.12		

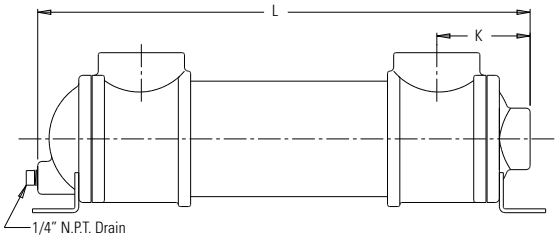
K-1000 Series

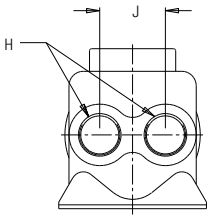




Two Pass

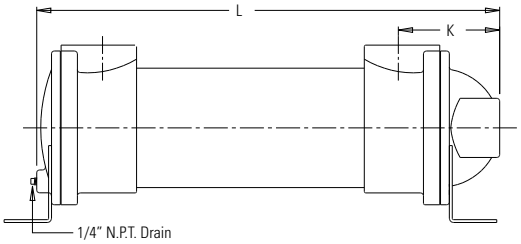
K-700 Series

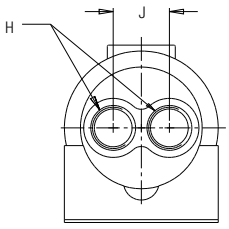




Model	L	H NPT	J	K
K-708-T	10.69	1.00	2.00	2.84
K-712-T	14.69			
K-714-T	16.69			
K-718-T	20.69			
K-1012-T	15.62	1.50	2.38	4.31
K-1014-T	17.62			
K-1018-T	21.62			
K-1024-T	27.62			

K-1000 Series





Model	A	B	C	D	E	F	G N.P.T.	M	N DIA.	WEIGHT (LBS)	G SAE (OPTIONAL)
K-508	5.75	8.00	10.25	2.50	1.88	1.62	.75	.34 X .50	2.50	7.75	#12 1-1/16 - 12 UN-2B
K-512	9.75	12.00	14.25							8.76	
K-514	11.75	14.00	16.25							9.12	
K-518	15.75	18.00	20.25							10.00	
K-708	5.00	8.00	10.75	3.00	2.62	2.25	1.50	.44 x .75	3.50	15.75	#24 1-7/8 - 12 UN-2B
K-712	9.00	12.00	14.75							18.40	
K-714	11.00	14.00	16.75							19.75	
K-718	15.00	18.00	20.75							21.50	
K-1012	8.50	12.00	15.50	4.00	3.50	4.00	2.00	.44 x 1.00	5.00	42.50	#32 2-1/2 -12 UN-2B
K-1014	10.50	14.00	17.50							44.25	
K-1018	14.50	18.00	21.50							49.00	
K-1024	20.50	24.00	27.50							57.00	

Note: We reserve the right to make reasonable design changes without notice. Dimensions are in inches.

Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the incoming water temperature (40°F approach temperature).

Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.**
Desired oil leaving cooler °F − Water Inlet temp. °F = Actual Approach

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
HP heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves.** Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI.

Oil Temperature

Oil coolers can be selected by using entering or leaving oil tempertures.

Typical operating temperature ranges are:

Hydraulic Motor Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F
Lube Oil Circuits	110°F - 130°F
Automatic Transmission Fluid	200°F - 300°F

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (Oil △T) with this formula:

Oil △T=(BTU's/Hr.)/GPM Oil Flow x 210).

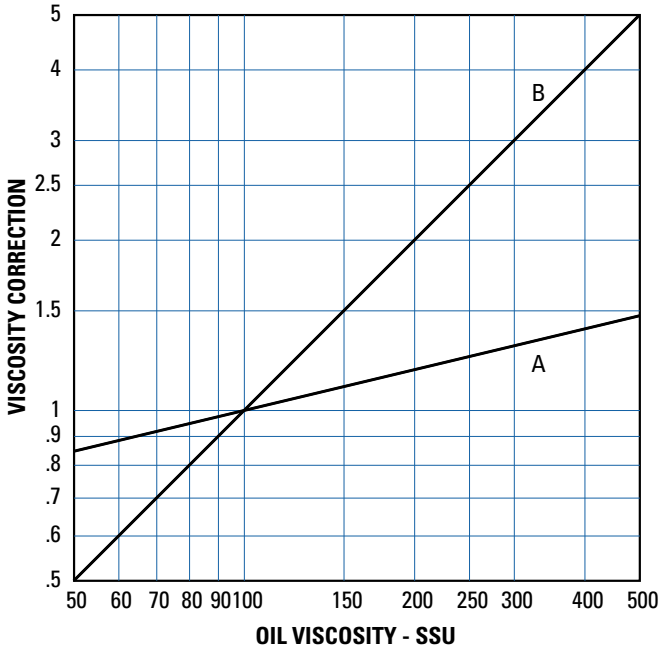
To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temperature = Oil Entering Temperature - Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

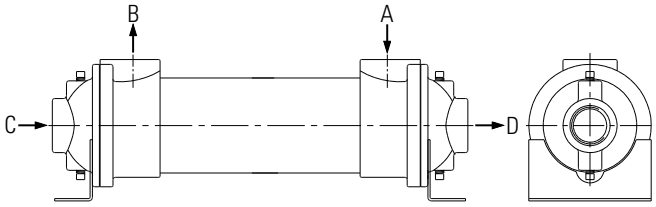
Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

OIL VISCOSITY CORRECTION MULTIPLIERS

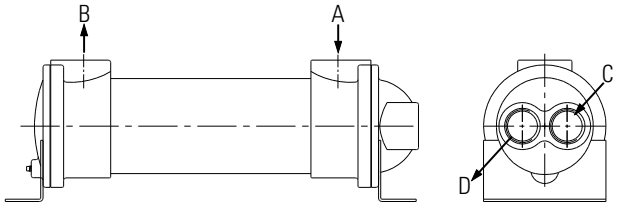


Piping Diagrams

Single Pass Model



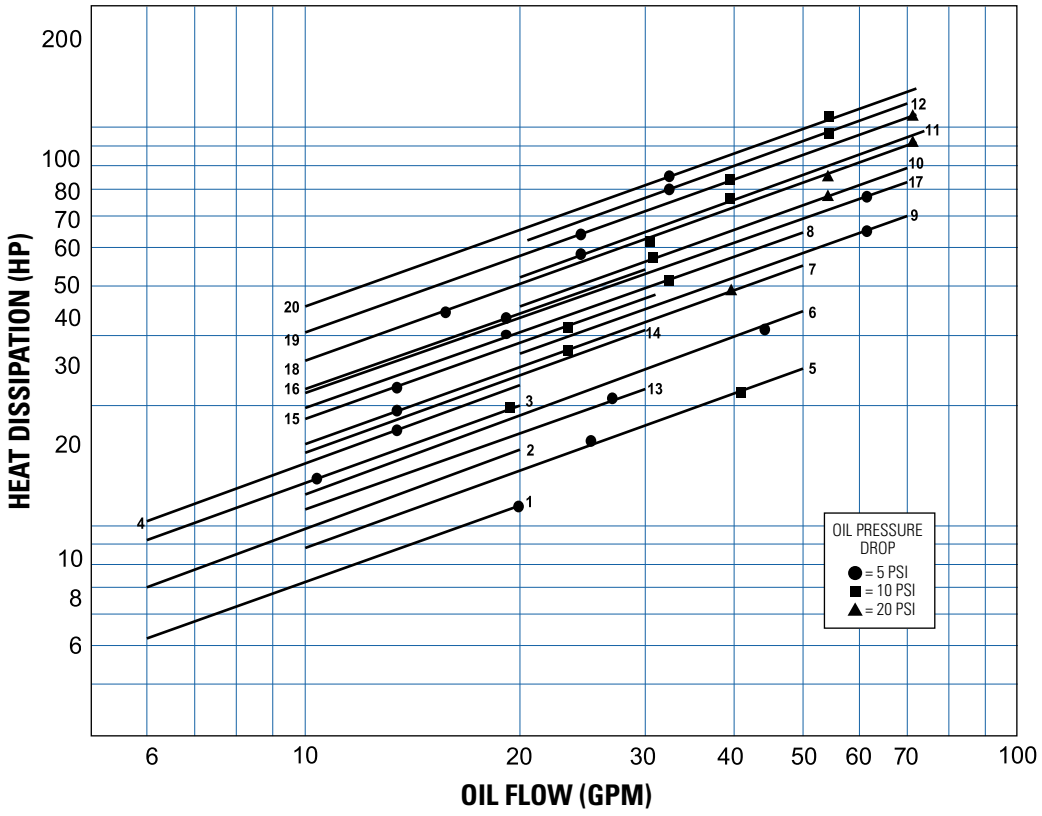
Two Pass Model



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

Performance Curves

2 to 1 Oil to Water Ratio

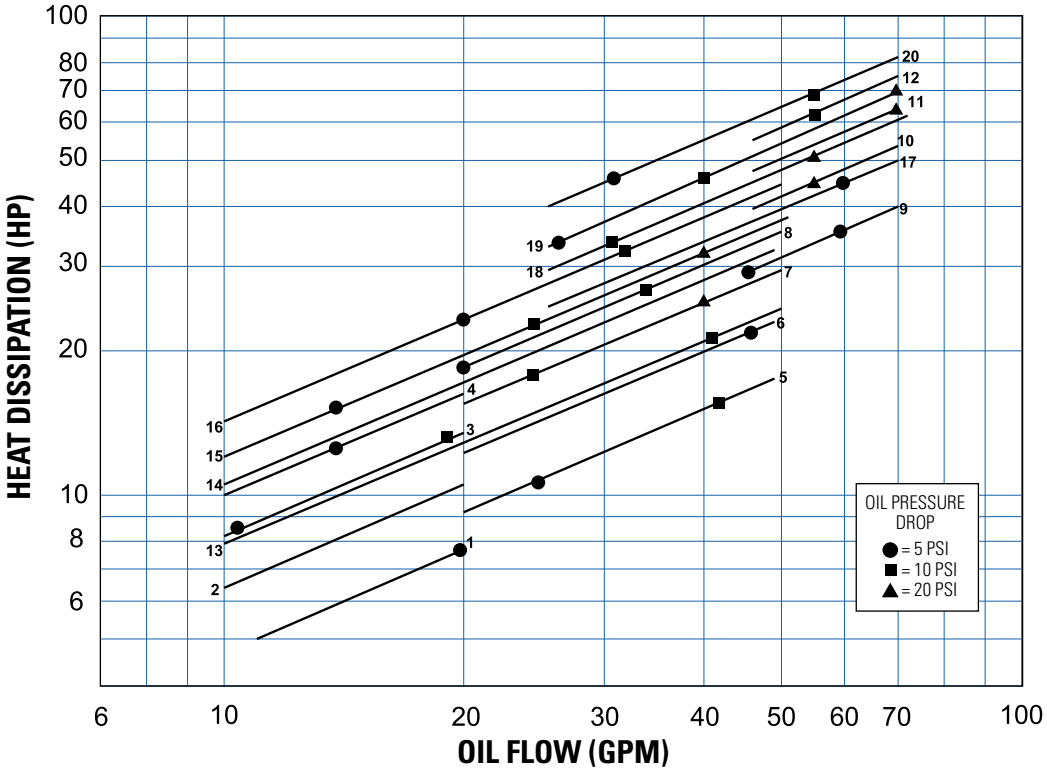


Model Code
1. K-508-0
2. K-512-0
3. K-514-0
4. K-518-0
5. K-708-0
6. K-712-0
7. K-714-0
8. K-718-0
9. K-1012-0
10. K-1014-0
11. K-1018-0
12. K-1024-0
13. K-708-T
14. K-712-T
15. K-714-T
16. K-718-T
17. K-1012-T
18. K-1014-T
19. K-1018-T
20. K-1024-T

Maximum Flow Rates

Unit Size	Shell Side (GPM)	Tube Side (GPM) O	T
500	20	13	—
700	70	24	12
1000	100	56	28

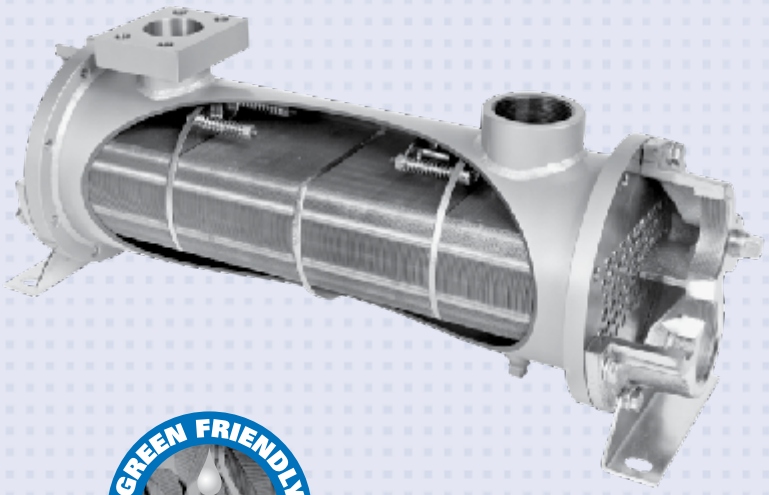
4 to 1 Oil to Water Ratio



COPPER & STEEL CONSTRUCTION

Features

- **Rugged Steel Shell Construction**
- **3/8" Tube Size**
- **Larger Shell Diameter than EK, 8.50" Dia Max**
- **High Flow Capacity & Performance**
- **High Efficiency Finned Bundle Design**
- **Optional Patented Built-in Surge-Cushion® Bypass**
- End bonnets removable for easy tube cleaning
- Mounting brackets included – may be rotated for simple installation
- NPT, SAE, BSPP, BSPT or flange connections
- Optional type 316 stainless steel or 90/10 copper-nickel components available



Cutaway view shows high performance copper tube/aluminum fin cooling chamber with patented SURGE-CUSHION® relief bypass valve, and optional flange connections.

Ratings

Operating Pressure 300 psi

Test Pressure 150 psi

Operating Temperature 300° F

Materials

Shell Steel

Tubesheets Steel

Tubes Copper

Baffles Steel

Mounting Brackets Steel

Gaskets Nitrile Rubber/Cellulose Fiber

Nameplate Aluminum Foil

Fins Aluminum

End Caps Grey Iron

Surge-Cushion (Option)

The SURGE-CUSHION® is a protective device (patented) designed to internally bypass a portion of the oil flow during cold start conditions, or when sudden flow surges temporarily exceed the maximum flow allowed for a given cooler. This device may replace an external bypass valve, but it is not intended to bypass the total oil flow.

How to Order

	–					–		–		–		–		–		–		–		–	

Model Series
EC
ECS
ECM
ECF
ECFM

Model Size Selected

Baffle Spacing

Tubeside Passes
0 - One Pass
T - 2 Pass
F - 4 Pass

Surge Cushion
Blank - No Valve
R - Value Included

Cooling Tube Material
Blank - Copper
CN - CuNi
SS - 316 Stainless Steel

End Bonnet Material
Blank - Cast Iron
B - Bronze
SB - 316 Stainless Steel

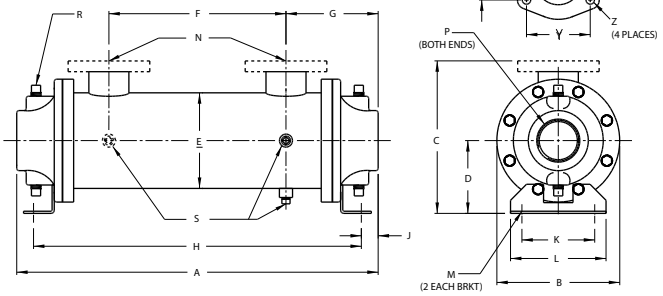
Tubesheet Material
Blank - Steel
W - CuNi
S - 316 Stainless Steel

Zinc Anodes
Blank - None
Z - Zinc Anodes

EC = NPT Oil connections; NPT Water connections.
ECS = SAE O-Ring Oil connections; NPT Water connections.
ECM = BSPP Oil connections; BSPP Water connections.
ECF = SAE 4 Bolt Flange (Tapped SAE) Oil connections; NPT Water connections.
ECFM = SAE 4 Bolt Flange (Tapped Metric) Oil connections; BSPP Water connections.

Dimensions

One Pass

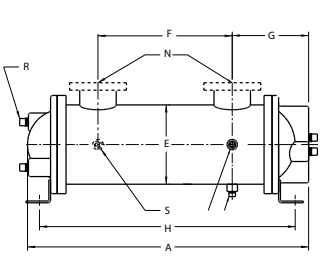


SAE Flange Size	X	Y	Z
1-1/2	1.41	2.75	1/2 - 13
2	1.69	3.06	UNC-2B
3	2.44	4.19	5/8 - 11 UNC 2B

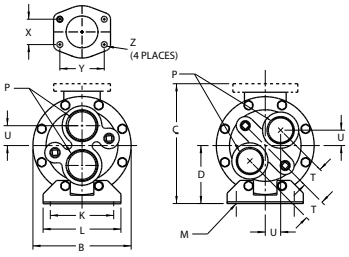
MODEL	A	B	C		D	E	F	G	H	J	K	L	M	N		P	R	S
			NPT / BSPP SAE O-RING	SAE FLANGE										NPT/BSPP FLANGE	SAE O-RING	NPT BSPP	NPT BSPP	NPT BSPP
EC-1014	20.22	6.75 DIA.	7.75	8.00	4.00	5.25 DIA.	10.12	5.05	18.38	.92	4.00	5.25	.50 x .75 SLOT	1-1/2	#24 SAE	2	(4) 3/8	(3) 3/8
EC-1024	30.22						20.12		28.38									
EC-1036	42.22						32.12		40.38									
EC-1054	60.22						50.12		58.32									
EC-1224	30.72	7.75 DIA.	8.75	9.38	4.50	6.25 DIA.	18.97	5.87	27.84	1.43	5.00	6.25		2	#32 SAE	3	(4) 3/8	
EC-1236	42.72						30.97		39.84									
EC-1254	60.72						48.97		57.84									
EC-1272	78.72						66.97		75.84									
EC-1724	32.22	10.50 DIA.	11.50	12.50	5.75	8.50 DIA.	18.75	7.23	29.25	1.99	7.00	8.25	.62 x .88 SLOT	3	N/A	4		
EC-1736	45.22						30.75		41.25									
EC-1754	63.22						48.75		59.25									
EC-1772	81.22						66.75		77.25									
EC-1784	43.22						78.75		89.25									

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Two Pass



EC-1200



EC-1000 & 1700

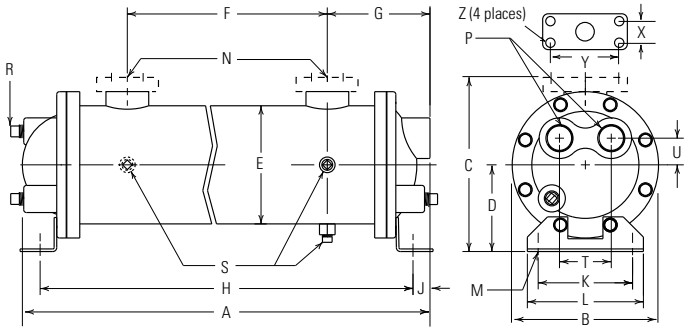
SAE Flange Size	X	Y	Z
1-1/2	1.41	2.75	1/2 - 13
2	1.69	3.06	UNC-2B
3	2.44	4.19	5/8 - 11 UNC 2B

MODEL	A	B	C		D	E	F	G	H	J	K	L	M	N		P	R	S	T	U
			NPT / BSPP SAE O-RING	SAE FLANGE										NPT/BSPP FLANGE	SAE O-RING	NPT BSPP	NPT BSPP	NPT BSPP		
EC-1014	19.75	6.75 DIA.	7.75	8.00	4.00	5.25 DIA.	10.12	5.05	18.38	.92	4.00	5.25	.50 x .75 SLOT	1-1/2	#24 SAE	1-1/2	(4) 3/8	3/8	1.50	1.06
EC-1024	29.75						20.12		28.38											
EC-1036	41.75						32.12		40.38											
EC-1054	59.75						50.12		58.32											
EC-1224	29.75	7.75 DIA.	8.75	9.38	4.50	6.25 DIA.	18.97	5.44	27.84	1.00	5.00	6.25		2	#32 SAE	2	(4) 3/8		—	1.56
EC-1236	41.75						30.97		39.84											
EC-1254	59.75						48.97		57.84											
EC-1272	77.75						66.97		75.84											
EC-1724	32.37	10.50 DIA.	11.50	12.50	5.75	8.50 DIA.	18.75	7.06	29.25	1.81	7.00	8.25	.62 x .88 SLOT	3	N/A				2.25	1.59
EC-1736	44.37						30.75		41.25											
EC-1754	62.37						48.75		59.25											
EC-1772	80.37						66.75		77.25											
EC-1784	92.37						78.75		89.25											

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Dimensions

Four Pass



SAE Flange Size	X	Y	Z
1-1/2	1.41	2.75	1/2 - 13
2	1.69	3.06	UNC-2B
3	2.44	4.19	5/8 - 11 UNC 2B

MODEL	A	B	C NPT BSPP SAE O-RING	C SAE FLANGE	D	E	F	G	H	J	K	L	M	N NPT BSPP FLANGE	N SAE O-RING	P NPT BSPP	R NPT BSPP	S NPT BSPP	T	U
EC-1014	19.87	6.75 DIA.	7.75	8.00	4.00	5.25 DIA.	10.12	4.82	18.38	.75	4.00	5.25	.50 x .75 SLOT	1 1/2	#24 SAE	1	(3) 3/8	(3) 3/8	2.40	1.20
EC-1024	29.87						20.12		28.38											
EC-1036	41.87						32.12		40.38											
EC-1054	59.87						50.12		58.38											
EC-1224	29.78	7.75 DIA.	8.75	9.38	4.50	6.25 DIA.	18.97	5.44	27.84	1.00	5.00	6.25		2	#32 SAE	1 1/2			2.82	1.41
EC-1236	41.78						30.97		39.84											
EC-1254	59.78						48.97		57.84											
EC-1272	77.78						66.97		75.84											
EC-1724	31.61	10.50 DIA.	11.50	12.50	5.75	8.50 DIA.	18.75	7.06	29.25	1.81	7.00	8.25	.62 x .88 SLOT	3	N/A	2			4.25	1.41
EC-1736	43.61						30.75		41.25											
EC-1754	61.61						48.75		59.25											
EC-1772	79.61						66.75		77.25											
EC-1784	91.61						78.75		89.25											

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the incoming water temperature (40°F approach temperature).

Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.**
Desired oil leaving cooler °F − Water Inlet temp. °F = Actual Approach

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
HP heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves.** Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI.

Oil Temperature

Oil coolers can be selected by using entering or leaving oil tempertures.

Typical operating temperature ranges are:

Hydraulic Motor Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F
Lube Oil Circuits	110°F - 130°F
Automatic Transmission Fluid	200°F - 300°F

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (Oil △T) with this formula:

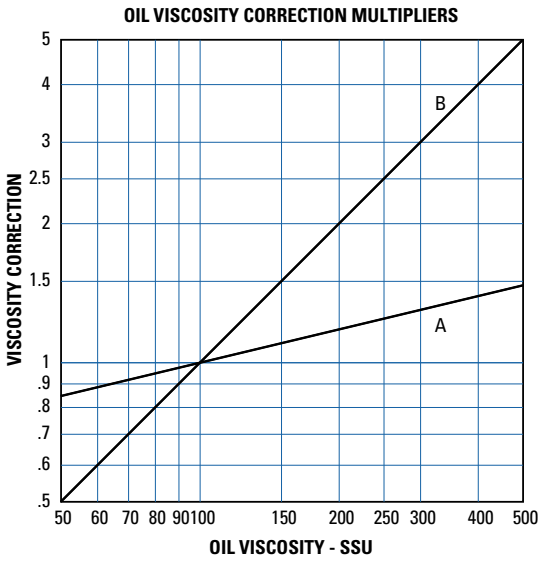
Oil △T=(BTU's/Hr.)/GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temperature = Oil Entering Temperature - Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.



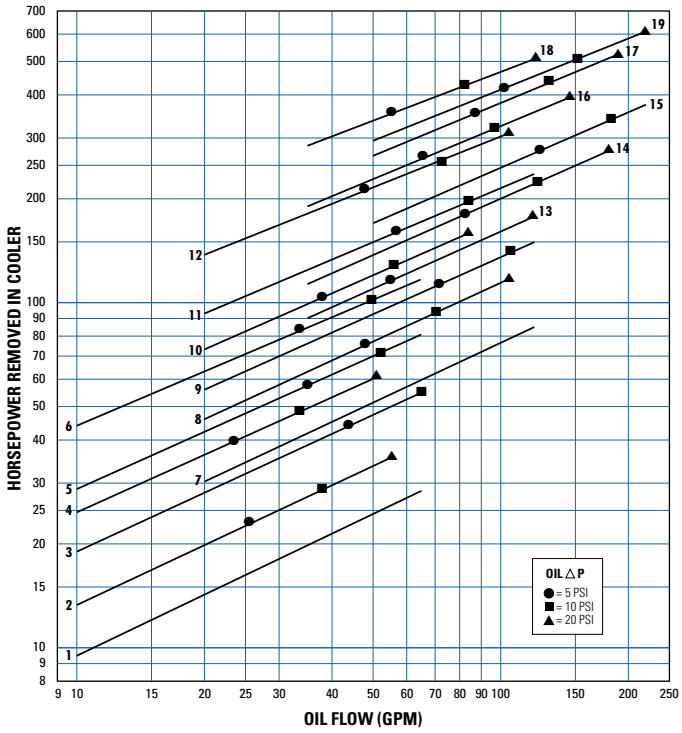
Maximum Flow Rates

Unit Size	Shell Side GPM	Tube Side GPM		
		One Pass	Two Pass	Four Pass
1000	70	65	32	16
1200	120	120	60	30
1700	250	220	110	65

Incorrect installation can cause premature failure.

Performance Curves

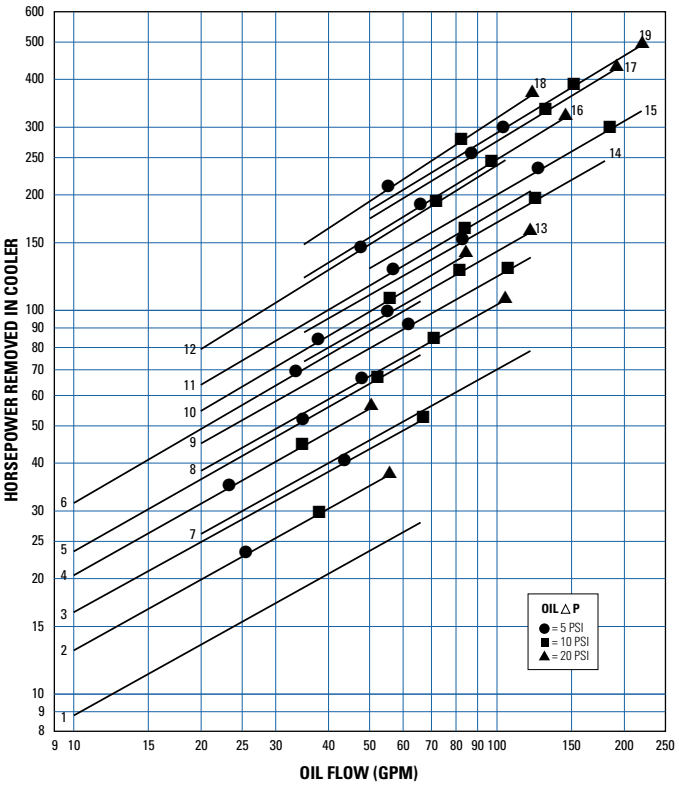
1:1 Oil to Water Ratio – High Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EC-1014-7-0	28	32
2	EC-1014-4-0	28	32
3	EC-1024-6-0	45	50
4	EC-1024-4-0	45	50
5	EC-1036-6-0	66	70
6	EC-1054-7-0	105	140
7	EC-1224-12-0	98	105
8	EC-1224-6-0	98	105
9	EC-1236-9-0	125	145
10	EC-1236-6-0	125	145
11	EC-1254-9-0	155	180
12	EC-1272-9-0	210	250
13	EC-1724-6-0	145	175
14	EC-1736-9-0	201	235
15	EC-1754-14-0	275	305
16	EC-1754-9-0	275	305
17	EC-1772-12-0	330	380
18	EC-1772-9-0	330	380
19	EC-1784-14-0	390	450

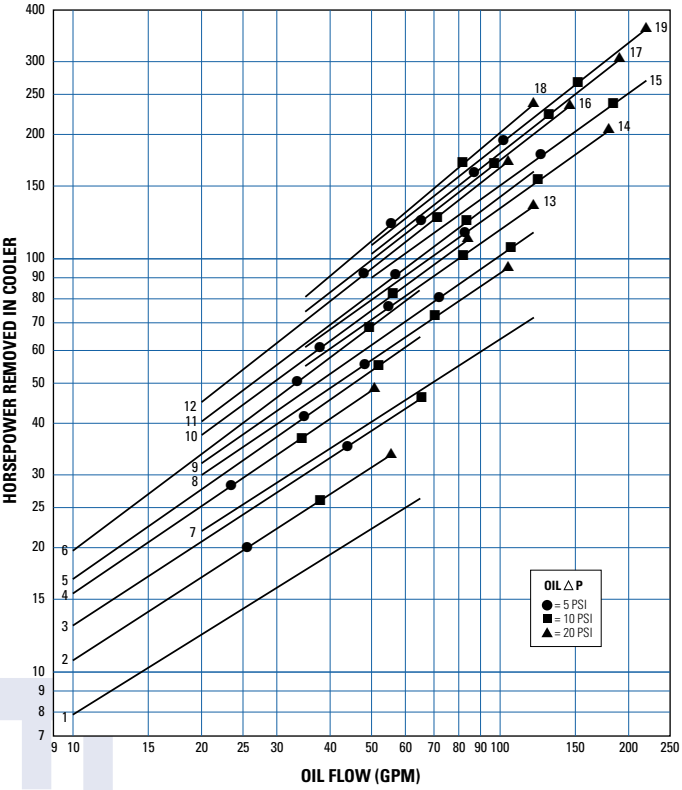
Performance Curves

2:1 Oil to Water Ratio – Medium Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EC-1014-7-T	28	32
2	EC-1014-4-T	28	32
3	EC-1024-6-T	45	50
4	EC-1024-4-T	45	50
5	EC-1036-6-T	66	70
6	EC-1054-7-T	105	140
7	EC-1224-12-T	98	105
8	EC-1224-6-T	98	105
9	EC-1236-9-T	125	145
10	EC-1236-6-T	125	145
11	EC-1254-9-T	155	185
12	EC-1272-9-T	210	250
13	EC-1724-6-T	145	175
14	EC-1736-9-T	201	235
15	EC-1754-14-T	275	305
16	EC-1754-9-T	275	305
17	EC-1772-12-T	330	380
18	EC-1772-9-T	330	380
19	EC-1784-14-T	390	450

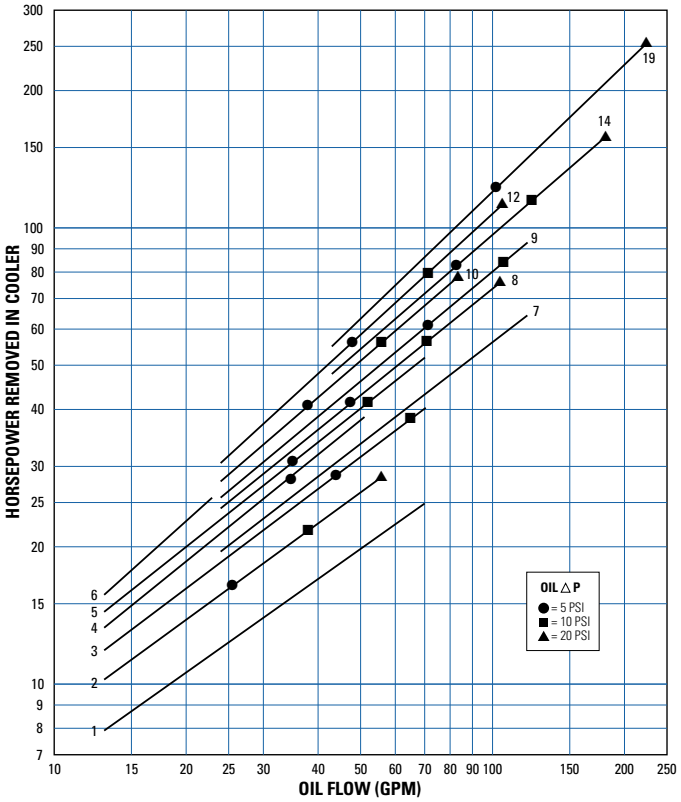
4:1 Oil to Water Ratio – Low Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EC-1014-7-F	28	32
2	EC-1014-4-F	28	32
3	EC-1024-6-F	45	50
4	EC-1024-4-F	45	50
5	EC-1036-6-F	66	70
6	EC-1054-7-F	105	140
7	EC-1224-12-F	98	105
8	EC-1224-6-F	98	105
9	EC-1236-9-F	125	145
10	EC-1236-6-F	125	145
11	EC-1254-9-F	155	180
12	EC-1272-9-F	210	250
13	EC-1724-6-F	145	175
14	EC-1736-9-F	201	235
15	EC-1754-14-F	275	305
16	EC-1754-9-F	275	305
17	EC-1772-12-F	330	380
18	EC-1772-9-F	330	380
19	EC-1784-14-F	390	450

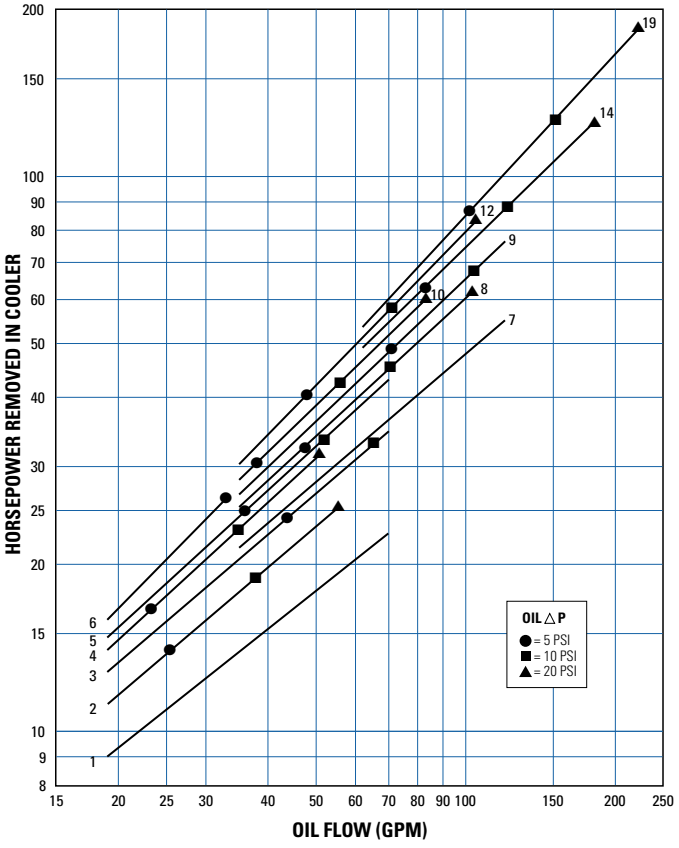
Performance Curves

7:1 Oil to Water Ratio – Lower Water Usage



Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EC-1014-7-F	28	32
2	EC-1014-4-F	28	32
3	EC-1024-6-F	45	50
4	EC-1024-4-F	45	50
5	EC-1036-6-F	66	70
6	EC-1054-7-F	105	140
7	EC-1224-12-F	98	105
8	EC-1224-6-F	98	105
9	EC-1236-9-F	125	145
10	EC-1236-6-F	125	145
12	EC-1254-9-F	210	250
14	EC-1736-9-F	201	235
19	EC-1784-14-F	390	450

10:1 Oil to Water Ratio – Low Water Usage

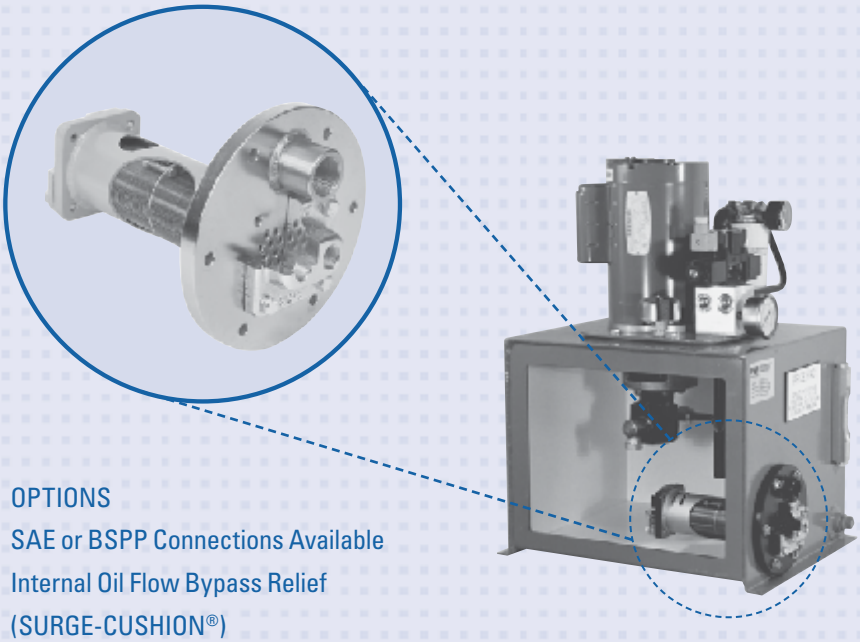


Curve Number	Model	Approx. Weights (lbs) Net	Shipping
1	EC-1014-7-F	28	32
2	EC-1014-4-F	28	32
3	EC-1024-6-F	45	50
4	EC-1024-4-F	45	50
5	EC-1036-6-F	66	70
6	EC-1054-7-F	105	140
7	EC-1224-12-F	98	105
8	EC-1224-6-F	98	105
9	EC-1236-9-F	125	145
10	EC-1236-6-F	125	145
12	EC-1254-9-F	210	250
14	EC-1736-9-F	201	235
19	EC-1784-14-F	390	450

COPPER & STEEL CONSTRUCTION

Features

- **HPU, In-tank Cooler**
- **Compact Size**
- **EK Style & Size**
- **High Efficiency Finned Bundle Design**
- **Serviceable**
- **Removable**
- In-tank Design Minimizes Space Requirements and Reduces Plumbing
- Internal Aluminum Fins Dramatically Increase Performance
- Removable End Bonnets Allow Water Passage Servicing
- High Strength Steel Shell



OPTIONS

SAE or BSPP Connections Available

Internal Oil Flow Bypass Relief (SURGE-CUSHION®)

Ratings

Operating Pressure:

Shellside 75 psi – **Tubeside** 150 psi

Test Pressure:

Shellside 75 psi – **Tubeside** 150 psi

Maximum Temperature 250° F

Materials

Shell Steel

Tubes Copper

Fins Aluminum

Tubesheets Steel

Baffles Steel

End Bonnets Cast Iron

Gaskets Nitrile Rubber/Cellulose Fiber

Surge-Cushion (Option)

The SURGE-CUSHION® is a protective device (patented) designed to internally bypass a portion of the oil flow during cold start conditions, or when sudden flow surges temporarily exceed the maximum flow allowed for a given cooler. This device may replace an external bypass valve, but it is not intended to bypass the total oil flow.

How to Order

	–		–	

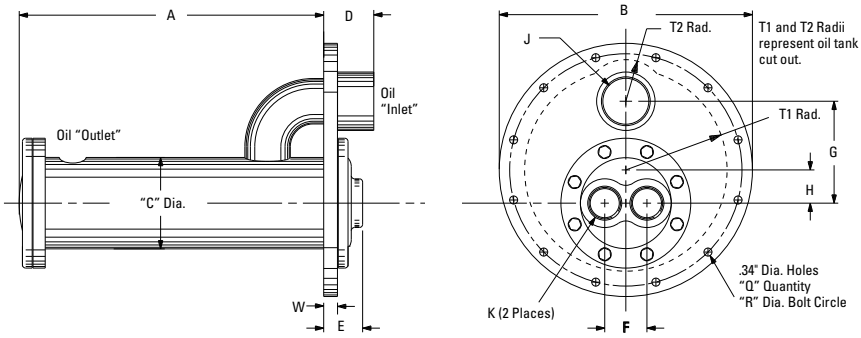
Model Series
EKT
EKTS
EKTM

Model Size Selected

SURGE-CUSHION®
Blank - No SURGE-CUSHION®
R - SURGE-CUSHION®

EKT = NPT Connections.
EKTS = SAE Oil Connections.
EKTM = All Metric Connections.

Dimensions



MODEL	A	B	C	D	E	F	G	H	J NPT or BSPF	J SAE	K NPT or BSPF	Q	R	T1	T2	W	Net. Wt.	Approx. Ship Wt.
EKT-508	8.87	6.79	2.55	1.84	1.68	1.12	2.44	.50	3/4"	#12	3/8"	6	5.60	2.25	.79	.62	11	14
EKT-518	18.87																14	16
EKT-708	8.72	9.75	3.52	2.22	1.67	1.62	3.94	1.25	1-1/2"	#24	3/4"	12	8.94	4.00	—	.70	23	27
EKT-718	18.72																30	34
EKT-1012	12.55	10.38	5.05		2.23	2.38	4.69	1.19			1"		9.62	4.38	1.12		42	46
EKT-1024	24.55																58	63

NOTE: We reserve the right to make reasonable design changes without notice. Certified drawings are available upon request. All dimensions in inches. Tank gasket is included. BSPP threads are 55° full form whitworth.

Selection Procedure

Performance Curves are based on a 40°F approach temperature, a 2:1 oil to water ratio and an average oil viscosity of 100 SSU. Example: oil leaving cooler at 125°F with 85°F cooling water (125°F - 85°F = 40°F). The 2:1 oil to water ratio means that for every GPM of oil circulated, a minimum of 1/2 GPM of water must must be circulated to obtain the curve results.

Step 1 **Corrections for approach temperature and oil viscosity.**

$$HP_{Heat\ Removed}\ in\ Cooler\ = HP_{Actual} \times \left[\frac{40°F}{Oil\ out\ and\ °F - Water\ in\ °F}\right] \times Correction\ A$$

Step 2 **Oil Pressure Drop Coding:** ● = 5 PSI; ■ = 10 PSI. Curves having no pressure drop symbol indicate that the oil pressure drop is less than 5 PSI to the highest oil flow rate for that curve. Multiply curve oil pressure drop by Correction B.

Viscosity Corrections

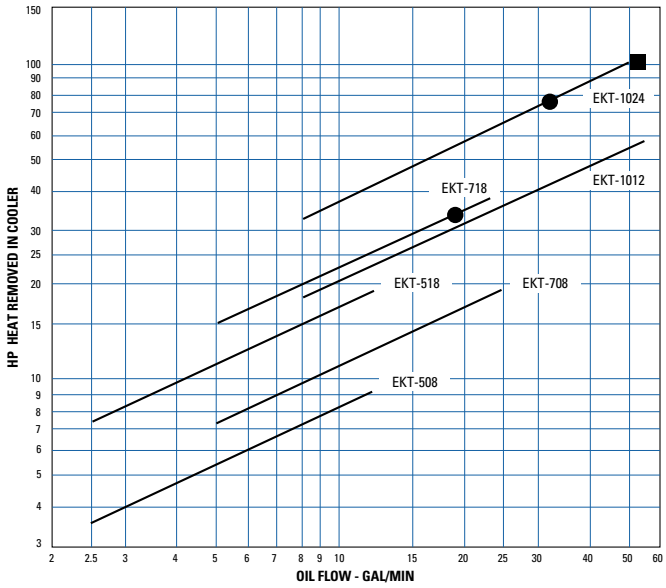
Average Oil SSU	A	B
50	0.84	0.6
100	1.0	1.0
200	1.14	2.0
300	1.24	3.1
400	1.31	4.1
500	1.37	5.1

Maximum Flow Rates

Unit Size	Shell Side GPM)	Tube Side(GPM)
500	20	6
700	60	12
1000	80	28

If maximum allowable flow rates are exceeded, premature failure may occur.

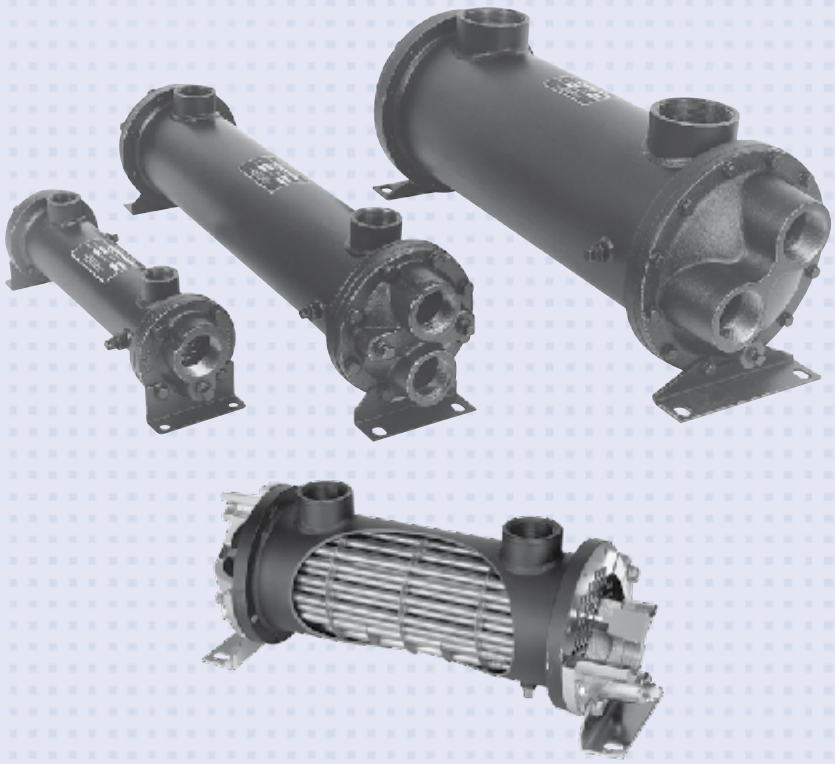
Performance Curves



COPPER/STEEL OR
STAINLESS STEEL CONSTRUCTION

Features

- **API/BASCO Interchange**
- **ASME Code Option**
- **Preferred for New Oil-Water Applications**
- **C-Series / SSC Series**
- **Rugged Steel Construction**
- **Low Cost**
- **Type 316 Stainless Steel Construction Optional**
- **Custom Designs Available**
- **Competitively Priced**
- Optional Material Construction on C-Series: Tubes, Tubesheets, End Bonnets
- NPT, SAE O-Ring, SAE Flange, or BSPP Shell Side Connections Available
- End Bonnets Removable for Servicing
- Mounting Feet Included (May be rotated in 90° increments)



Ratings Standard

Maximum Shell Pressure 300 psi
Maximum Tube Side Pressure 150 psi
Maximum Temperature 300°F

Ratings ASME Code

Maximum Shell Pressure 300 psi
Maximum Tube Side Pressure 150 psi
ASME Code SSC-1700 200 psi
Maximum Temperature 300°F

Materials C Series

Tubes Copper
Headers Steel
Shell Steel
Shell Connections Steel
Baffles Brass
End Bonnets Cast Iron
Mounting Brackets Steel
Gaskets Nitrile Rubber/Cellulose Fiber
Nameplate Aluminum Foil

Materials SSC Series

Tubes 316 Stainless Steel
Tubesheets 316 L Stainless Steel
Shell 316 L Stainless Steel
Shell Connections 316 L Stainless Steel
Baffles 316 Stainless Steel
End Bonnets 316 Stainless Steel
Mounting Brackets Mild Steel
Gaskets Nitrile Rubber/Cellulose Fiber
Nameplate Aluminum Foil

How to Order

[ ] – [ ][ ][ ][ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Model Series
C & SSC
CS & SSCS
CM & SSCM
CF
CFM

Model Size Selected

Baffle Spacing

Tube Diameter Code
4 - 1/4"
6 - 3/8"

Tubeside Passes
0 - One Pass
T - Two Pass
F - Four Pass

Cooling Tube Material
Blank - Copper
CN - CuNi
SS - Stainless Steel
AD - Admiralty Brass

End Bonnet Material
Blank - Cast Iron
B - Bronze
SB - Stainless Steel

Tubesheet Material
Blank - Steel
W - CuNi
S - Stainless Steel

Zinc Anodes
Blank - None
Z - Zinc

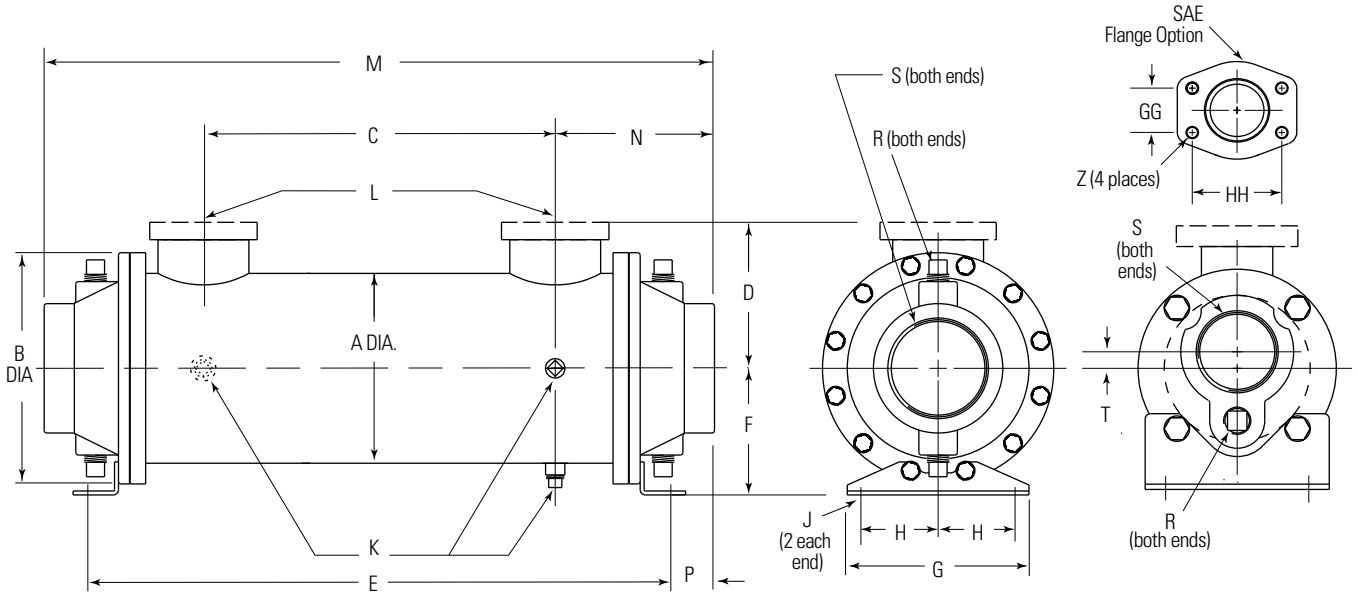
C = NPT Shell side connections; NPT Tube side connections
CS = SAE O-Ring Shell side connections; NPT Tube side connections
CM = BSPP Shell side connections; BSPP Tube side connections
CF = SAE Flange (with UNC threads) Shell side connections; NPT Tube side connections
CFM = SAE Flange (with Metric threads) Shell side connections; BSPP Tube side connections
SSC = NPT Shell side connections; NPT Tube side connections
SSCS = SAE O-Ring Shell side connections; NPT Tube side connections
SSCM = BSPP Shell side connections; BSPP Tube side connections

ADD FOR C, CS, CM, CF and CFM MODELS ONLY:
Cooling tube material, end bonnet material, tubesheet material & zinc anodes

Consult factory for ASME Code

Dimensions

One Pass



All Models except C-600 Series

C-600 Series

Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

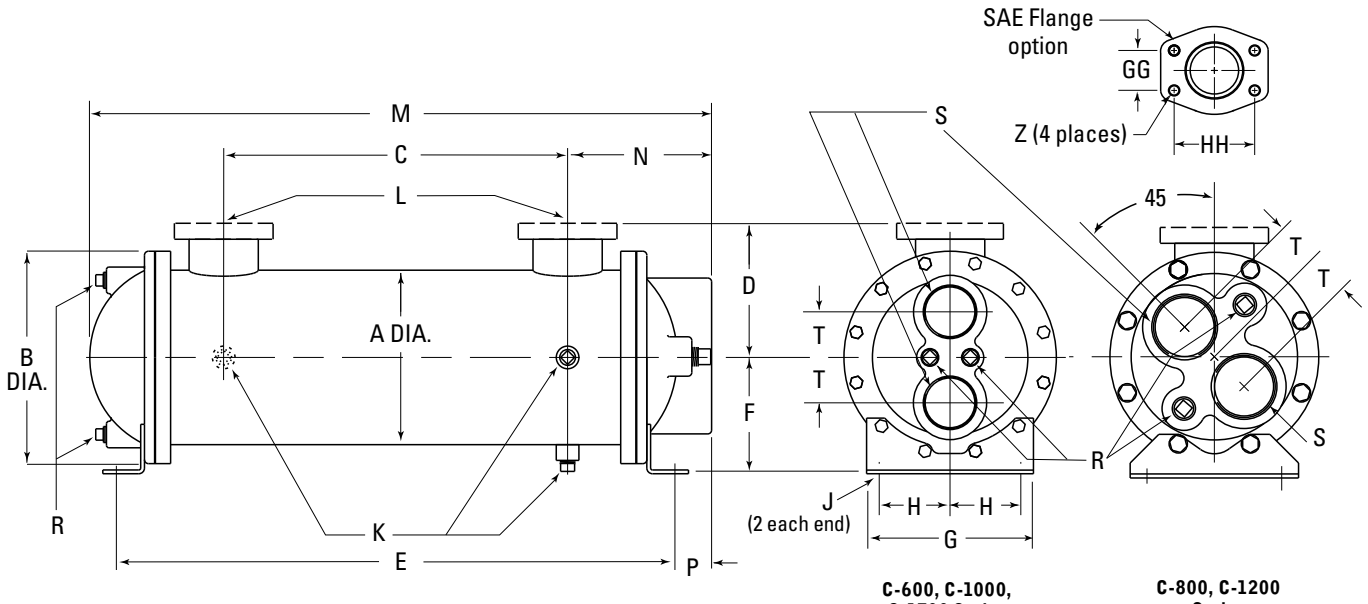
MODEL SIZE	A	B	C	D		E	F	G	H	J	K NPT	L		M	N	P	R NPT	S NPT/ BSPP	T
				NPT/BSPP SAE O-RING	SAE FLANGE							NPT/BSPP FLANGE	SAE O-RING						
614	3.25	4.50	10.00	2.62	2.88	16.38	2.75	4.18	1.62	.44 DIA.	(3) .25	1.00	#16 $1^{5}/_{16}$-12 UNF-2B	17.18	3.59	.40	(2) .38	1.50	.38
624			20.00			26.38								27.18					
814	4.25	6.00	9.00	3.25	3.50	16.62	3.50	4.25	1.75			1.50	#24 $1^{7}/_{8}$-12 UN-2B	17.88	4.44	.63		2.00	—
824			19.00			26.62								27.88					
836			31.00			38.62								39.88					
1014	5.25	6.75	9.00	3.75	4.00	17.12	4.00	5.25	2.00	.50 x .75				19.09	5.05	.92	(4) .38		
1024			19.00			27.12								29.09					
1036			31.00			39.12								41.09					
1224	6.25	7.75	18.25	4.25	4.88	27.13	4.50	6.25	2.50		(3) .38	2.00	#32 $2^{1}/_{2}$-12 UN-2B	30.00	5.87	1.43	(4) .50	3.00	—
1236			30.25			39.13								42.00					
1248			42.25			51.13								54.00					
1260			54.25			63.13								66.00					
1724	8.62	10.50	17.00	5.84	6.81	27.50	5.75	8.25	3.50	.62 x .88		3.00	—	31.47	7.23	1.99		4.00	—
1736			29.00			39.50								43.47					
1748			41.00			51.50								55.47					
1760			53.00			63.50								67.47					
1772			65.00			75.50								79.47					

NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

C/SSC

Dimensions

Two Pass



C-600, C-1000, C-1700 Series

C-800, C-1200 Series

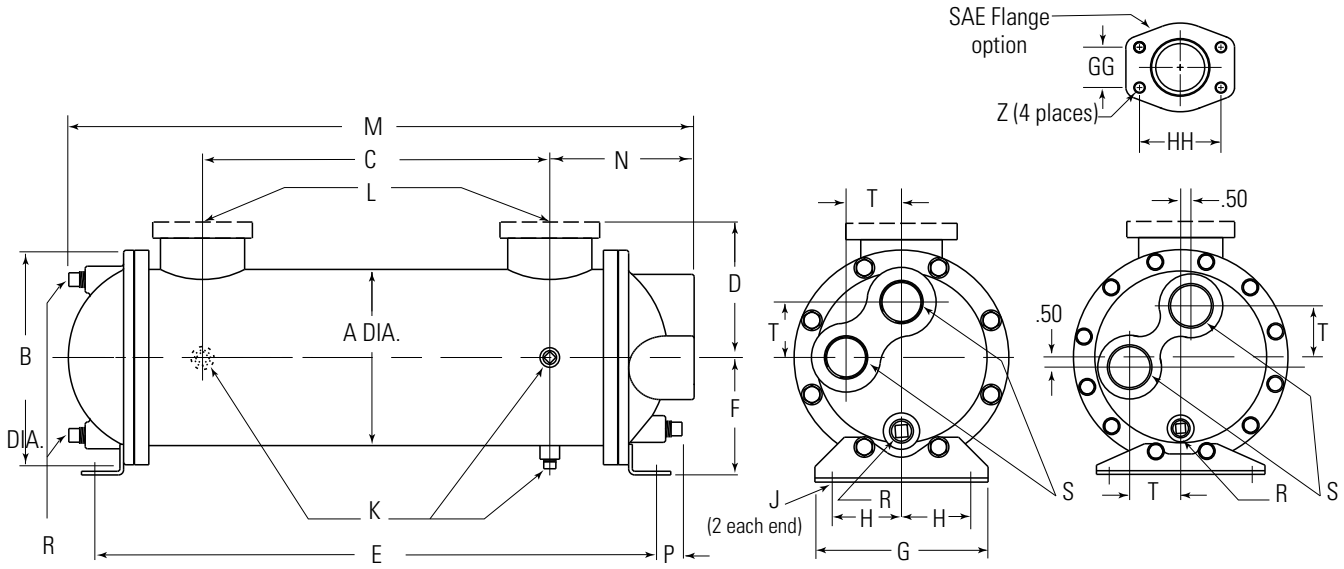
Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL SIZE	A	B	C	D		E	F	G	H	J	K	L		M	N	P	R	S	T
				NPT/BSPP SAE O-RING	SAE FLANGE						NPT	NPT/BSPP FLANGE	SAE O-RING				NPT	NPT/BSPP	
614	3.25	4.50	10.00	2.62	2.88	16.38	2.75	4.18	1.62	.44 DIA.	(3) .25	1.00	#16 $1\frac{5}{16}$-12 UNF-2B	17.12	3.56	.38	(2) .38	1.00	1.00
624			20.00			26.38								27.12					
814	4.25	6.00	9.00	3.25	3.50	16.62	3.50	4.25	1.75			1.50	#24 $1\frac{7}{8}$-12 UN-2B	17.88	4.44	.63		1.25	1.06
824			19.00			26.62								27.88					
836			31.00			38.62								39.88					
1014	5.25	6.75	9.00	3.75	4.00	17.12	4.00	5.25	2.00	.50 x .75				18.62	5.00	.94	(4) .38	1.50	1.50
1024			19.00			27.12								28.62					
1036			31.00			39.12								40.62					
1224	6.25	7.75	18.25	4.25	4.88	27.13	4.50	6.25	2.50		(3) .38	2.00	#32 $2\frac{1}{2}$-12 UN-2B	29.02	5.43	1.00	(4) .50	2.00	1.56
1236			30.25			39.13								41.03					
1248			42.25			51.13								53.03					
1260			54.25			63.13								65.03					
1724	8.62	10.50	17.00	5.84	6.81	27.50	5.75	8.25	3.50	.62 x .88		3.00	–	30.62	7.06	1.81		2.50	2.25
1736			29.00			39.50								42.62					
1748			41.00			51.50								54.62					
1760			53.00			63.50								66.62					
1772			65.00			75.50								78.62					

NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Dimensions

Four Pass



All Models except C-1700 Series

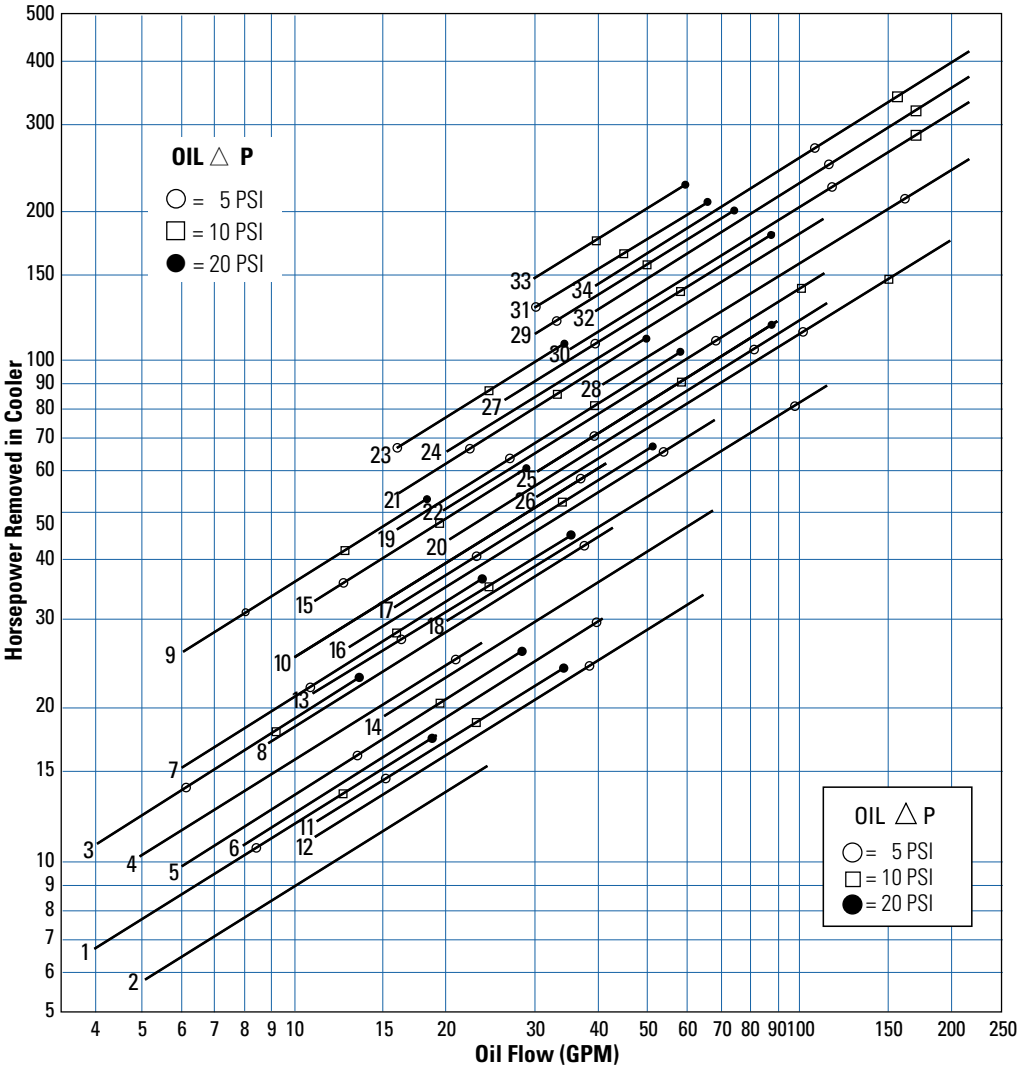
Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

C-1700 Series

MODEL SIZE	A	B	C	D		E	F	G	H	J	K NPT	L		M	N	P	R NPT	S NPT/ BSPP	T
				NPT/BSPP SAE O-RING	SAE FLANGE							NPT/BSPP FLANGE	SAE O-RING						
614	3.25	4.50	10.00	2.62	2.88	16.38	2.75	4.18	1.62	.44 DIA.	(3) .25	1.00	#16 $1\frac{5}{16}$-12 UNF-2B	17.12	3.56	.38	(2) .38	.75	1.00
624			20.00			26.38								27.12					
814	4.25	6.00	9.00	3.25	3.50	16.62	3.50	4.25	1.75			1.50	#24 $1\frac{7}{8}$-12 UN-2B	17.88	4.44	.63	(3) .38		1.25
824			19.00			26.62								27.88					
836			31.00			38.62								39.88					
1014	5.25	6.75	9.00	3.75	4.00	17.12	4.00	5.25	2.00	.50 x .75				18.81	4.81	.75		1.00	1.69
1024			19.00			27.12								28.81					
1036			31.00			39.12								40.81					
1224	6.25	7.75	18.25	4.25	4.88	27.13	4.50	6.25	2.50		(3) .38	2.00	#32 $2\frac{1}{2}$-12 UN-2B	29.13	5.44	1.00		1.50	2.00
1236			30.25			39.13								41.13					
1248			42.25			51.13								53.13					
1260			54.25			63.13								65.13					
1724	8.62	10.50	17.00	5.84	6.81	27.50	5.75	8.25	3.50	.62 x .88		3.00	–	29.86	7.06	1.81		2.00	2.50
1736			29.00			39.50								41.86					
1748			41.00			51.50								53.86					
1760			53.00			63.50								65.86					
1772			65.00			75.50								77.86					

NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Performance Curves



Model	Ship Wt. (lbs)
1. C/SSC-614-1.3-4-F	17
2. C/SSC-614-3-4-F	17
3. C/SSC-624-1.3-4-F	24
4. C/SSC-624-3-4-F	24
5. C/SSC-814-1.7-4-F	32
6. C/SSC-814-4-4-F	32
7. C/SSC-824-1.7-4-F	41
8. C/SSC-824-4-4-F	41
9. C/SSC-836-1.7-4-F	53
10. C/SSC-836-4-4-F	53
11. C/SSC-1014-2-6-F	43
12. C/SSC-1014-5-6-F	43
13. C/SSC-1024-2-6-F	57
14. C/SSC-1024-5-6-F	57
15. C/SSC-1036-2-6-F	72
16. C/SSC-1036-5-6-F	72
17. C/SSC-1224-2.5-6-F	85
18. C/SSC-1224-6-6-F	85
19. C/SSC-1236-2.5-6-F	110
20. C/SSC-1236-6-6-F	110
21. C/SSC-1248-2.5-6-F	135
22. C/SSC-1248-6-6-F	135
23. C/SSC-1260-2.5-6-F	160
24. C/SSC-1260-6-6-F	160
25. C/SSC-1724-3.5-6-F	140
26. C/SSC-1724-8.4-6-F	140
27. C/SSC-1736-3.5-6-F	180
28. C/SSC-1736-8.4-6-F	180
29. C/SSC-1748-3.5-6-F	220
30. C/SSC-1748-8.4-6-F	220
31. C/SSC-1760-3.5-6-F	260
32. C/SSC-1760-8.4-6-F	260
33. C/SSC-1772-3.5-6-F	300
34. C/SSC-1772-8.4-6-F	300

**Shipping Weights are approximate*

Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the incoming water temperature (40°F approach temperature). Curves are based on a 2:1 oil to water ratio.

Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)

If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.**

Desired oil leaving cooler °F − Water Inlet temp. °F = Actual Approach

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:

HP heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves.** Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.

○ = 5 PSI □ = 10 PSI ● = 20 PSI

Oil Temperature

Oil coolers can be selected by using entering or leaving oil tempertures.

Typical operating temperature ranges are:

Hydraulic Motor Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F
Lube Oil Circuits	110°F - 130°F
Automatic Transmission Fluid	200°F - 300°F

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (Oil △T) with this formula:

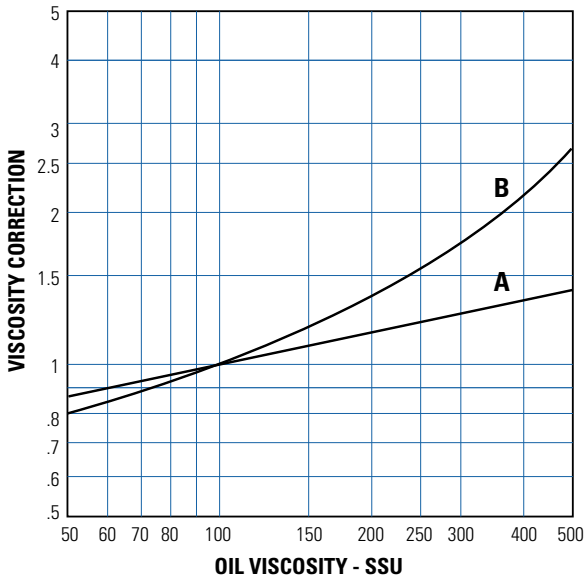
Oil △T=(BTU's/Hr.)/GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temperature = Oil Entering Temperature - Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.



Maximum Flow Rates

Example Model No.

C/SSC - 1024 - 2 - 6 - F

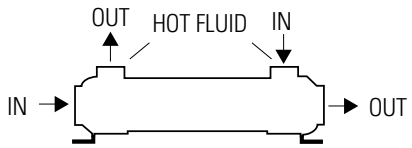
Unit Size	Baffle Spacing	Shell Side (GPM)	Tube Side (GPM) O	T	F
600	1.3, 3	19, 29	48	24	12
800	1.7, 4	32, 69	84	42	21
1000	2, 5	41, 69	146	73	37
1200	2.5, 6	60, 115	224	112	56
1700	3.5, 8.4	125, 253	465	232	116

Exceptions to Maximum Shell Side Flows	
C/SSC-814-4-4-*	63 GPM Max.
C/SSC-1014-2-6-*	33 GPM Max.
C/SSC-1014-5-6-*	66 GPM Max.
C/SSC-1724-3.5-6-*	105 GPM Max.
C/SSC-1724-8.4-6-*	200 GPM Max.

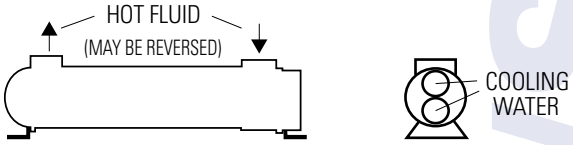
Caution: *Incorrect installation can cause this product to fail prematurely, causing the shell side and tube side fluids to intermix.*

Piping Hook-up

One Pass



Two and Four Pass

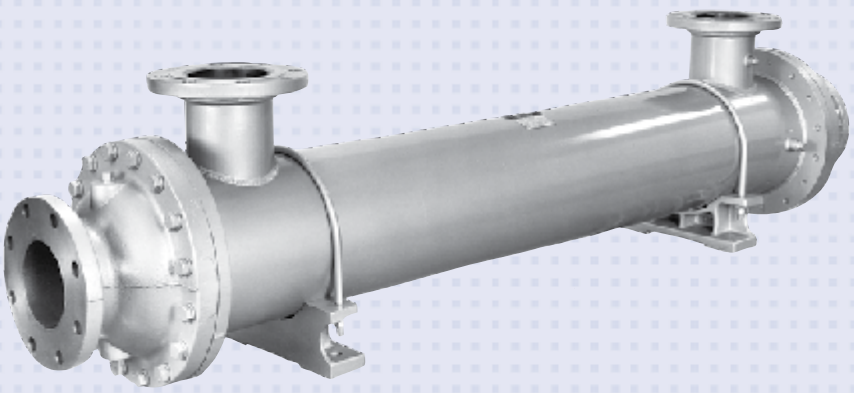


Specific applications may have different piping arrangements. Contact factory for assistance.

COPPER & STEEL CONSTRUCTION

Features

- **Super High Flow**
- **Largest Flow Rates & Heat Transfer Available**
- **ASME Code**
- **Rugged Steel Construction**
- **Custom Designs Available**
- **Competitively Priced**
- **3/8" & 5/8" Tubes Available**
- **Max. 10" Diameter, 12' Long**
- **150# ANSI/ASME Flanged Shell Connections (Metric Available)**
- Optional Construction on CA-2000 Series: Tubes, Tubesheets, and End Bonnets
- End Bonnets Removable For Servicing
- Saddle Brackets For Incremental Mounting
- ASME Code (Section VIII, Division I) and TEMA-C Construction Available (Consult Factory for Ordering Information)



Ratings

Maximum Shell Pressure 150 psi
Maximum Tube Side Pressure 150 psi
Maximum Temperature 300° F

Materials

Headers Steel
Shell Steel
Shell Connections Steel
Baffles Brass
End Bonnets Cast Iron
Mounting Brackets Steel/Cast Iron
Gaskets Nitrile Rubber/Cellulose Fiber
Nameplate Aluminum Foil

Maximum Flow Rates

Shell Side (GPM)		Tube Side GPM		
6" Baffle	9" Baffle	One Pass	Two Pass	Four Pass
210	320	652	326	163

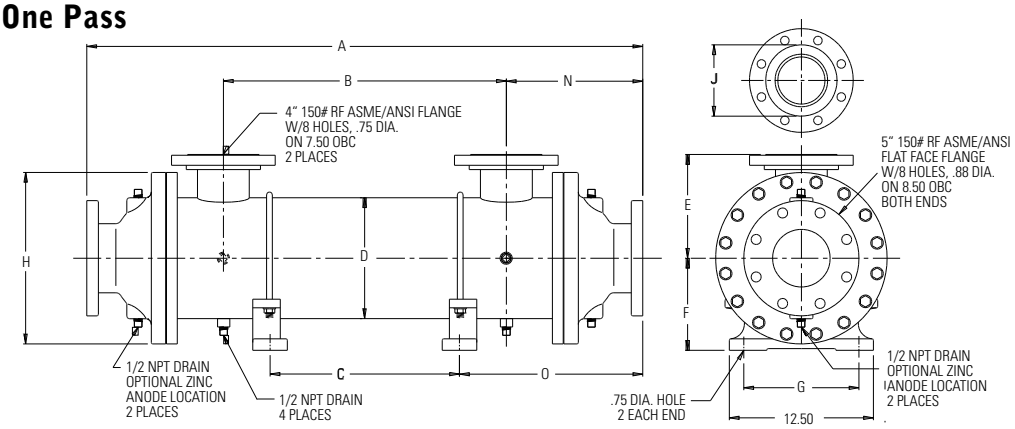
How to Order

	–		–		–		–		–	
Model Series **CA** **CAM**		Model Size Selected		Baffle Spacing	Tube Diameter Code **6** - 3/8" **10** - 5/8"	Tubeside Passes **0** - One Pass **T** - Two Pass **F** - Four Pass	Cooling Tube Material **Blank** - Copper **CN** - CuNi **SS** - Stainless Steel **AD** - Admiralty Brass	End Bonnet Material **Blank** - Cast Iron **NP** - Electroless Nickel Plate	Tubesheet Material **Blank** - Cast Iron **W** - CuNi **S** - Stainless Steel	Zinc Anodes **Blank** - None **Z** - Zinc

CA = NPT tubeside bottom connections; ASME/ANSI flange shell top connections.
CAM = BSPP shellside connections; BSPP tubeside connections.

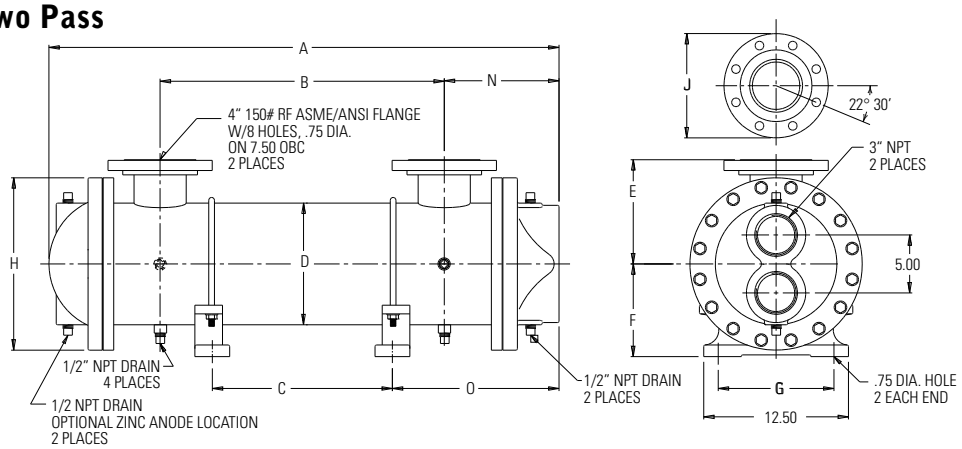
Dimensions

One Pass



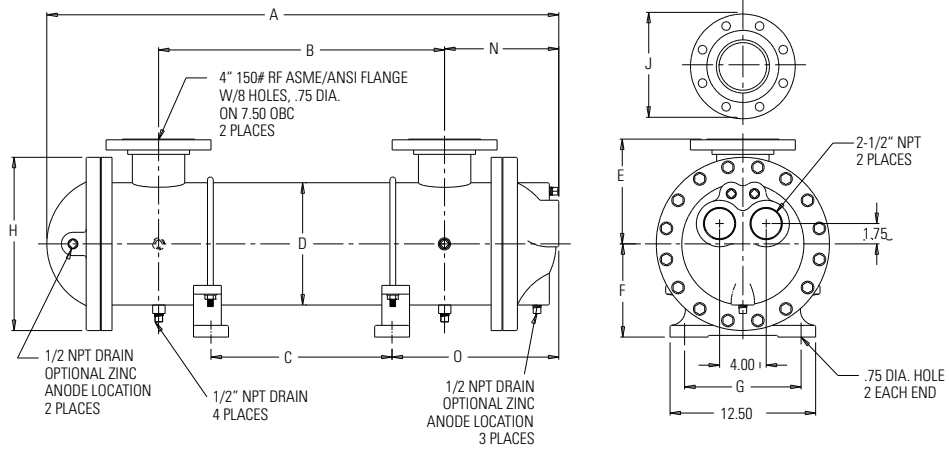
Model	A	N	O
CA-2036	49.64		
CA-2048	61.64		
CA-2060	73.64		
CA-2072	85.64		
CA-2084	97.64	11.82	15.92
CA-2096	109.64		
CA-20108	121.64		
CA-20120	133.64		
CA-20132	145.64		
CA-20144	157.64		

Two Pass



Model	A	N	O
CA-2036	45.55		
CA-2048	57.55		
CA-2060	69.55		
CA-2072	81.55		
CA-2084	93.55	9.90	14.38
CA-2096	105.55		
CA-20108	117.55		
CA-20120	129.55		
CA-20132	141.55		
CA-20144	153.55		

Four Pass



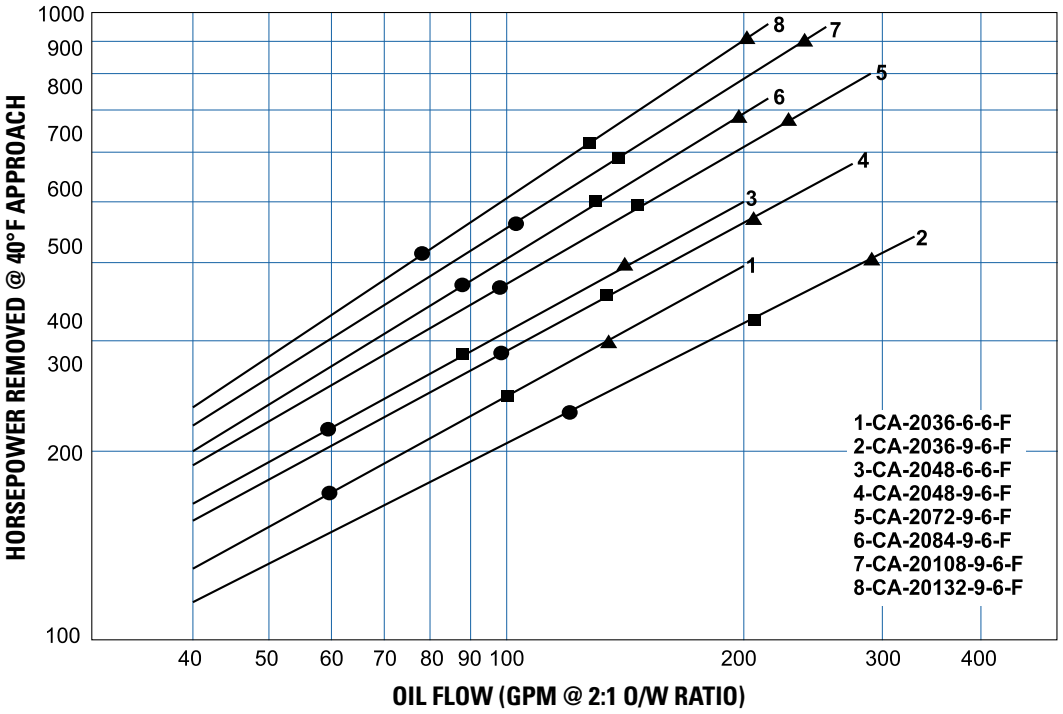
Model	A	N	O
CA-2036	45.34		
CA-2048	57.34		
CA-2060	69.34		
CA-2072	81.34		
CA-2084	93.34	9.78	13.78
CA-2096	105.34		
CA-20108	117.34		
CA-20120	129.34		
CA-20132	141.34		
CA-20144	153.34		

Model	B	C	D	E	F	G	H	J
CA-2036	26	18						
CA-2048	38	30						
CA-2060	50	42						6.19 DIA
CA-2072	62	54						Raised
CA-2084	74	66	10.5 DIA	9	8	10	14.88 DIA	Face
CA-2096	86	78						2 Places
CA-20108	98	90						
CA-20120	110	102						
CA-20132	122	114						
CA-20144	134	126						

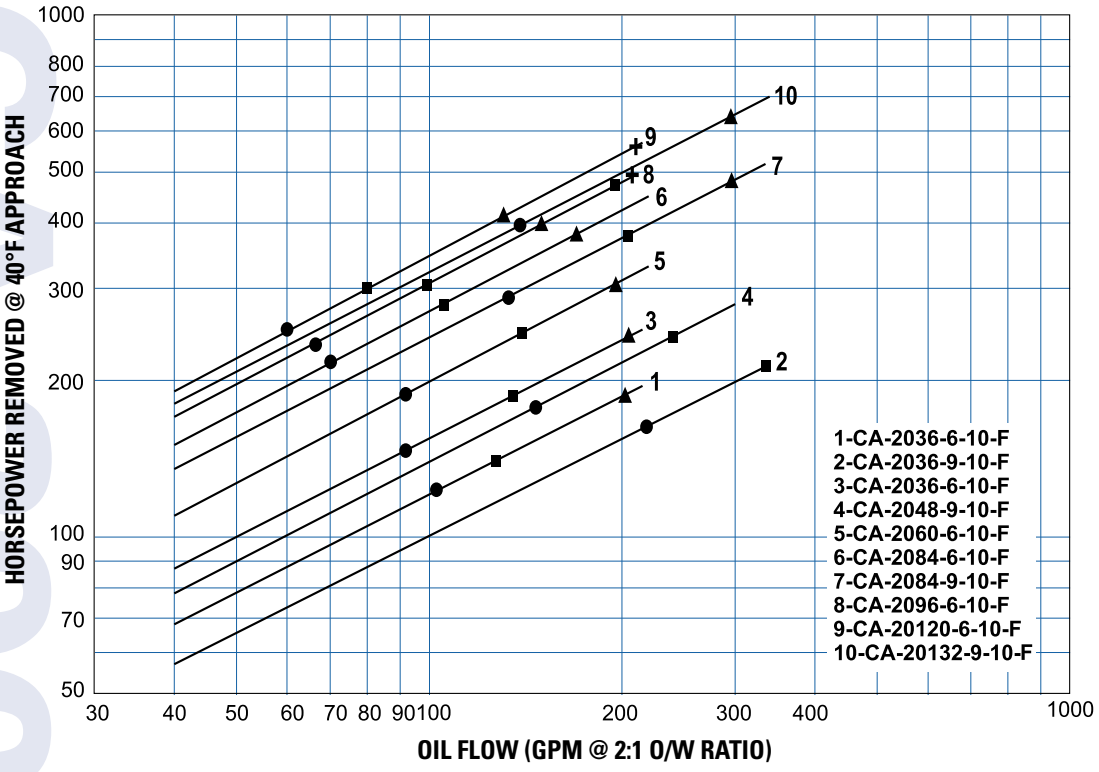
NOTE: We reserve the right to make reasonable design changes without notice. Dimensions are in inches.

Performance Curves

3/8" Tubes



5/8" Tubes



Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the incoming water temperature (40°F approach temperature). Curves are based on a 2:1 oil to water ratio.

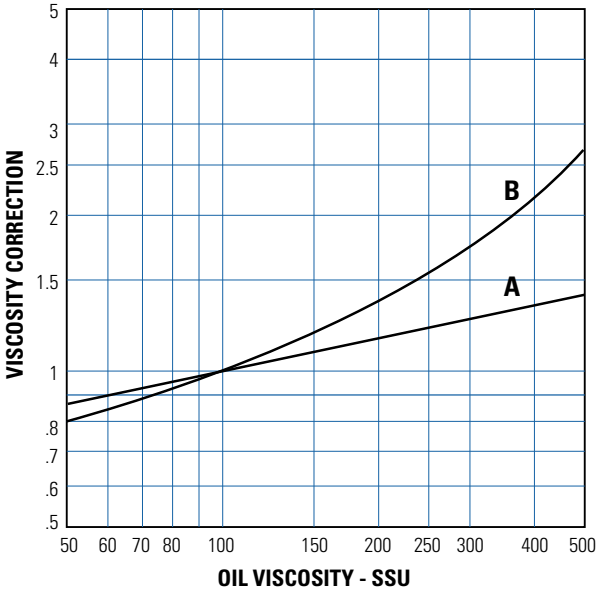
Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.**
Desired oil leaving cooler °F – Water Inlet temp. °F = Actual Approach

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
HP heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves.** Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.
● = 5 PSI; ■ = 10 PSI; ▲ = 20 PSI; ✚ = 40 PSI.



Oil Temperature

Oil coolers can be selected by using entering or leaving oil tempertures.

Typical operating temperature ranges are:

Hydraulic Motor Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F
Lube Oil Circuits	110°F - 130°F
Automatic Transmission Fluid	200°F - 300°F

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (Oil △T) with this formula:

Oil △T=(BTU's/Hr.)/GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temperature = Oil Entering Temperature - Oil △T.

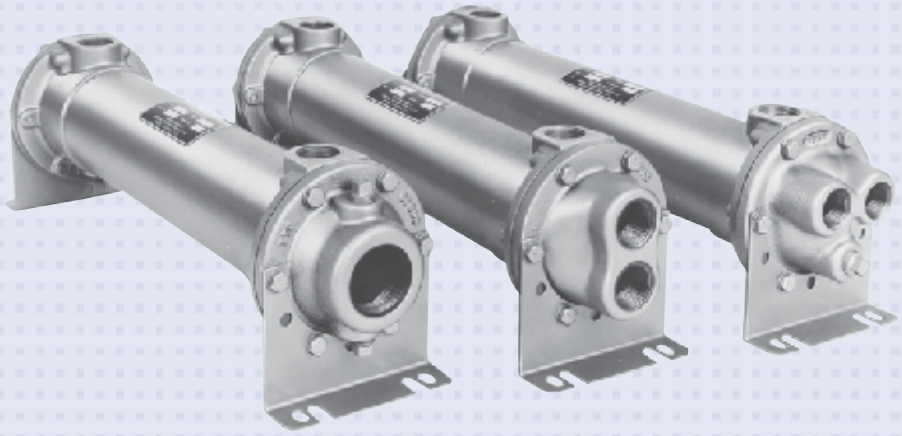
This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

COPPER & STEEL CONSTRUCTION

Features

- **Young Touchstone Interchange**
- **Optional Non-Ferrous Construction**
- **Competitively Priced**
- **1/4" or 3/8" Tubes Standard**
- **Water to Water Applications**
- **Sea Water Applications**
- Optional 90/10 Copper Nickel Cooling Tubes and Bronze End Bonnets for Sea Water Service
- NPT, SAE O-Ring, SAE Flange, or BSPP Shell Side Connections Available
- End Bonnets Removable for Servicing
- Mounting Feet Included (May be Rotated in 90° Increments)



Ratings

Maximum Shell Pressure 250 psi
Maximum Tube Side Pressure 150 psi
Maximum Temperature 350° F

Materials

Tubes Copper
Hubs & Tubesheets Steel or Brass
Shell Steel or Brass
Baffles Brass
End Bonnets Cast Iron
Mounting Brackets Steel
Gaskets Nitrile Rubber/Cellulose Fiber
Nameplate Aluminum Foil

How to Order

[ ] – [ ][ ][ ][ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Model Series
SB
SBF
B
BS
BM
BF
BFM

Model Size Selected

Baffle Spacing
A - 1.125
B - 2.25
C - 4.5
D - 9.0

Tube Diameter Code
4 - 1/4"
6 - 3/8"

Tubeside Passes
0 - One Pass
T - Two Pass
F - Four Pass

Shell Material
Blank - Steel
BR - Brass

Cooling Tube Material
Blank - Copper
CN - CuNi

End Bonnet Material
Blank - Cast Iron
B - Bronze

Zinc Anodes
Blank - None
Z - Zinc

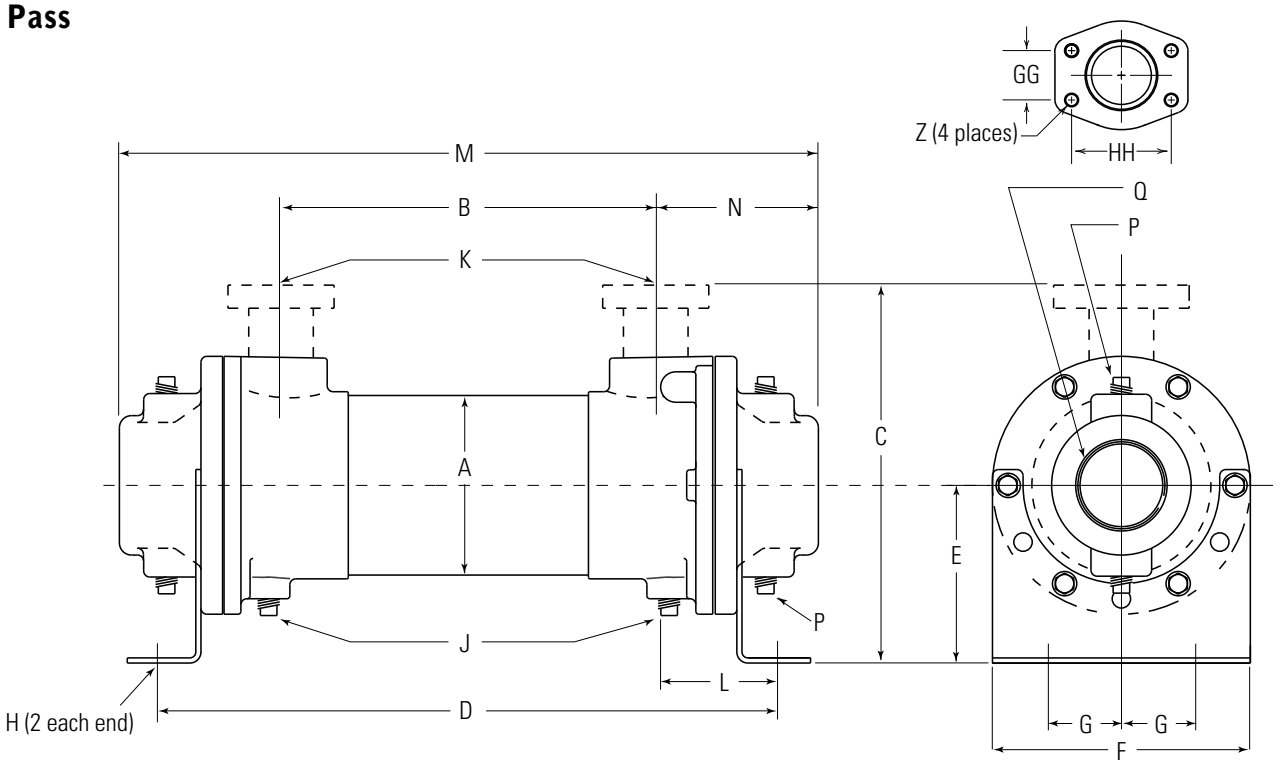
ADD FOR B SERIES MODELS ONLY:
BR-CN-B-Z is to be used for all seawater/dirty water applications.

Steel Hub
SB = NPT Shell Side, NPT Tube Side
SBF = SAE Flange (with UNC threads) Shell Side connections; NPT Tube Side connections

Brass Hub
B = NPT Shell Side connections; NPT Tube Side connections
BS = SAE O-Ring Shell Side connections; NPT Tube Side connections
BM = BSPP Shell Side connections; BSPP Tube Side connections
BF = SAE Flange (with UNC threads) Shell Side connections; NPT Tube Side connections
BFM = SAE Flange (with Metric threads) Shell Side connections; BSPP Tube Side connections
SAE flanges available on some models. Consult factory for details.

Dimensions

One Pass



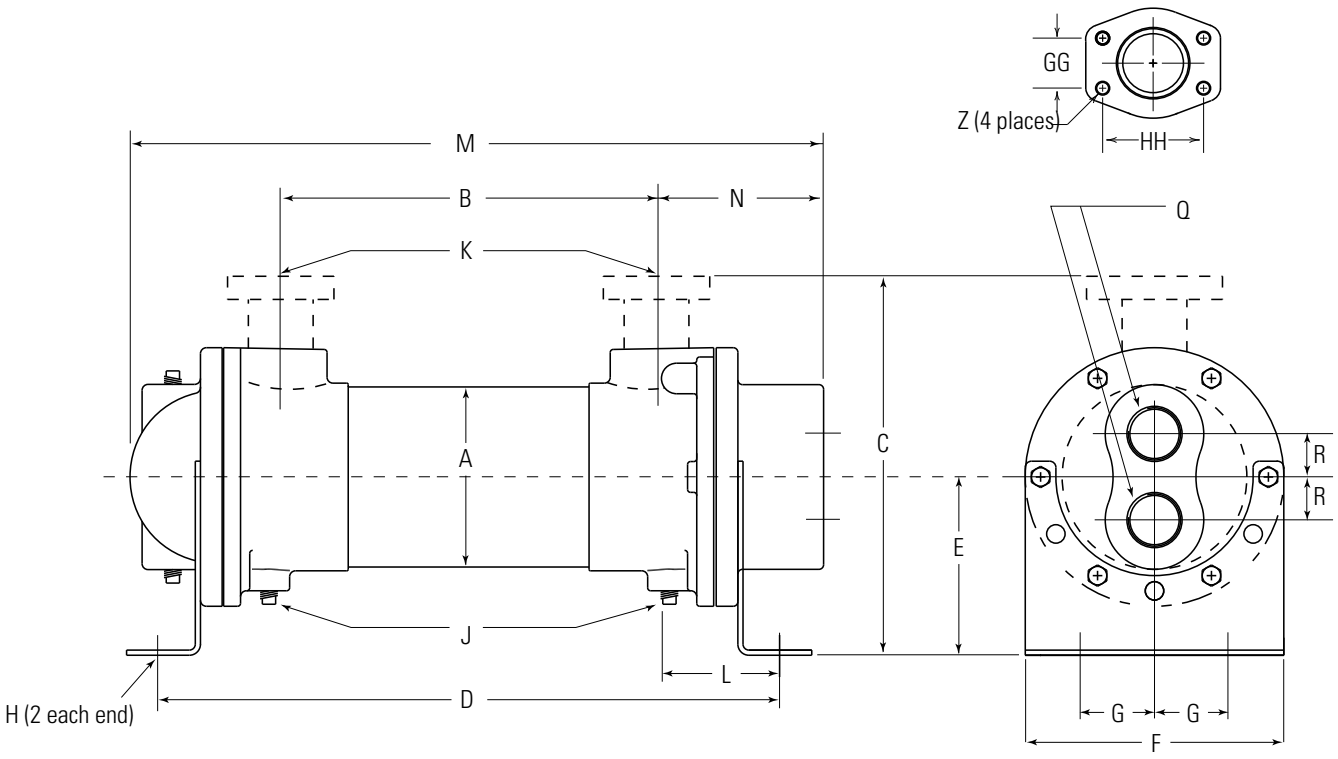
Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL	A	B	C		D	E	F	G	H	J	K		L	M	N	P	Q
			NPT/BSPP SAE O-RING	SAE FLANGE						NPT	NPT/BSPP FLANGE	SAE O-RING				NPT	NPT
B-401	2.125	7.62	3.50	—	11.01	1.94	2.62	.88	.41 Dia.	—	*.50	#8, 3/4-16 UNF-2B	1.72	11.24	1.81	—	1.00
B-402		16.62			20.01									20.24			
B-701	3.656	7.00	6.25	C/F	12.01	3.62	5.25	1.50	.44 x 1.00	(2) .38	1.00	#16, $1^{5}/_{16}$-12 UNF-2B	2.69	13.64	3.24	(4) .38	1.50
B-702		16.00			21.01									22.64			
B-703		25.00			30.01									31.64			
B-1002	5.125	15.50	7.38	8.46	21.71	4.00	6.75	2.00			1.50	#24, $1^{7}/_{8}$-12 UN-2B	3.06	23.60	4.05		2.00
B-1003		24.50			30.71									32.60			
B-1004		33.50			39.71									41.60			
B-1202	6.125	14.62	8.81	10.50	21.50	4.75	7.50	2.50	.44 x .88	(6) .38	2.00	#32, $2^{1}/_{2}$-12 UN-2B	3.44	24.38	4.88	(4) .50	3.00
B-1203		23.50			30.38									33.25			
B-1204		32.38			39.25									42.12			
B-1205		41.38			48.25									51.12			
B-1206		50.50			57.38									60.25			
B-1207		59.50			66.38									69.25			
B-1208		68.38			75.25									78.12			
B-1602	8.00	13.60	12.13	15.61	22.38	6.50	8.62	3.50	.44 x 1.00		3.00	—	4.39	26.62	6.52		4.00
B-1603		22.60			31.38									35.62			
B-1604		31.60			40.38									44.62			
B-1605		40.60			49.38									53.62			
B-1606		49.60			58.38									62.62			
B-1607		58.60			67.38									71.62			
B-1608		67.60			76.38									80.62			
B-1609		76.60			85.38									89.62			
B-1610		85.60			94.38									98.62			

B-401 and B-402 SAE Flange not available. NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Dimensions

Two Pass



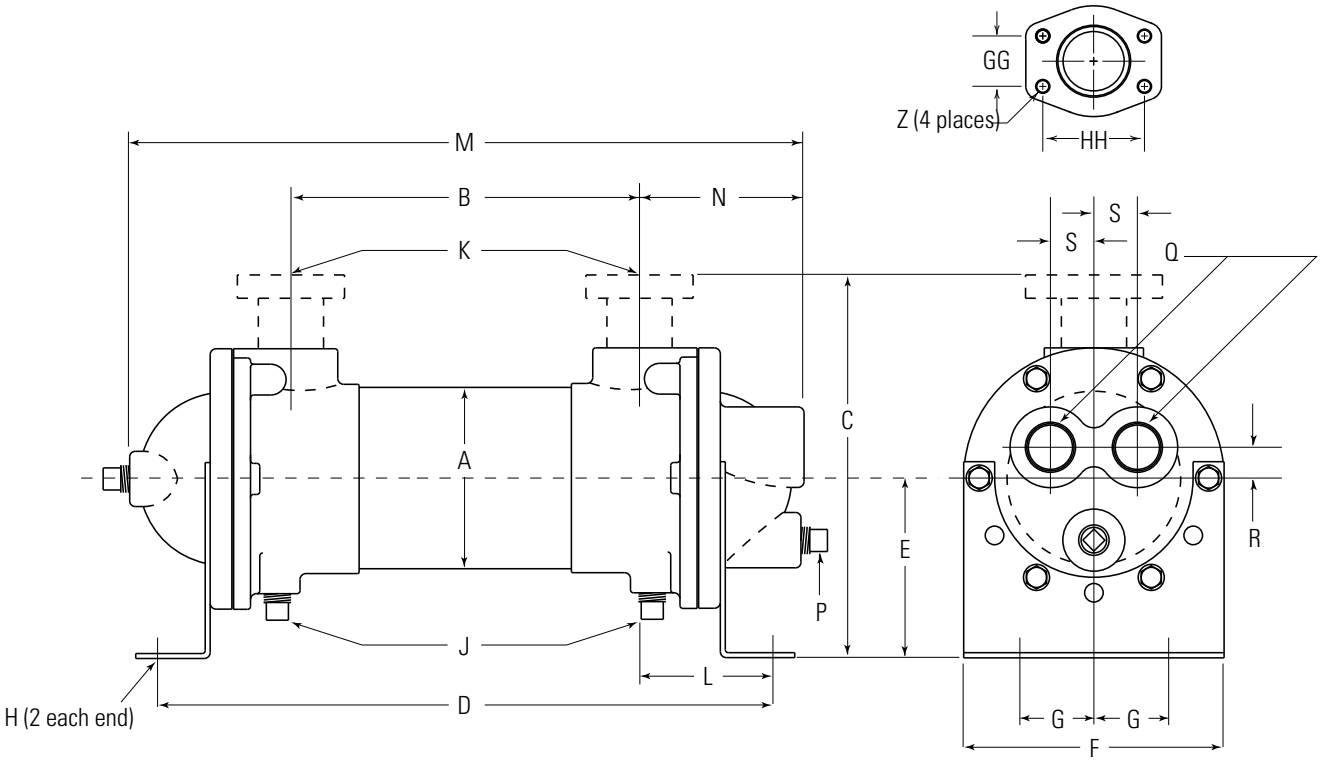
Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL	A	B	C		D	E	F	G	H	J	K		L	M	N	P	Q	R
			NPT/BSPP SAE O-RING	SAE FLANGE						NPT	NPT/BSPP FLANGE	SAE O-RING				NPT	NPT	
B-701	3.656	7.00	6.25	C/F	12.01	3.62	5.25	1.50	.44 x 1.00	(2) .38	1.00	#16, $1^{5}/_{16}$-12 UNF-2B	2.69	13.28	3.30	(2) .38	1.00	.88
B-702		16.00			21.01									22.28				
B-703		25.00			30.01									31.28				
B-1002	5.125	15.50	7.38	8.46	21.71	4.00	6.75	2.00		(6) .38	1.50	#24, $1^{7}/_{8}$-12 UN-2B	3.06	23.29	3.80		1.50	1.19
B-1003		24.50			30.71									32.29				
B-1004		33.50			39.71									41.29				
B-1202	6.125	14.62	8.81	10.50	21.50	4.75	7.50	2.50	.44 x .88		2.00	#32, $2^{1}/_{2}$-12 UN-2B	3.44	23.94	4.56	(2) .50	2.00	1.44
B-1203		23.50			30.38									32.81				
B-1204		32.38			39.25									41.69				
B-1205		41.38			48.25									50.69				
B-1206		50.50			57.38									59.81				
B-1207		59.50			66.38									68.81				
B-1208		68.38			75.25									77.69				
B-1602	8.00	13.60	12.13	15.61	22.38	6.50	8.62	3.50	.44 x 1.00		3.00	—	4.39	25.10	6.08		2.50	1.88
B-1603		22.60			31.38									34.10				
B-1604		31.60			40.38									43.10				
B-1605		40.60			49.38									52.10				
B-1606		49.60			58.38									61.10				
B-1607		58.60			67.38									70.10				
B-1608		67.60			76.38									79.10				
B-1609		76.60			85.38									88.10				
B-1610		85.60			94.38									97.10				

NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Dimensions

Four Pass

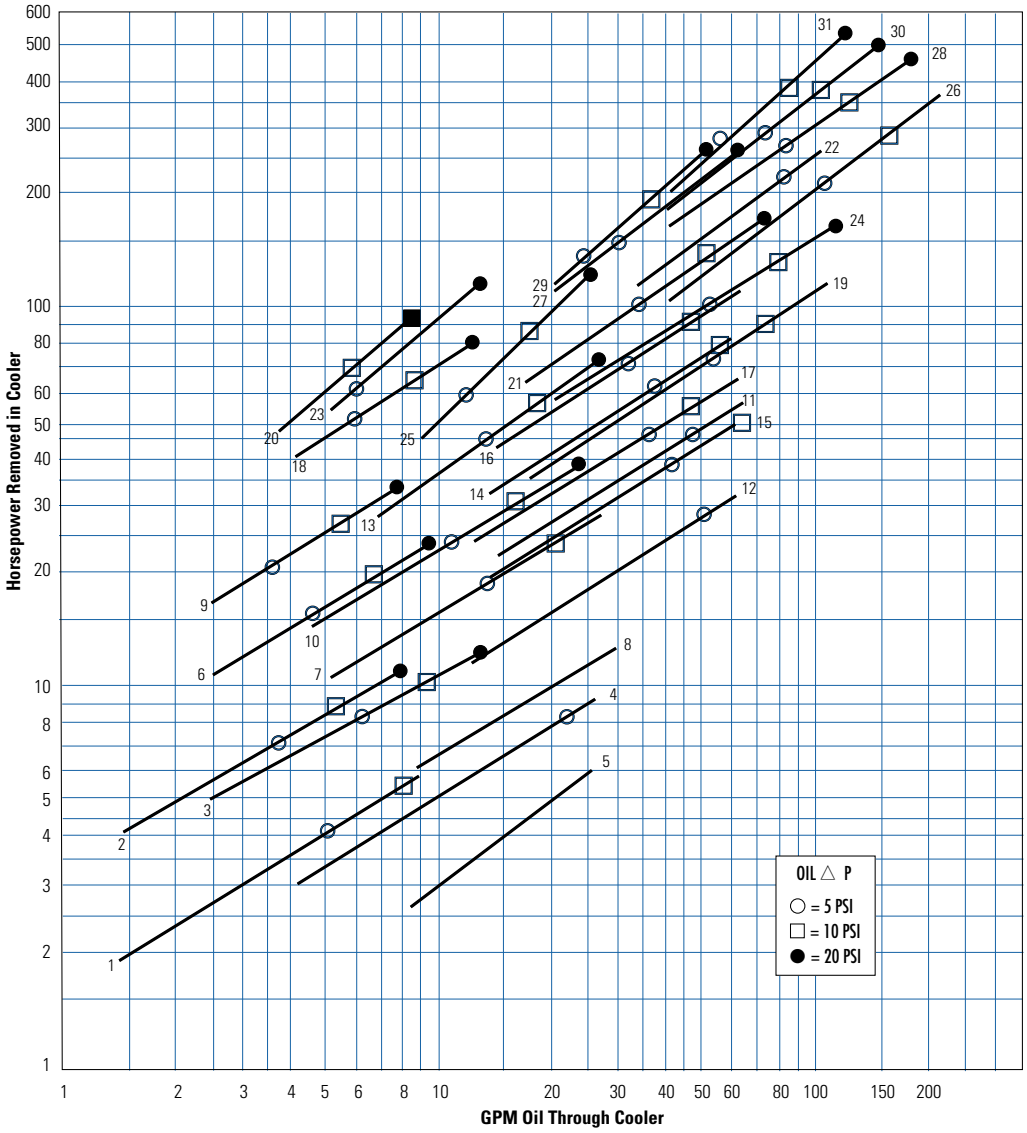


Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL	A	B	C		D	E	F	G	H	J	K		L	M	N	P	Q	R	S
			NPT/BSPP SAE O-RING	SAE FLANGE						NPT	NPT/BSPP FLANGE	SAE O-RING				NPT	NPT		
B-701	3.656	7.00	6.25	C/F	12.01	3.62	5.25	1.50	.44 x 1.00	(2) .38	1.00	#16, $1^{5}/_{16}$-12 UNF-2B	2.69	13.57	3.32	(3) .38	.75	.62	.88
B-702		16.00			21.01									22.57					
B-703		25.00			30.01									31.57					
B-1002	5.125	15.50	7.38	8.46	21.71	4.00	6.75	2.00			1.50	#24, $1^{7}/_{8}$-12 UN-2B	3.06	23.57	4.12		1.00	.75	1.34
B-1003		24.50			30.71									32.57					
B-1004		33.50			39.71									41.57					
B-1202	6.125	14.62	8.81	10.50	21.50	4.75	7.50	2.50	.44 x .88	(6) .38	2.00	#32, $2^{1}/_{2}$-12 UN-2B	3.44	24.44	4.90	(2) .38 (1) .50	1.50	1.06	1.40
B-1203		23.50			30.38									33.31					
B-1204		32.38			39.25									42.19					
B-1205		41.38			48.25									51.19					
B-1206		50.50			57.38									60.31					
B-1207		59.50			66.38									69.31					
B-1208		68.38			75.25									78.19					
B-1602	8.00	13.60	12.13	15.61	22.38	6.50	8.62	3.50	.44 x 1.00		3.00	—	4.39	26.72	6.48	(3) .50	2.00	1.38	1.88
B-1603		22.60			31.38									35.72					
B-1604		31.60			40.38									44.72					
B-1605		40.60			49.38									53.72					
B-1606		49.60			58.38									62.72					
B-1607		58.60			67.38									71.72					
B-1608		67.60			76.38									80.72					
B-1609		76.60			85.38									89.72					
B-1610		85.60			94.38									98.72					

NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Performance Curves



Model	Ship Wt. (lbs)
*1. B-401-A4-0	7
*2. B-402-A4-0	10
*3. B-701-A4-T	23
4. B-701-B6-F	23
5. B-701-C6-T	23
*6. B-702-A4-T	28
7. B-702-B4-F	28
8. B-702-C6-T	28
*9. B-703-A4-T	35
10. B-703-B4-F	35
11. B-1002-C4-T	49
12. B-1002-C6-T	49
13. B-1003-B4-F	65
14. B-1003-C4-T	65
15. B-1003-C6-T	65
16. B-1004-C4-T	72
17. B-1004-C6-T	72
*18. B-1202-A4-F	72
19. B-1202-C4-F	72
*20. B-1204-A4-F	110
21. B-1204-C4-F	110
22. B-1206-D4-F	160
*23. B-1602-A4-F	145
24. B-1602-C4-F	145
25. B-1604-B4-F	195
26. B-1604-D4-F	195
27. B-1606-C4-F	259
28. B-1606-D4-F	259
29. B-1608-C4-F	310
30. B-1608-D4-F	310
31. B-1610-D4-F	400

Shipping weights are approximate

Maximum Flow Rates

Example Model No.

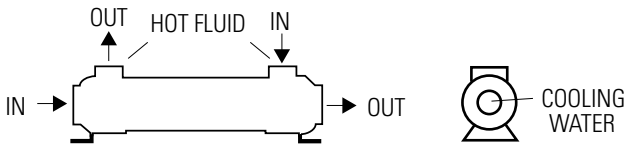
B - 1003 - C4 - F

Unit Size	Shell Side (GPM) A	B	Baffle Spacing C	D	Tube Side (GPM) O	T	F
400	9.6	—	—	—	25	—	—
700	17	29	29	—	61	31	15
1000	24	48	69	69	146	73	37
1200	29	57	115	115	224	112	56
1600	37	74	149	253	363	181	91

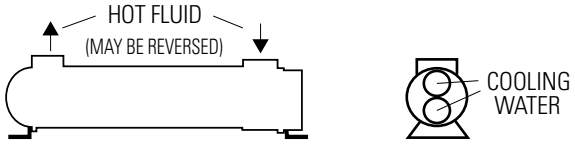
Caution: *Incorrect installation can cause this product to fail prematurely, causing the shell side and tube side fluids to intermix.*

Piping Hook-up

One Pass



Two and Four Pass



Specific applications may have different piping arrangements. Contact factory for assistance.

Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the water temperature used for cooling. This is also referred to as a 40°F approach temperature. Curves are based on a 2:1 oil to water flow ratio. *Curves are 1:1.

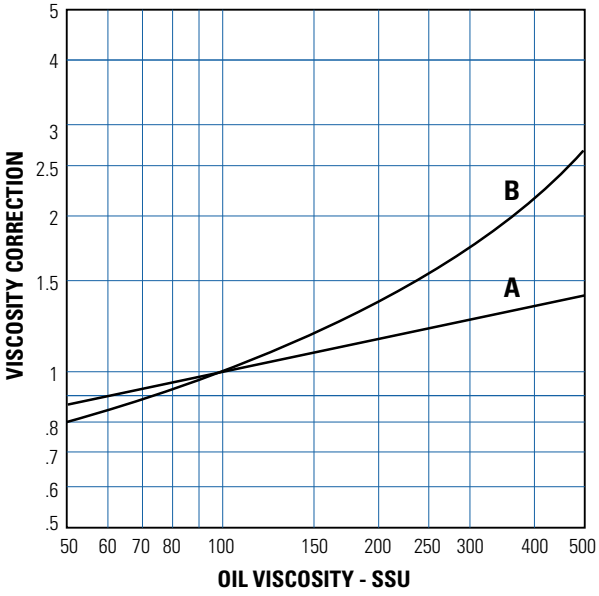
Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.** Desired oil leaving cooler °F – Water Inlet temp. °F = Actual Approach (Max. reservoir temp.)

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
Horsepower heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves:**
◯ = 5 PSI; □ = 10 PSI; ● = 20 PSI. Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.



Oil Temperature

Oil coolers can be selected using entering or leaving oil temperatures.

Typical operating temperature ranges are:

Hydraulic Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F,
Bearing Lube Oil	120°F - 160°F
Lube Oil Circuits	110°F - 130°F.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature *entering* the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil ▲T) with this formula:

Oil ▲T = (BTU's/Hr.) / (GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temp. = Oil Entering Temp – Oil ▲T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

COPPER & STEEL CONSTRUCTION

Features

- **ITT Interchange**
- **B or C Series is Recommended for New Applications**
- **Competitively Priced**
- Optional Non-Ferrous Construction (Water-to-Water Service)
- Optional 90/10 Copper Nickel Cooling Tubes and Bronze End Bonnets for Sea Water Service
- NPT, SAE O-Ring, SAE Flange, or BSPP Shell Side Connections Available
- End Bonnets Removable for Servicing
- Mounting Feet Included (May be Rotated in 90° Increments)

Ratings

Maximum Shell Pressure 300 psi
Maximum Tube Side Pressure 150 psi
Maximum Temperature 300° F

Materials

Tubes Copper
Hubs & Tubesheets Steel or Brass
Shell Steel
Baffles Brass
End Bonnets Cast Iron
Mounting Brackets Steel
Gaskets Nitrile Rubber/Cellulose Fiber
Nameplate Aluminum Foil

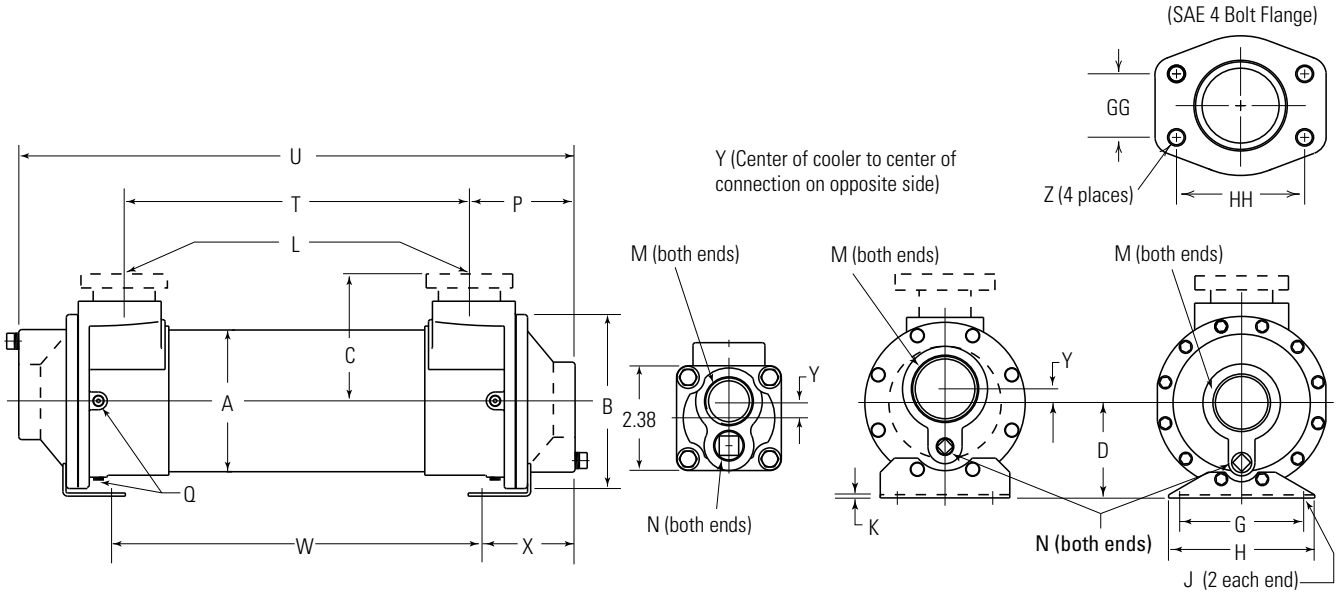
How to Order

Model Series	Model Size Selected	Baffle Spacing	Tube Diameter Code	Tubeside Passes	Shell Material	Cooling Tube Material	End Bonnet Material	Zinc Anodes
SA **SAF** **A** **AS** **AM** **AF** **AFM**			**4** - 1/4" **6** - 3/8"	**0** - One Pass **T** - Two Pass **F** - Four Pass	**Blank** - Steel **BR** - Brass	**Blank** - Copper **CN** - CuNi	**Blank** - Cast Iron **B** - Bronze	**Blank** - None **Z** - Zinc

SA = NPT Shell side, NPT Tube. Available in 1200 & 1600 models only.
SAF = SAE 4 Bolt Flange (with UNC threads) Shell side connections; NPT Tube side connections. Available in 1200 & 1600 models only.
A = NPT Shell side connections; NPT Tube side connections
AS = SAE O-Ring Shell side connections; NPT Tube side connections
AM = BSPP Shell side connections; BSPP Tube side connections
AF = SAE 4 Bolt Flange (with UNC threads) Shell side connections; NPT Tube side connections
AFM = SAE 4 Bolt Flange (with Metric threads) Shell side connections; BSPP Tube side connections
SAE flanges available on some models. Consult factory for details.

Dimensions

One Pass



A-400 Series | **A-600 & A-800 Series** | **A-1000, A-1200 & A-1600 Series**

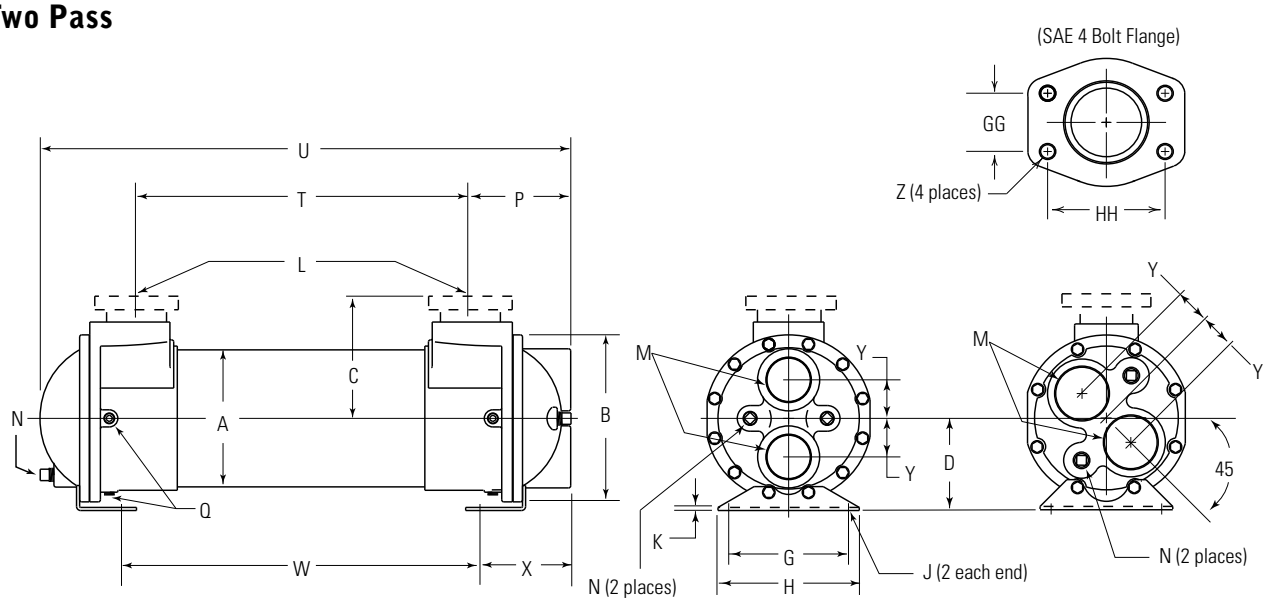
Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL	A DIA.	B DIA.	C NPT/BSPP SAE O-RING	C SAE 4 BOLT FLANGE	D	G	H	J	K	L NPT/BSPP FLANGE	L SAE O-RING	M NPT	N NPT	P	Q NPT	T	U	W	X	Y
A-408	2.12	—	1.69	—	—	—	—	—	—	*1.00	N/A	.75		2.38	—	6.25	11.00	—	—	
A-608											#16,					6.12	11.25	5.47		.38
A-614	3.12	4.19	2.44		2.44	2.50	3.50	.38 x .88		1.00	15/16-12	1.50		2.56	(2) .25	12.12	17.25	11.47	3.06	
A-624				C/F							UNF-2B					22.12	27.25	21.47		
A-814																11.12	18.00	12.88		
A-824	4.12	5.88	3.12			3.50	4.75	.50 x 1.62		1.50	#24,	2.00	.38	3.44	(6) .38	21.12	28.00	22.88	2.56	.50
A-836					3.50						17/8-12					33.12	40.00	34.88		
A-1014									.12		UN-2B					11.12	18.50	11.75		
A-1024	5.12	6.50	3.62	4.34		4.00	5.00					2.50		3.69		21.12	28.50	21.75	3.38	
A-1036								.50 x .88								33.12	40.50	33.75		
A-1224																20.50	29.00	21.50		
A-1236	6.12	7.50	4.25	4.84**	4.12	5.00	6.00			2.00	#32,	3.00	.50	4.25	(6) .25	32.50	41.00	33.50	3.75	
A-1248											21/2-12					44.50	53.00	45.50		
A-1260											UN-2B					56.50	65.00	57.50		
A-1624																19.00	31.00	20.50		
A-1636																31.00	43.00	32.50		
A-1648	8.00	9.75	5.62	6.12***	5.38	7.00	8.25	.62 x 1.12	.19	3.00	—			6.00		43.00	55.00	44.50	5.25	
A-1660																55.00	67.00	56.50		
A-1672																67.00	79.00	68.50		

**A-408 SAE Flange not available. **SAF-1200 5.88. ***SAF-1600 7.38.*
NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Dimensions

Two Pass



A-600, A-800, A-1000 & A-1600 Series

A-1200 Series

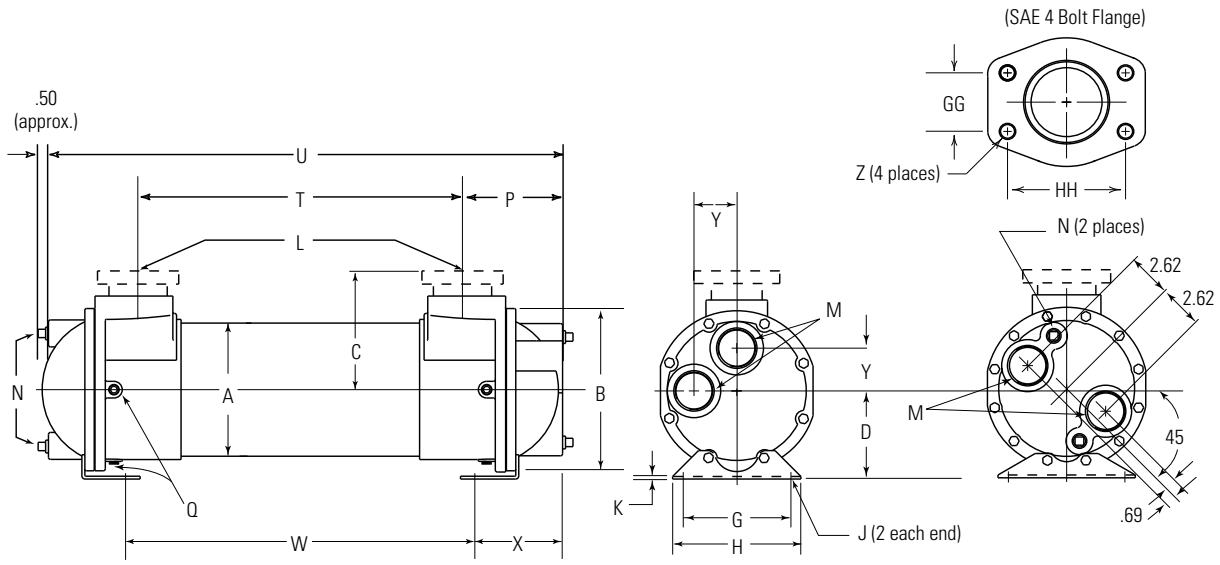
Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL	A DIA.	B DIA.	C		D	G	H	J	K	L		M NPT	N NPT	P	Q NPT	T	U	W	X	Y
			NPT/BSPP SAE O-RING	SAE 4 BOLT FLANGE						NPT/BSPP FLANGE	SAE O-RING									
A-608	3.12	4.19	2.44	C/F	2.44	2.50	3.50	.38 x .88	.12	1.00	#16, $1^{5}/_{16}$-12 UNF-2B	1.00	.38	2.44	(2) .25	6.12	10.75	5.47	2.94	1.00
A-614																12.12	16.75	11.47		
A-624																22.12	26.75	21.47		
A-814	4.12	5.88	3.12		3.50	3.50	4.75	.50 x 1.62		1.50	#24, $1^{7}/_{8}$-12 UN-2B	1.25		3.44	(6) .38	11.12	17.62	12.88	2.56	1.19
A-824																21.12	27.62	22.88		
A-836																33.12	39.62	34.88		
A-1014	5.12	6.50	3.62	4.34		4.00	5.00	.50 x .88				1.50		3.69	(6) .25	11.12	18.31	11.75	3.38	1.50
A-1024																21.12	28.31	21.75		
A-1036																33.12	40.31	33.75		
A-1224	6.12	7.50	4.25	4.84*	4.12	5.00	6.00			2.00	#32, $2^{1}/_{2}$-12 UN-2B	2.00	.50	4.25		20.50	28.75	21.50	3.75	1.56
A-1236																32.50	40.75	33.50		
A-1248																44.50	52.75	45.50		
A-1260																56.50	64.75	57.50		
A-1624	8.00	9.75	5.62	6.12**	5.38	7.00	8.25	.62 x 1.12	.19	3.00	—	2.50		6.00		19.00	30.50	20.50	5.25	2.25
A-1636																31.00	42.50	32.50		
A-1648																43.00	54.50	44.50		
A-1660																55.00	66.50	56.50		
A-1672																67.00	78.50	68.50		

**SAF-1200 5.88. **SAF-1600 7.38.*
NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Dimensions

Four Pass



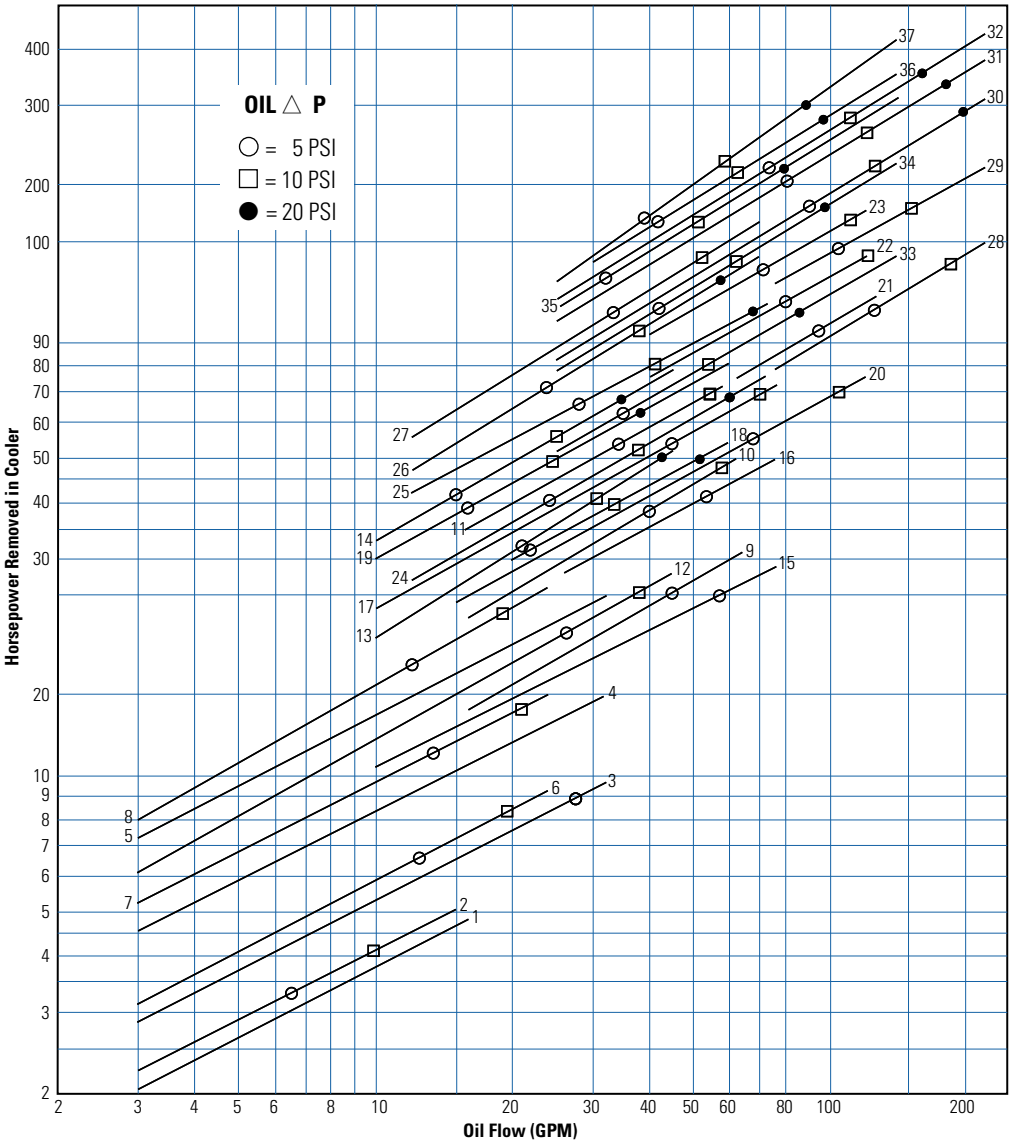
A-600, A-800, A-1000 & A-1200 Series **A-1600 Series**

Flange Size	GG	HH	Z - CF	Z - CFM
1	1.03	2.06	3/8-16 UNC	M-10
1.50	1.41	2.75	1/2-13 UNC	M-12
2	1.69	3.06		
3	2.44	4.19	5/8-11 UNC	M-16

MODEL	A DIA.	B DIA.	C NPT/BSPP SAE O-RING	C SAE 4 BOLT FLANGE	D	G	H	J	K	L NPT/BSPP FLANGE	L SAE O-RING	M NPT	N NPT	P	Q NPT	T	U	W	X	Y
A-608																6.12	10.88	5.47		
A-614	3.12	4.19	2.44		2.44	2.50	3.50	.38 x .88		1.00	#16, $1^{5}/_{16}$-12 UNF-2B			2.31	(2) .25	12.12	16.88	11.47	2.81	1.00
A-624												.75				22.12	26.88	21.47		
A-814				C/F												11.12	17.62	12.88		
A-824	4.12	5.88	3.12			3.50	4.75	.50 x 1.62						3.44	(6) .38	21.12	27.62	22.88	2.56	1.06
A-836					3.50					1.50	#24, $1^{7}/_{8}$-12 UN-2B		.38			33.12	39.62	34.88		
A-1014									.12							11.12	18.38	11.75		
A-1024	5.12	6.50	3.62	4.34		4.00	5.00					1.00		3.56		21.12	28.38	21.75	3.25	1.69
A-1036																33.12	40.38	33.75		
A-1224								.50 x .88								20.50	29.00	21.50		
A-1236	6.12	7.50	4.25	4.84*	4.12	5.00	6.00			2.00	#32, $2^{1}/_{2}$-12 UN-2B	1.50		4.25	(6) .25	32.50	41.00	33.50	3.75	2.00
A-1248																44.50	53.00	45.50		
A-1260													.50			56.50	65.00	57.50		
A-1624																19.00	30.75	20.50		
A-1636																31.00	42.75	32.50		
A-1648	8.00	9.75	5.62	6.12**	5.38	7.00	8.25	.62 x 1.12	.19	3.00	—	2.00		6.00		43.00	54.75	44.50	5.25	—
A-1660																55.00	66.75	56.50		
A-1672																67.00	78.75	68.50		

**SAF-1200 5.88. **SAF-1600 7.38.*
NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.

Performance Curves

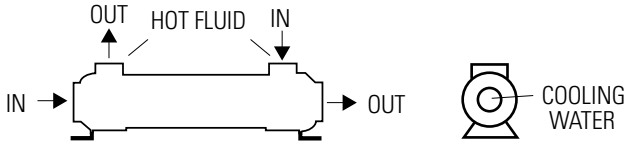


Model	Ship Wt. (lbs)
1. A-408-2-4-O	7
2. A-408-.75-4-O	7
3. A-608-2-4-F	12
4. A-614-4-4-F	17
5. A-624-4-4-F	20
6. A-608-1-4-F	12
7. A-614-1.5-4-F	17
8. A-624-2-4-F	20
9. A-814-3-4-F	40
10. A-824-4-4-F	50
11. A-836-4-4-F	58
12. A-814-1.5-4-F	40
13. A-824-2-4-F	50
14. A-836-2-4-F	58
15. A-1014-3-6-F	49
16. A-1024-4-6-F	63
17. A-1036-4-6-F	72
18. A-1024-2-6-F	63
19. A-1036-2-6-F	72
20. A-1224-4-6-F	78
21. A-1236-6-6-F	118
22. A-1248-6-6-F	143
23. A-1260-6-6-F	165
24. A-1224-2-6-F	78
25. A-1236-3-6-F	118
26. A-1248-3-6-F	143
27. A-1260-4-6-F	165
28. A-1624-6-6-F	180
29. A-1636-6-6-F	210
30. A-1648-6-6-F	250
31. A-1660-6-6-F	286
32. A-1672-6-6-F	330
33. A-1624-2-6-F	180
34. A-1636-3-6-F	210
35. A-1648-3-6-F	250
36. A-1660-4-6-F	286
37. A-1672-4-6-F	330

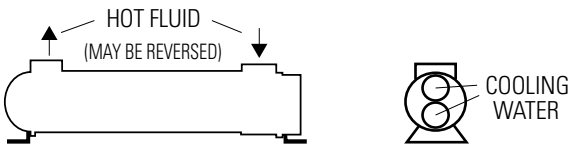
Shipping weights are approximate

Piping Hook-up

One Pass



Two and Four Pass



Specific applications may have different piping arrangements. Contact factory for assistance.

Selection Procedure

Performance Curves are based on 100SSU oil leaving the cooler 40°F higher than the water temperature used for cooling. This is also referred to as a 40°F approach temperature. Curves are based on a 2:1 oil to water flow ratio.

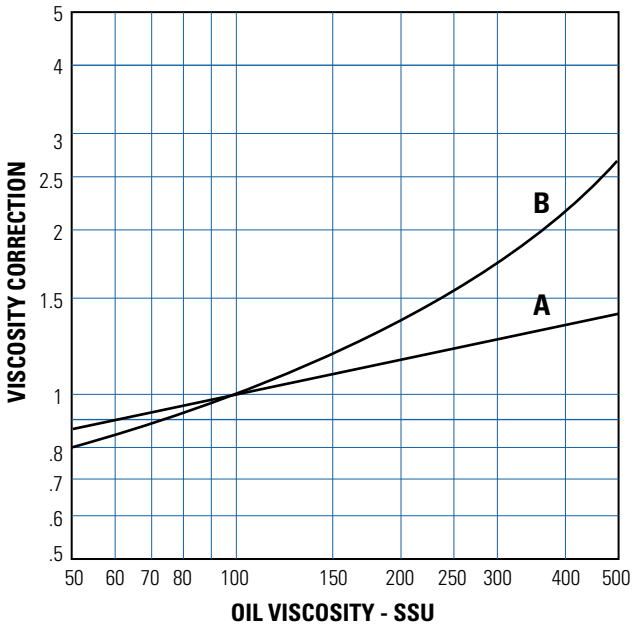
Step 1 **Determine the Heat Load.** This will vary with different systems, but typically coolers are sized to remove 25 to 50% of the input nameplate horsepower. (Example: 100 HP Power Unit x .33 = 33 HP Heat load.)
If BTU/Hr. is known: $HP = \frac{BTU/Hr}{2545}$

Step 2 **Determine Approach Temperature.** Desired oil leaving cooler °F – Water Inlet temp. °F = Actual Approach (Max. reservoir temp.)

Step 3 **Determine Curve Horsepower Heat Load.** Enter the information from above:
Horsepower heat load x $\frac{40}{\text{Actual Approach}}$ x Viscosity Correction A = Curve Horsepower

Step 4 **Enter curves** at oil flow through cooler and curve horsepower. Any curve above the intersecting point will work.

Step 5 **Determine Oil Pressure Drop from Curves:**
◯ = 5 PSI; ☐ = 10 PSI; ● = 20 PSI. Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.



Oil Temperature

Oil coolers can be selected using entering or leaving oil temperatures.

Typical operating temperature ranges are:

Hydraulic Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F,
Bearing Lube Oil	120°F - 160°F
Lube Oil Circuits	110°F - 130°F.

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the oil temperature *entering* the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (oil ▲T) with this formula:

Oil ▲T = (BTU's/Hr.) / (GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temp. = Oil Entering Temp – Oil ▲T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

Maximum Flow Rates

Example Model No.
A - 1024 - 2 - 6 - F

Unit Size	Baffle Spacing	Shell Side (GPM)	Tube Side (GPM) 0	T	F
400	.75, 2	7, 19	18	–	–
608	1, 2	14, 29	48	24	12
614	1.5, 4	21, 29	48	24	12
624	2, 4	29	48	24	12
814	1.5, 3	29, 57	87	44	22
824 & 836	2, 4	38, 69	87	44	22
1014	1.5, 3	32, 64	146	73	37
1024 & 1036	2, 4	42, 69	146	73	37
1224	2, 4	51, 103	224	112	56
1236 & 1248	3, 6	77, 115	224	112	56
1260	4, 6	103, 115	224	112	56
1624	2, 6	66, 200	280	140	70
1636 & 1648	3, 6	100, 200	280	140	70
1660 & 1672	4, 6	133, 200	280	140	70

Caution: *Incorrect installation can cause this product to fail prematurely, causing the shell side and tube side fluids to intermix.*

COPPER & STEEL CONSTRUCTION

Features

- **Steam & Large Temperature Differentials**
- **Removable Tube Bundle for Servicing**
- **Reduces Thermal Expansion Stresses**
- **3/8" Tubes**
- Built-In Expansion Chamber
- Threaded or Flanged Connections
- Mounting Brackets Included
- Steel Shell Assembly

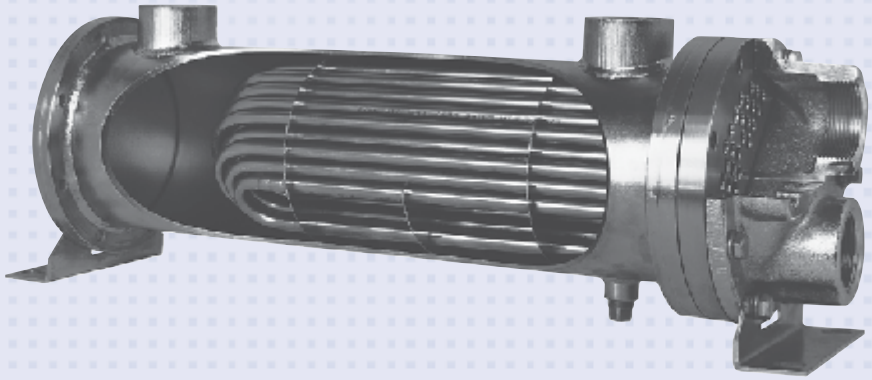
OPTIONS

ASME Code Design

Wide Variety of Materials Available

Custom Sizes/Designs

Stainless Steel Hardware and Mounting



Ratings

UC SERIES

Maximum Shell Pressure 250 psi

Maximum Tube Side Pressure 150 psi

Maximum Temperature 400° F

UCV SERIES

Maximum Shell Pressure
600, 800, 1000 250 psi
1200, 1700 150 psi

Maximum Tube Side Pressure 150 psi

Maximum Temperature 400° F

Materials UC/UCV Series

Tubes Copper

Tube Sheets Steel

Shell Steel/316L Stainless Steel (UCV)

Shell Connections Steel

Baffles Stainless Steel

End Bonnets Cast Iron

Mounting Brackets Steel

Gaskets Non-Asbestos Fiber/Nitrile Rubber

Nameplate Aluminum Foil

Materials USSC/USSCV Series

Tubes 316L Stainless Steel

Tube Sheets 316L Stainless Steel

Shell 316L Stainless Steel

Shell Connections 316L Stainless Steel

Baffles 316L Stainless Steel

End Bonnets 316L Stainless Steel

Mounting Brackets Steel

Gaskets Non-Asbestos Fiber/Nitrile Rubber

Nameplate Aluminum Foil

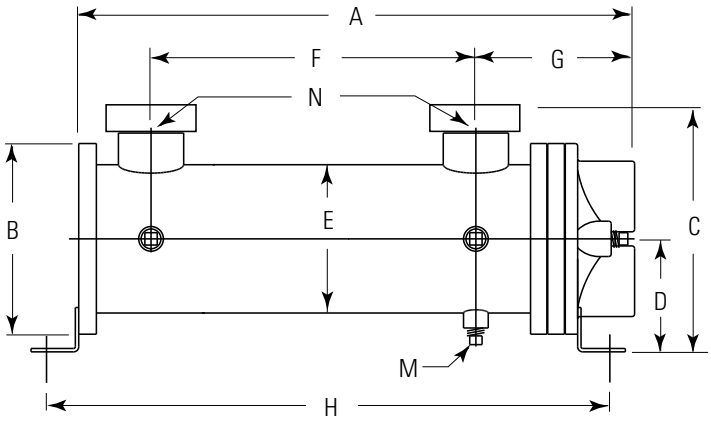
How to Order

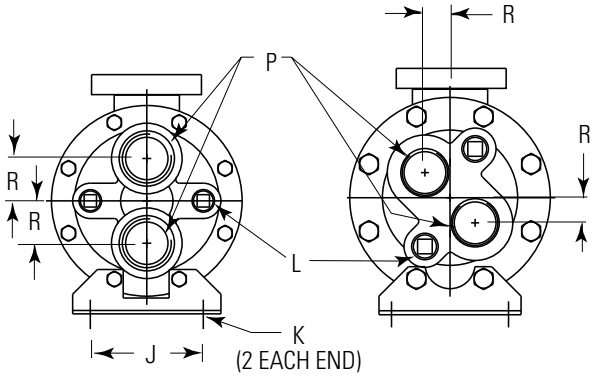
Model Series	Model Size Selected	Baffle Spacing	Tube Diameter	Tubeside Passes	Cooling Tube Material	End Bonnet Material	Tube Sheet Material	Zinc Anodes
UC/USSC **UCA/USSCA** **UCV/USSCV**				**T** - Two Pass **F** - Four Pass	**Blank** - Copper **CN** - CuNi **SS** - Stainless Steel	**Blank** - Cast Iron **B** - Bronze **SB** - Stainless Steel	**Blank** - Steel **W** - CuNi **S** - Stainless Steel	**Blank** - None **Z** - Zinc

UC/USSC = NPT Shell Connections; NPT Tube Connections
UCA/USSCA = ASME/ANSI Flange Shell Connections, NPT Tube Connections
UCV/USSCV = 1000 and Smaller: Inlet and Outlet NPT Shell Connections Rotated 180°, NPT Tube Side Connections
UCV/USSCV = 1200 and Larger: ASME/ANSI Flange Inlet and NPT Outlet Shell Connections Rotated 180°, NPT Tube Side Connections

Dimensions

UC Two Pass





All models except UC-800 & UC-1200 Series

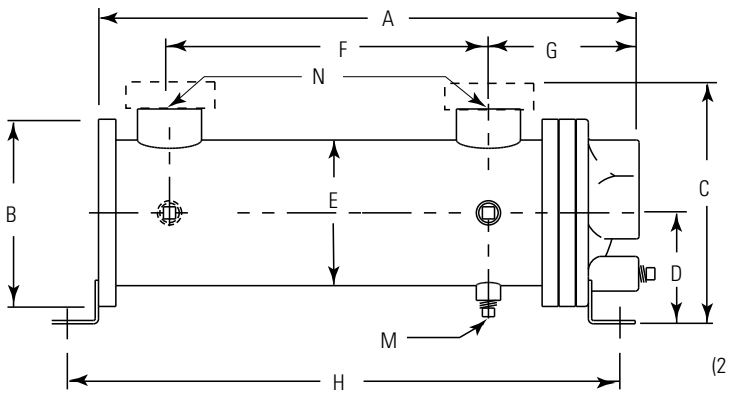
UC-800 & UC-1200 Series

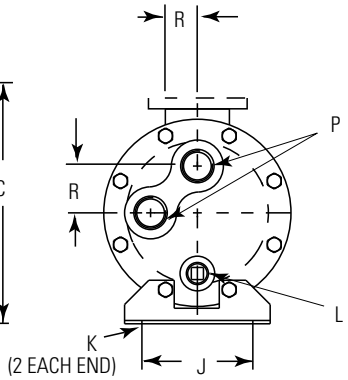
MODEL	A	B DIA	C NPT	C ASME* FLANGE	D	E DIA	F	G	H	J	K	L NPT	M NPT	N NPT	P NPT	R	FT² SURFACE AREA
612	17.22	4.50	5.38	6.75	2.75	3.25	11.25	4.03	17.66	3.25	.44 DIA	(2) .38	(3) .25	1.00	1.00	—	2.4
624	29.22						23.25		29.66							—	4.7
812	19.47	6.00	6.75	8.25	3.50	4.25	12.38	4.97	19.65	3.50	.44 DIA	(2) .38	(3) .25	1.50	1.25	0.75	4.0
824	31.47						24.38		31.65								7.9
836	43.47						36.38		43.65								11.9
1012	19.68	6.75	7.75	9.25	4.00	5.25	11.50	5.62	19.94	4.00	.50 x .75 SLOT	(2) .38	(3) .38	1.50	1.50	1.50	7.4
1024	31.68						23.50		31.94								14.5
1036	43.68						35.50		43.94								21.5
1218	26.22	7.75	8.75	10.38	4.50	6.25	17.38	5.89	26.12	5.00	.50 x .75 SLOT	(2) .50	(3) .38	2.00	2.00	1.10	15.3
1224	32.22						23.38		32.12								21.1
1236	44.22						35.38		44.12								31.3
1248	56.22						47.38		56.12								41.6
1724	34.69	10.50	11.58	13.00	5.75	8.62	23.50	7.81	34.27	7.00	.62 x .88 SLOT	(2) .50	(3) .38	3.00	2.50	2.25	47.7
1736	46.69						35.50		46.27								70.1
1748	58.69						47.50		58.27								92.5
1760	70.69						59.50		70.27								114.8

**150# ASME/ANSI Flange (Optional). NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.*

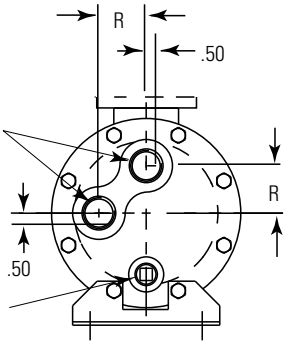
Dimensions

UC Four Pass





All models except UC-1700 Series



UC-1700 Series

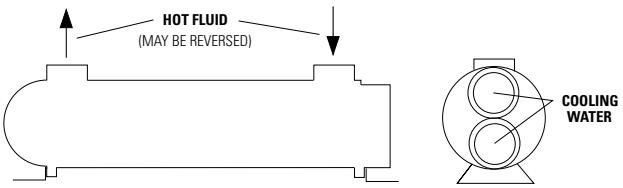
MODEL	A	B DIA	C NPT	C ASME* FLANGE	D	E DIA	F	G	H	J	K	L NPT	M NPT	N NPT	P NPT	R	FT² SURFACE AREA
612	17.20	4.50	5.38	6.75	2.75	3.25	11.25	4.01	17.66	3.25	.44 DIA	—	(3) .25	1.00	.75	1.00	2.4
624	29.20						23.25		29.66			—					4.7
812	19.47	6.00	6.75	8.25	3.50	4.25	12.00	4.97	19.65	3.50	.44 DIA	(2) .38	(3) .25	1.50	.75	1.25	4.0
824	31.47						24.00		31.65								7.9
836	43.47						36.00		43.65								11.9
1012	19.50	6.75	7.75	9.25	4.00	5.25	11.50	5.43	19.95	4.00	.50 x .75 SLOT	(2) .38	(3) .38	1.50	1.00	1.69	7.4
1024	31.50						23.50		31.95								14.5
1036	43.50						35.50		43.95								21.5
1218	26.22	7.75	8.75	10.38	4.50	6.25	17.38	5.89	26.12	5.00	.50 x .75 SLOT	(2) .38	(3) .38	2.00	1.50	2.00	15.3
1224	32.22						23.38		32.12								21.1
1236	44.22						35.38		44.12								31.3
1248	56.22						47.38		56.12								41.6
1724	34.69	10.50	11.58	13.00	5.75	8.62	23.50	7.81	34.27	7.00	.62 x .88 SLOT	(2) .38	(3) .38	3.00	2.00	2.50	47.7
1736	46.69						35.50		46.27								70.1
1748	58.69						47.50		58.27								92.5
1760	70.69						59.50		70.27								114.8

**150# ASME/ANSI Flange (Optional). NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.*

UC Applications

U-Tube Heat Exchangers allow the shell and tube bundle to expand and contract independently with temperature fluctuation. This reduces temperature dependent stresses so they are ideal in applications with large temperature differentials. Some typical examples for **UC** units include quench oil coolers, liquid to liquid heaters, and barrel oil coolers for plastic extrusion machines. The removable bundle design allows for easier cleaning of the shell side cavity when the bundle is removed.

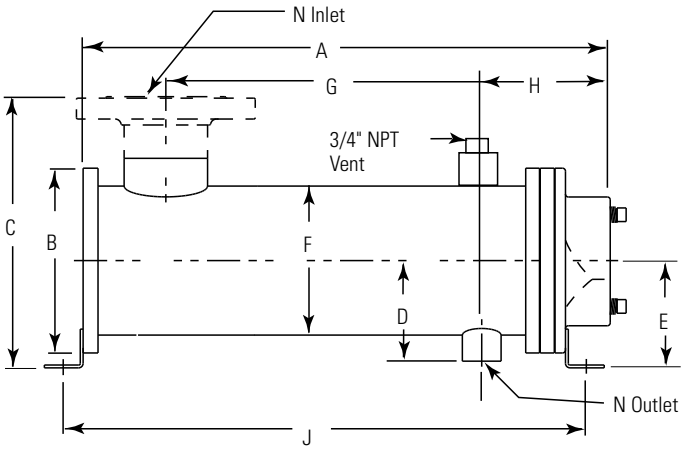
Piping Hook-up

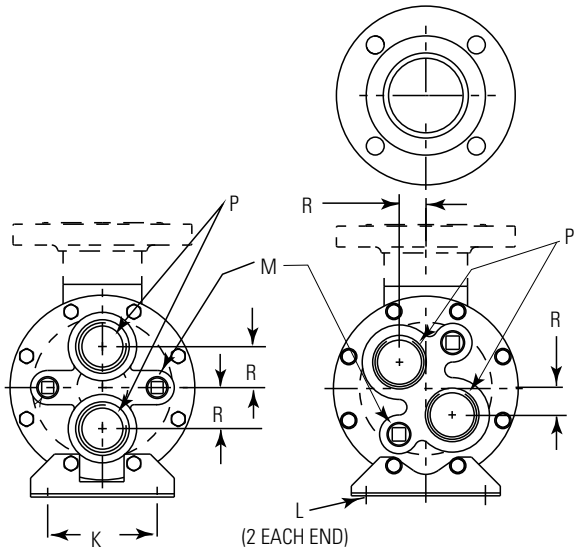


Specific applications may have different piping arrangements. Consult factory for assistance.

Dimensions

UCV Two Pass





All models except UCV-800 & UCV-1200 Series

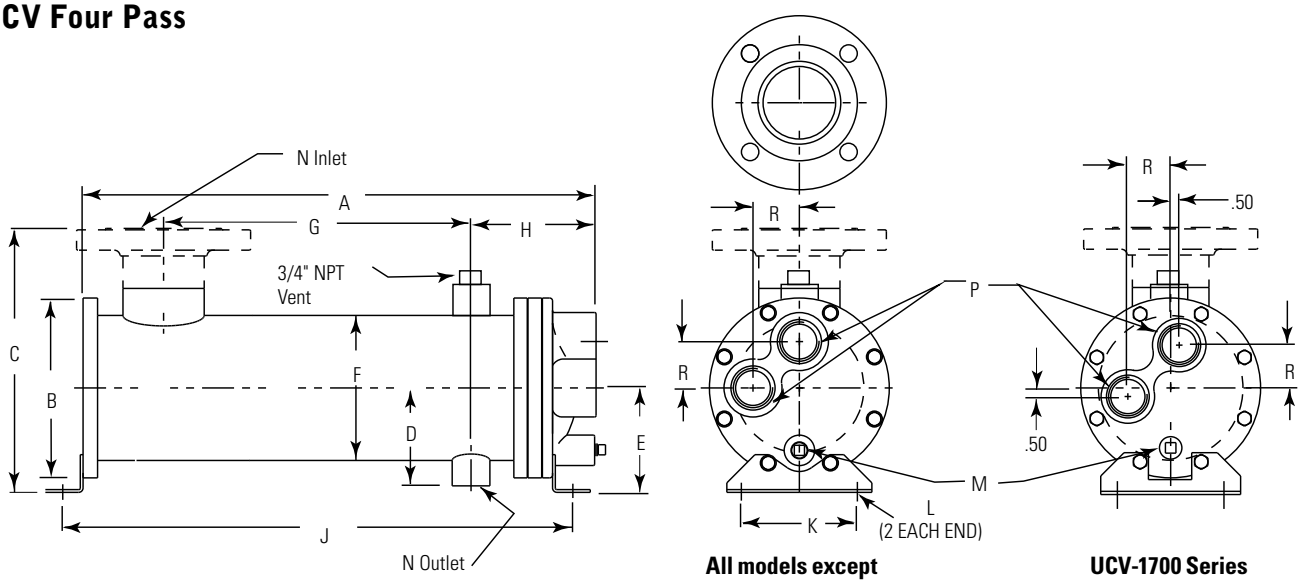
UCV-800 & UC-1200 Series

MODEL	A	B DIA	C	D	E	F DIA	G	H	J	K	L	M NPT	N INLET	N OUTLET	P NPT	R	FT² SURFACE AREA
612	17.22	4.50	5.25	2.62	2.75	3.25	11.00	4.00	17.66	3.25	.44 DIA	(2) .38	1.25	.75	1.00	—	2.4
624	29.22						23.00		29.66							—	4.7
812	19.47	6.00	6.75	3.15	3.50	4.25	12.00	4.60	19.65	3.50	.44 DIA	(2) .38	1.50	.75	1.25	0.75	4.0
824	31.47						24.00		31.65								7.9
836	43.47						36.00		43.65								11.9
1012	19.68	6.75	7.77	3.70	4.00	5.25	11.50	5.37	19.94	4.00	.50 x .75 SLOT	(2) .38	2.00	1.00	1.50	1.50	7.4
1024	31.68						23.50		31.94								14.5
1036	43.68						35.50		43.94								21.5
1218	26.22	7.75	11.38	4.22	4.50	6.25	17.38	5.38	26.12	5.00	.50 x .75 SLOT	(2) .50	3.00*	1.00	2.00	1.10	15.3
1224	32.22						23.38		32.12								21.1
1236	44.22						35.38		44.12								31.3
1248	56.22						47.38		56.12								41.6
1724	34.69	10.50	14.00	5.58	5.75	8.62	23.00	7.31	34.27	7.00	.62 x .88 SLOT	(2) .50	4.00*	1.50	2.50	2.25	47.7
1736	46.69						35.00		46.27								70.1
1748	58.69						47.00		58.27								92.5
1760	70.69						59.00		70.27								114.8

**150# ASME/ANSI Flange. NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.*

Dimensions

UCV Four Pass



All models except UCV-1700 Series

UCV-1700 Series

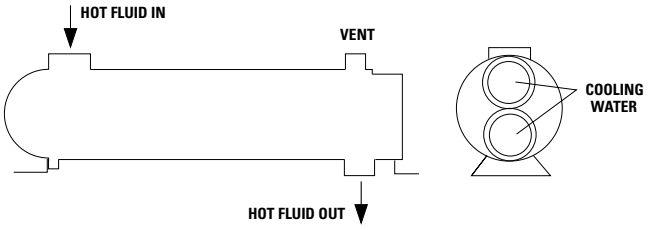
MODEL	A	B DIA	C	D	E	F DIA	G	H	J	K	L	M NPT	N INLET	N OUTLET	P NPT	R	FT² SURFACE AREA
612	17.20	4.50	5.25	2.62	2.75	3.25	11.00	3.98	17.66	3.25	.44 DIA	(2) .38	1.25	.75	.75	1.00	2.4
624	29.20						23.00		29.66								4.7
812	19.47	6.00	6.75	3.15	3.50	4.25	12.38	4.60	19.65	3.50	.44 DIA	(2) .38	1.50	.75	.75	1.25	4.0
824	31.47						24.38		31.65								7.9
836	43.47						36.38		43.65								11.9
1012	19.50	6.75	7.77	3.70	4.00	5.25	11.50	5.18	19.95	4.00	.50 x .75 SLOT	(2) .38	2.00	1.00	1.00	1.69	7.4
1024	31.50						23.50		31.95								14.5
1036	43.50						35.50		43.95								21.5
1218	26.22	7.75	10.38	4.22	4.50	6.25	17.38	5.38	26.12	5.00	.50 x .75 SLOT	(2) .38	3.00*	1.00	1.50	2.00	15.3
1224	32.22						23.38		32.12								21.1
1236	44.22						35.38		44.12								31.3
1248	56.22						47.38		56.12								41.6
1724	34.69	10.50	13.00	5.58	5.75	8.62	23.00	7.31	34.27	7.00	.62 x .88 SLOT	(2) .38	4.00*	1.50	2.00	2.50	47.7
1736	46.69						35.00		46.27								70.1
1748	58.69						47.00		58.27								92.5
1760	70.69						59.00		70.27								114.8

**150# ASME/ANSI Flange. NOTE: We reserve the right to make reasonable design changes without notice. Consult factory. All dimensions are inches.*

UCV Applications

U-Tube Heat Exchangers allow the shell and tube bundle to expand and contract independently with temperature fluctuation. This reduces temperature dependent stresses so they are ideal in applications with large temperature differentials. Some typical examples for **UCV** units include steam to liquid heaters, vapor condensers, and steam condensers. The removable bundle design allows for easier cleaning of the shell side cavity when the bundle is removed.

Piping Hook-up



Specific applications may have different piping arrangements. Consult factory for assistance.

Notes

STAINLESS STEEL CONSTRUCTION

Features

- **Stacked Plate**
- **Stainless Steel**
- **Copper Brazed**
- **Oil to Water Applications**
- **High Performance**
- **Compact Design**
- **SAE Connections**
- Corrosion Resistant Type 316 Stainless Steel Plates
- Mounting Studs Standard
- SAE Oil Connections, NPT Water Connections
- Optional Mounting Bracket
- Optional Nickel/Chrome Brazed Construction

ADDITIONAL MODELS AVAILABLE – please consult factory for more information

Ratings

Maximum Working Temperature 350° F at 450 psi*

Maximum Working Pressure 450 psi**

Test Pressure 600 psi

*Maximum working temperature can increase with derating of working pressure.

**Maximum working pressure can increase with a derating of working temperature.

Materials

Plate Material 316L Stainless Steel

Braze Material Copper – Standard
Nickel/Chrome – Optional

Stud Bolts 304 Stainless Steel

Front and Back Pressure Plates 304 Stainless Steel

Connectors 304 Stainless Steel

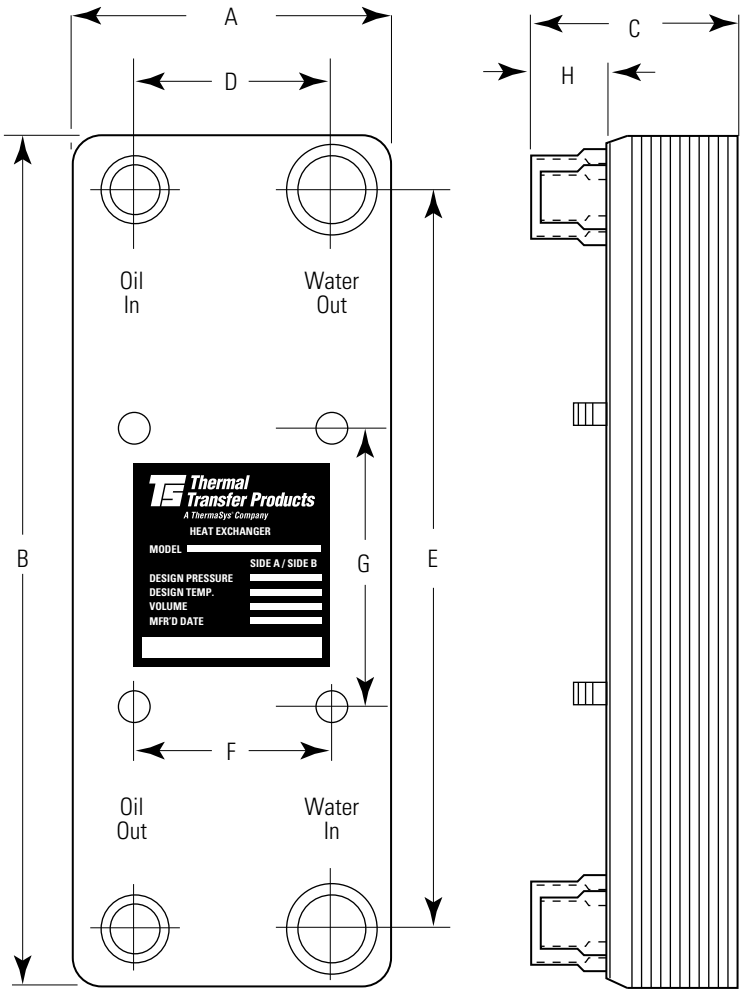
Foot Mounting Brackets 304 Stainless Steel

How to Order

BPS	–		–		–	
Model Series		Number of Plates		Model Size Selected 12 x 5 20 x 10		Options FB - Foot Mounting Brackets

BPS - SAE Oil Connections, NPT Water

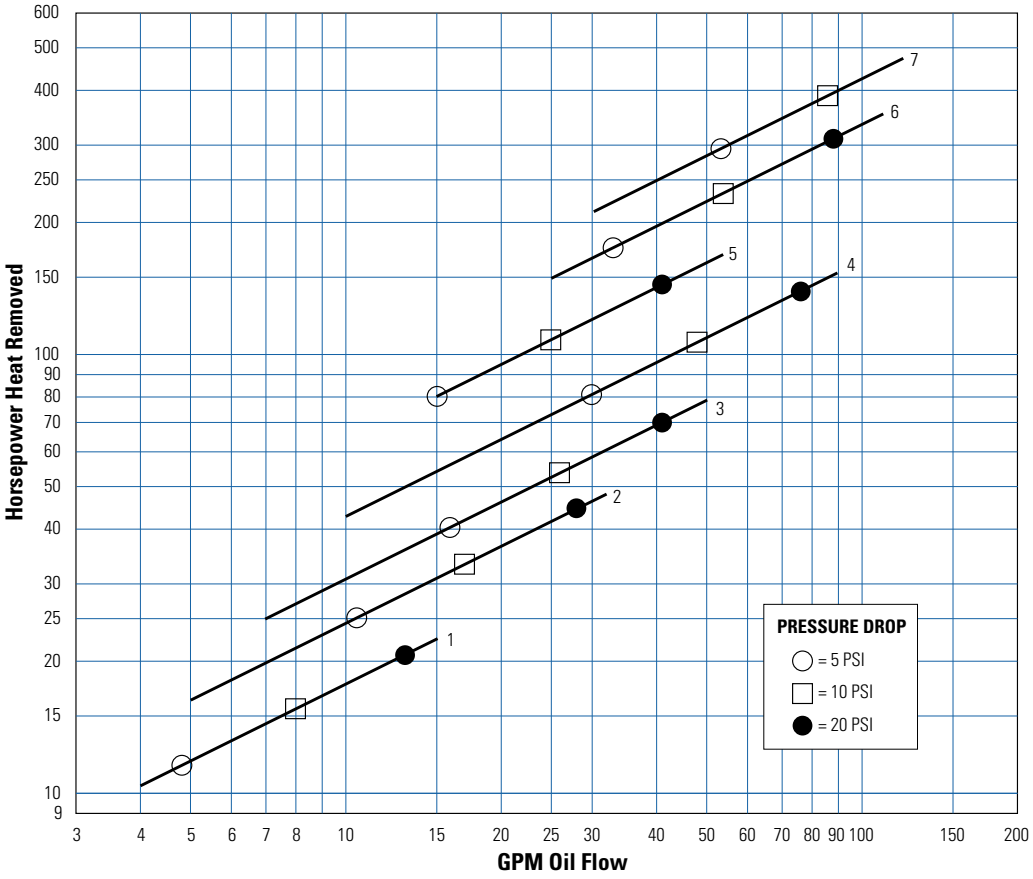
Dimensions



Model	A	B	C	D	E	F	G	H		Oil SAE	Water NPT	Net Wt. lbs.
								SAE	NPT			
BPS-12-12x5	4.9	12.2	2.61	2.7	9.9	2.5	3.5	1.25	1.12	#12	3/4	8
BPS-24-12x5			3.75									12
BPS-36-12x5			5.00					1.50	1.25	#20	1-1/4	16
BPS-70-12x5			8.19									27
BPS-24-20x10	9.8	20.3	3.99	6.5	17.0	4.0	5.5	1.75	1.38	#24	1-1/2	39
BPS-50-20x10			6.44									68
BPS-80-20x10			9.25									100

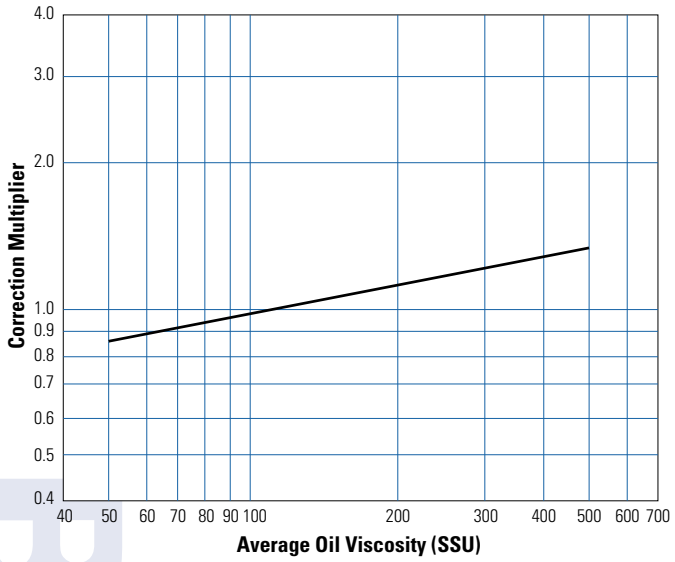
NOTE: We reserve the right to make reasonable design changes without notice. Dimensions are in inches.
SAE Connection Thread Forms: #12 SAE = 1-1/16 - 12UN-2B #20 SAE = 1-5/8 - 12UN-2B #24 SAE = 1-7/8 - 12UN-2B
NPT Connections are internal threads (female).

Performance Curves

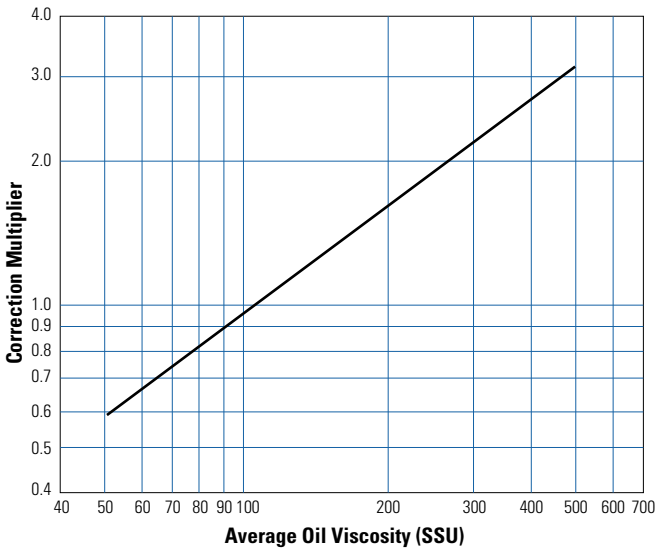


Model
1. BPS-12-12X5
2. BPS-24-12X5
3. BPS-36-12X5
4. BPS-70-12X5
5. BPS-24-20X10
6. BPS-50-20X10
7. BPS-80-20X10

Performance Correction



Pressure Drop Correction



Selection Procedure

Performance Curves are based on 100SSU oil at 40°F approach temperature (125°F oil leaving cooler, 85°F water entering cooler), 2:1 oil: water ratio (1 GPM water flow for each 2 GPM oil flow).

Step 1 **Determine Curve Horsepower Heat to be Removed.**

$$\text{Horsepower heat load} \times \frac{40}{\text{Oil leaving cooler °F Minus water entering cooler °F}} \times \text{Performance Correction Multiplier} = \text{Curve Horsepower Heat to be Removed}$$

Step 2 **Determine Actual Oil Pressure Drop.** Pressure drop shown on curve x Pressure drop correction multiplier = Actual pressure drop.

Oil Temperature

Oil coolers can be selected by using entering or leaving oil tempertures.

Typical operating temperature ranges are:

Hydraulic Motor Oil	110°F - 130°F
Hydrostatic Drive Oil	130°F - 180°F
Lube Oil Circuits	110°F - 130°F
Automatic Transmission Fluid	200°F - 300°F

Desired Reservoir Temperature

Return Line Cooling: Desired temperature is the oil temperature leaving the cooler. This will be the same temperature that will be found in the reservoir.

Off-Line Recirculation Cooling Loop: Desired temperature is the temperature entering the cooler. In this case, the oil temperature change must be determined so that the actual oil leaving temperature can be found. Calculate the oil temperature change (Oil △T) with this formula:

Oil △T=(BTU's/Hr.)/GPM Oil Flow x 210).

To calculate the oil leaving temperature from the cooler, use this formula:

Oil Leaving Temperature = Oil Entering Temperature - Oil △T.

This formula may also be used in any application where the only temperature available is the entering oil temperature.

Oil Pressure Drop: Most systems can tolerate a pressure drop through the heat exchanger of 20 to 30 PSI. Excessive pressure drop should be avoided. Care should be taken to limit pressure drop to 5 PSI or less for case drain applications where high back pressure may damage the pump shaft seals.

STAINLESS STEEL CONSTRUCTION

Features

- **Stacked Plate**
- **Stainless Steel**
- **Copper Brazed**
- **Oil to Water Applications**
- **High Performance**
- **Compact Design**
- **NPT Connections**
- Oil Cooling
- Solvent Condensing
- Water Cooling/Heating
- Refrigeration Service
- Gas to Gas
- Gas to Liquid
- Optional Nickel/Chrome Brazed Construction

ADDITIONAL MODELS AVAILABLE – please consult factory for more information

Ratings

Maximum Working Temperature 350° F at 450 psi*

Maximum Working Pressure 450 psi**

Test Pressure 600 psi

*Maximum working temperature can increase with derating of working pressure.

**Maximum working pressure can increase with a derating of working temperature.

Materials

Plate Material 316L Stainless Steel

Braze Material Copper – Standard
Nickel/Chrome – Optional

Stud Bolts 304 Stainless Steel

Front and Back Pressure Plates 304 Stainless Steel

Connectors 304 Stainless Steel

Foot Mounting Brackets 304 Stainless Steel

Model Coding

Example Model No.

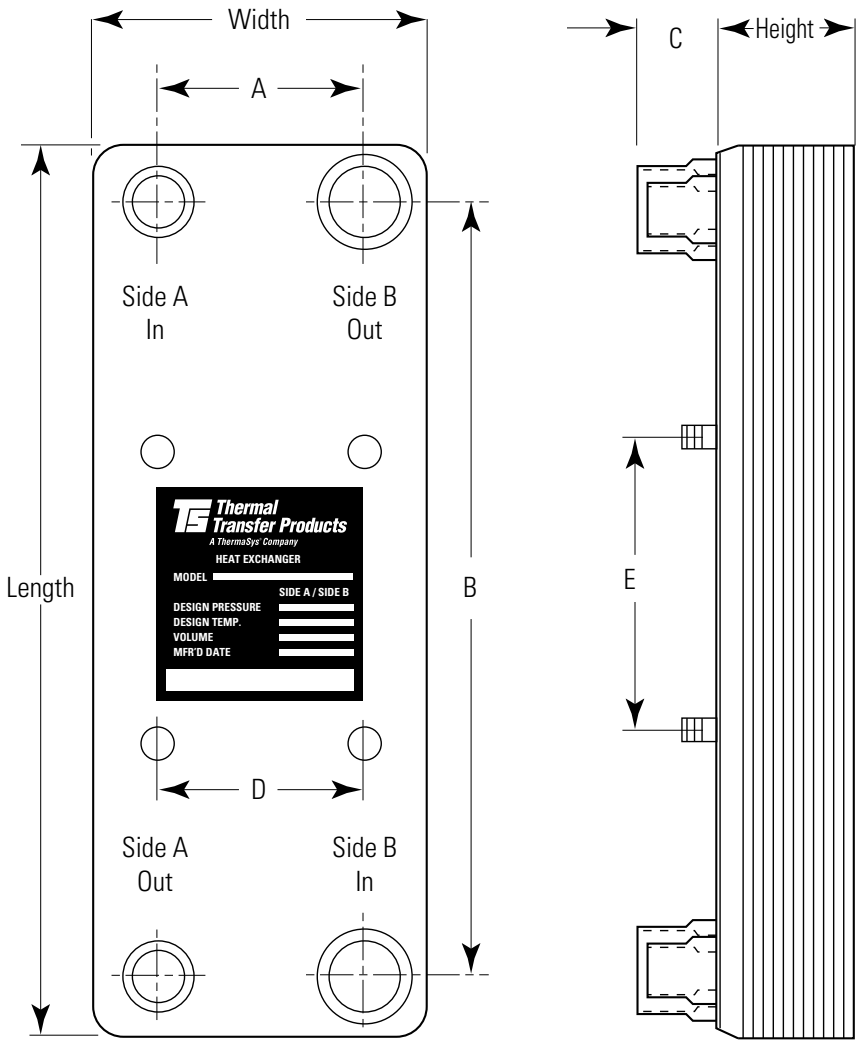
BP	-	20	-	12x5	-	5/8" Sw	-	7/8" Sw.	-	1" NPT	-	1" NPT	-	FB
Brazed Plate Series		Number of Plates		Plate Size (inches)		Side A "In"		Side A "Out"		Side B "In"		Side B "Out"		Foot Bracket (optional mounting bracket)

See dimension page for connection availability

How to Order

BP	–		–		–		–		–		–		–	
Model Series		**Number of Plates**		**Model Size Selected** 12 x 5 20 x 5 20 x 10		**Side A "In"**		**Side A "Out"**		**Side B "In"**		**Side B "Out"**		**Options** FB - Foot Mounting Brackets

Dimensions



Model	D	E
12 x 5	2.5"	3.5"
20 x 5	2.5"	5.5"
20 x 10	4.0"	5.5"

Model	Stud Bolt Length
12 x 5	3/8-16 x 7/8"
20 x 5	
20 x 10	1/2-13 x 1-1/8"

Connection Type	C Dimension
1/2, 5/8, 7/8 ID Sweat & 3/4" NPT	1.125"
1-1/8 ID Sweat & 1" NPT	1.250"
1-3/8 ID Sweat & 1-1/4" NPT	1.375"
1-5/8 ID Sweat & 1-1/2" NPT	1.500"
2-1/8 ID Sweat & 2" NPT	1.750"
2-5/8 ID Sweat & 2-1/2" NPT	2.000"

Model	Dimensions (in.)					Connections	Weight Approx. (lbs)
	L	W	H	A	B		
BP 12 x 5	12.2	4.9	.094 x #plates + .36	2.7	9.9	Sweat: 5/8", 7/8", 1-1/8", 1-3/8" ID Threaded: 3/4", 1", 1-1/4" NPT	.34 x #plates + 3.0
BP 20 x 5	20.3	5.0	.094 x #plates + .36	2.8	18.1	Sweat: 5/8", 7/8", 1-1/8", 1-3/8" ID Threaded: 1", 1-1/4" NPT	.52 x #plates + 4.2
BP 20 x 10	20.3	9.8	.094 x #plates + .36	6.5	17.0	Sweat: 7/8", 1-1/8", 1-3/8" 1-5/8" 2-1/8", 2-5/8" ID Threaded: 1-1/2", 2",2-1/2" NPT	.80 x #plates + 9.8

Notes: When ordering, add description of all four connections (sweat or Male Pipe Thread MPT and size).
*Some applications may require that the **In** and **Out** connections be reversed. Consult factory for recommendations.*

STAINLESS STEEL CONSTRUCTION

Features

- **Stacked Plate**
- **Stainless Steel**
- **Copper Brazed**
- **Oil to Water Applications**
- **High Performance**
- **Compact Design**
- **Water Chilling**
- **Lower Refrigerant Charge**
- Specifically Designed for DX Water Chilling Applications from 1 to 40 Tons
- Unique DX Distribution Tube Assures Proper Gas Distribution and Peak Performance
- Type 316 Stainless Steel Plates
- Copper Brazed (Optional Nickel Brazing Compound)
- Optional Foot Mounting Bracket
- Optional Nickel/Chrome Brazed Construction

Ratings

Maximum Working Temperature 350° F at 450 psi*

Maximum Working Pressure 450 psi**

Test Pressure 600 psi

*Maximum working temperature can increase with derating of working pressure.

**Maximum working pressure can increase with a derating of working temperature.

Materials

Plate Material 316L Stainless Steel

Braze Material Copper – Standard
Nickel/Chrome – Optional

Stud Bolts 304 Stainless Steel

Front and Back Pressure Plates 304 Stainless Steel

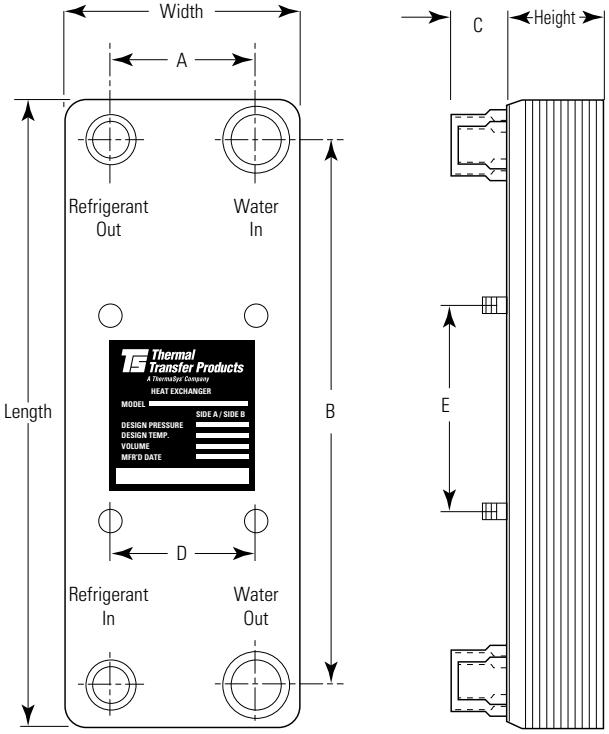
Connectors 304 Stainless Steel

Foot Mounting Brackets 304 Stainless Steel

How to Order

BPCH	–		–		–		–		–		–		–	
Model Series		**Number of Plates**		**Model Size Selected** 12 x 5 20 x 5 20 x 10		**Side A "In"**		**Side A "Out"**		**Side B "In"**		**Side B "Out"**		**Options** FB - Foot Mounting Brackets

Dimensions



Model	D	E
12 x 5	2.5"	3.5"
20 x 5	2.5"	5.5"
20 x 10	4.0"	5.5"

Model	Stud Bolts
12 x 5	Optional 3/8 - 16 x 7/8"L
	Optional 2 - 5 Tons
20 x 5	Standard 7.5 - 15 Tons
	3/8 - 24 x 7/8"L
20 x 10	Standard 1/2 - 13 x 7/8"L

Connection Type	C Dimension
1/2, 5/8, 7/8 ID Sweat & 3/4" NPT	1.125"
1-1/8 ID Sweat & 1" NPT	1.250"
1-3/8 ID Sweat & 1-1/4" NPT	1.375"
1-5/8 ID Sweat & 1-1/2" NPT	1.500"
2-1/8 ID Sweat & 2" NPT	1.750"
2-5/8 ID Sweat & 2-1/2" NPT	2.000"

Waterside Pressure Drop

Model	2 GPM/ton	2.4 GPM/ton	3 GPM/ton
BPCH 1A thru BPCH 5A	.8 PSI	1.6 PSI	1.9 PSI
BPCH 2 thru BPCH 5	2.7 PSI	3.8 PSI	5.6 PSI
BPCH 7-1/2 thru BPCH 15B	2.7 PSI	3.9 PSI	5.7 PSI
BPCH 10 thru BPCH 40	2.6 PSI	3.8 PSI	5.9 PSI

12" x 5" Models

Model	Tons	Width	Length	Height	A	B	Refrig Out	Refrig In	Water	Wt (lbs)
BPCH 1A	1	4.9	12.2	1.3	2.7	9.9	5/8 ID - 7/8 ID	5/8 ID - 7/8 ID	7/8 ID	5
BPCH 1-1/2A	1.5			1.5						6
BPCH 2A	2			1.9						8
BPCH 3A	3			2.6						10
BPCH 4A	4			3.2			7/8 ID			12
BPCH 5A	5			4.2						14

20" x 5" Models

Model	Tons	Width	Length	Height	A	B	Refrig Out	Refrig In	Water	Wt (lbs)
BPCH 1-1/2	2	5.0	20.3	1.1	2.8	18.1	5/8 ID - 7/8 ID	5/8 ID - 7/8 ID	7/8 ID	8
BPCH 2	3			1.3						9
BPCH 2-1/2	2.5			1.5						10
BPCH 3	3			1.7						12
BPCH 3-1/2	3.5			1.9						13
BPCH 4	4			2.3			7/8 ID		1-1/8 ID	14
BPCH 5	5			2.6						16
BPCH 7-1/2	7.5			3.8			1-1/8 ID	7/8 ID		22
BPCH 10B	10			5.1			1-3/8 ID		1-3/8 ID	28
BPCH 12B	12.5			6.0						34
BPCH 15B	15			7.0						40

20" x 10" Models

Model	Tons	Width	Length	Height	A	B	Refrig Out	Refrig In	Water	Wt (lbs)
BPCH 10	10	9.8	20.3	2.6	6.5	17.0	1-3/8 ID	7/8 ID	1-5/8 ID	34
BPCH 12	12.5			3.2						40
BPCH 15	15			3.7				7/8 ID*		45
BPCH 20	20			5.1			1-5/8 ID			57
BPCH 25	25			6.0				1-1/8 ID*	2-1/8 ID	68
BPCH 30	30			7.0			2-1/8 ID			81
BPCH 35	35			8.8					2-5/8 ID	92
BPCH 40	40			9.8						104

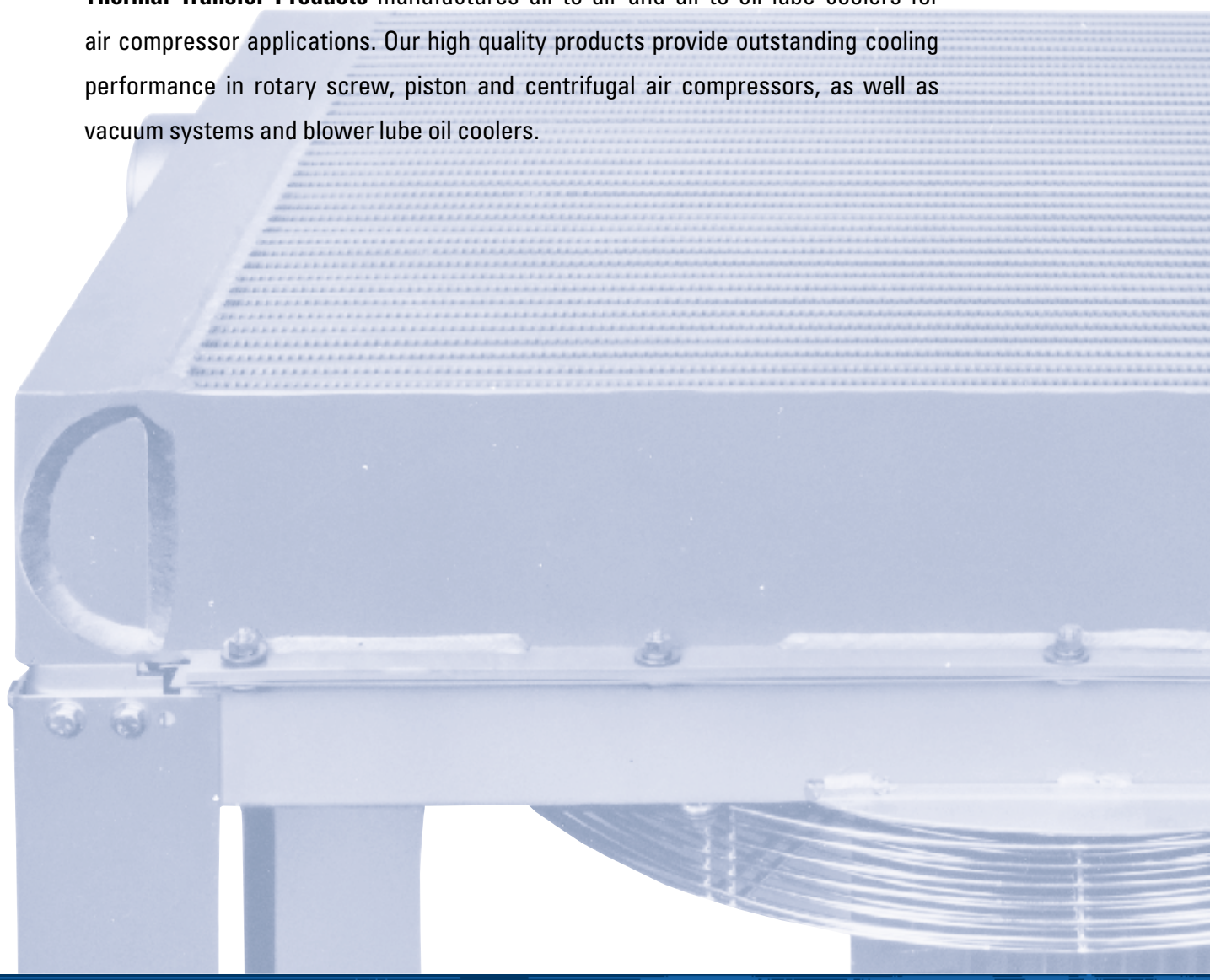
*Notes: Nominal tons – 12,000 BTUH per ton, 54°F EWT, 44°F LWT, 35°F Evap. Temp., 10°F Superheat, 2.4 gpm per ton, R-22. For Glycol, special fluids or design conditions other than listed above, please contact the factory for special computer selection. *Add .75" to height of refrigerant in connection.*

COMPRESSED AIR COOLING

COMPRESSED AIR AFTERCOOLERS & OIL COOLER

AIR COOLED & WATER COOLED

Thermal Transfer Products manufactures air-to-air and air-to-oil lube coolers for air compressor applications. Our high quality products provide outstanding cooling performance in rotary screw, piston and centrifugal air compressors, as well as vacuum systems and blower lube oil coolers.



3

COPPER TUBE CONSTRUCTION

AIR COOLED

Compressed Air Aftercoolers

UPA Series Low SCFM capacity, horizontal or vertical fan air flow

AA Series Medium SCFM capacity, horizontal air flow, optional TEFC motor(s) and weatherproof junction boxes

Belt Guard Aftercoolers M Series with rotated ports for easier condensate removal and copper tube construction

Belt Guard Aftercoolers BGA Series brazed aluminum construction in a compact, energy efficient design

WATER COOLED

Compressed Air & Gas Aftercoolers

AB Series Single pass, 180° rotated shell ports, oversized air connections for low pressure drops

C Series Low cost, low-to-high flow applications, see Section 2

BRAZED ALUMINUM CONSTRUCTION

Industrial Application

AOL Series Industrial duty, very high flows, very high heat removal, see Section 1

AHP(H) Series High SCFM capability, vertical or horizontal flow, aluminum core, optional air motors

ACOC(H) Series Used to convert water cooled screw compressors to air cooled, vertical or horizontal air flow, aluminum core, free standing, combines oil cooler and aftercooler into common core

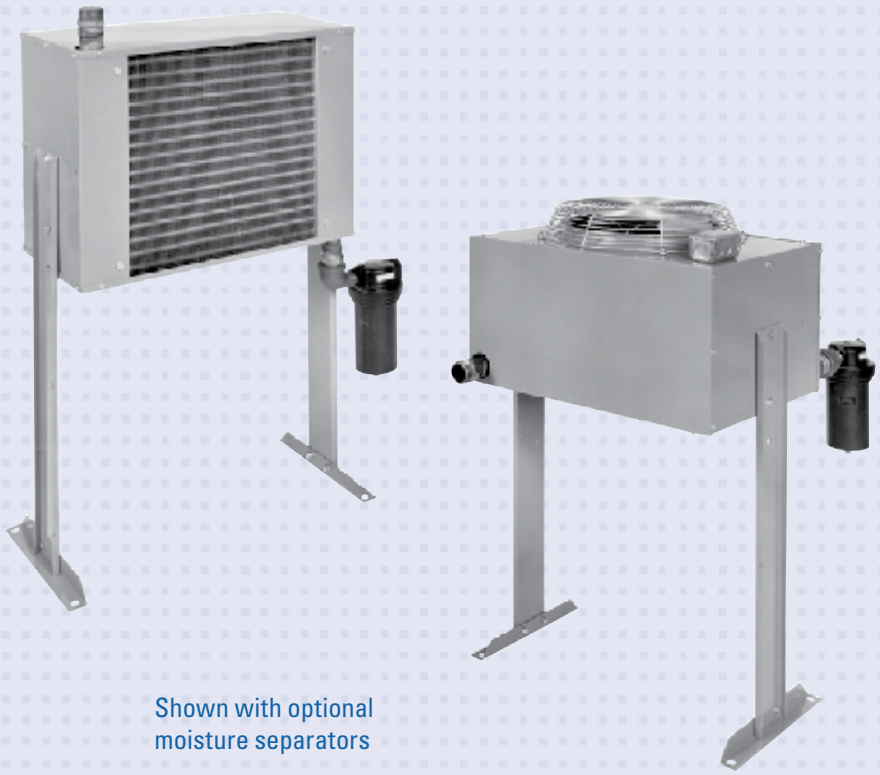
Thermal Transfer Products
A ThermaSys® Company

a global leader in manufacturing highly engineered heat transfer products

COPPER TUBE CONSTRUCTION

Features

- **Full Line of Sizes and Features**
- **Energy Efficient**
- **High Performance**
- **Low flows to 100 CFM**
- Floor or Suspended Mounting
- Lightweight, may be Shipped UPS
- Ratings Based on Comprehensive Testing
- Attractive, Durable Baked Enamel Finish
- Floor or Suspended Mounting
- Detachable Legs (shipped unattached)



Shown with optional moisture separators

Ratings

Maximum Operating Pressure 250 PSIG

Maximum Operating Temperature 350° F

Materials

Cabinet Steel with Baked Enamel Finish

Core Aluminum Fins on Copper Tubes

Fan Heave Gauge Aluminum with Steel Hub

Motor Open Vented

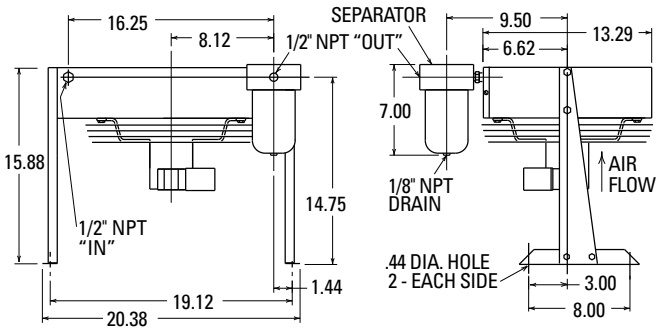
Fan Guard Zinc Chromate Plated Steel

How to Order

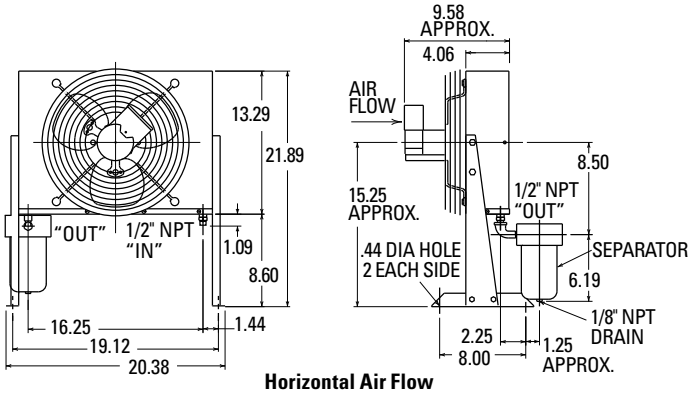
UPA	–		–	
Model Series UPA		**Model Size Selected**		**Specify Motor Required** 0 - No Motor 1 - Single Phase 60 Hz ODP 115 Volt

Dimensions

Models UPA-20 & UPA-35

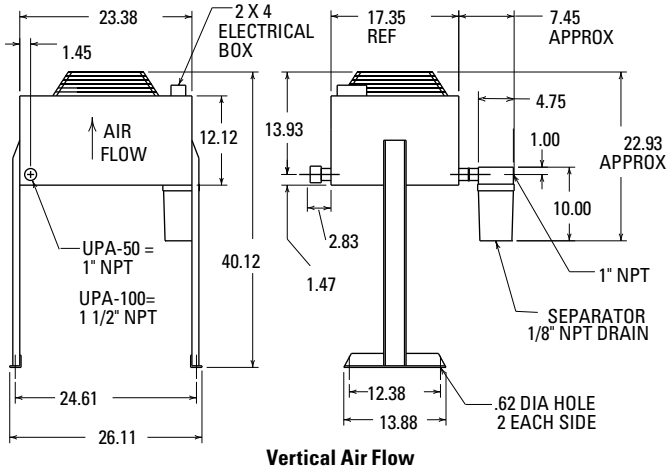


Vertical Air Flow

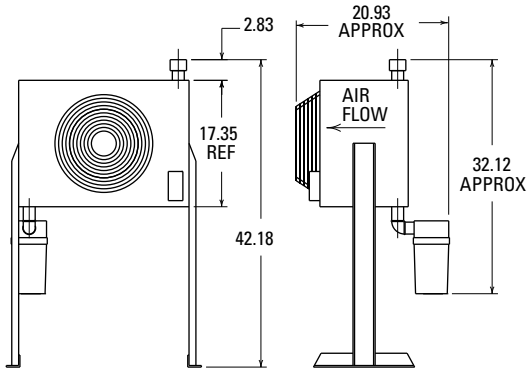


Horizontal Air Flow

Models UPA-50 & UPA-100



Vertical Air Flow



Horizontal Air Flow

Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

Capacity Selection Chart Max. SCFM @ 5, 10, 15 and 20°F Approach

Inlet Temp. °F		150				200				250				300				350				Recommended Optional Separator Model Number
Approach Temp. °F		5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	
Model Number	UPA-20	17	35*	35*	35*	11	22	35	35*	8	16	20	35	6	12	19	26	5	10	15	21	S-50M or AD
	UPA-35	29	43*	43*	43*	17	36	43*	43*	12	27	35	42*	10	20	31	42*	8	16	26	35	
	UPA-50	43	72	72*	72*	28	50	70	72*	22	35	50	70	18	32	45	57	15	28	39	50	S-100M or AD
	UPA-100	95	125*	125*	125*	66	111	125*	125*	52	88	100	125*	44	74	100	125	38	64	86	108	

Above specifications are based on 80 to 125 PSIG operating pressures. Maximum pressure drop, less than 3 psi.
A flexible metal hose must be properly installed between the compressor and aftercooler to validate warranty.
**Maximum ratings restricted by pressure drop, actual thermal capacities are higher.*

Electric Motor & Fan Data

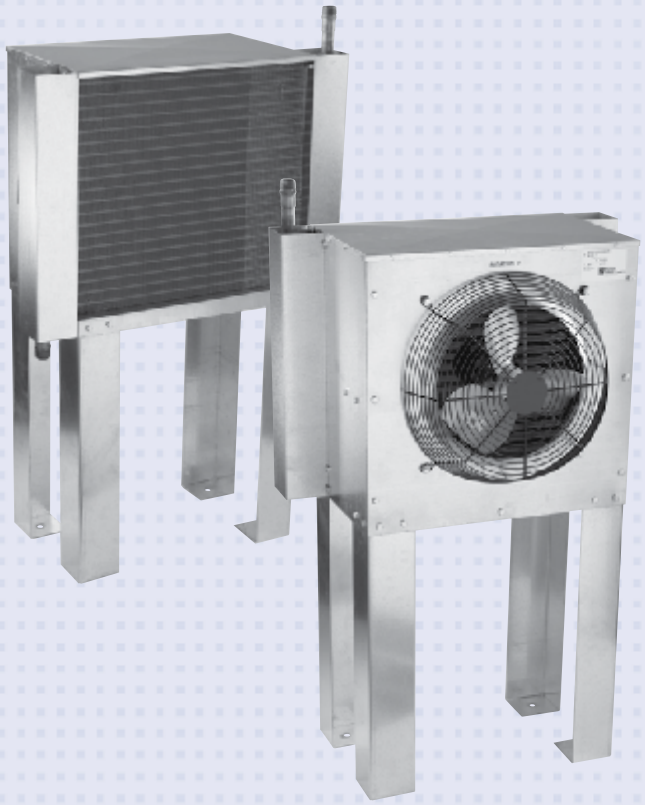
Model	Fan CFM	Motor H.P.	Voltage	Phase	Full Load Amps	Hz	RPM	Nema Frame	Thermal Overload	Approx. Shipping Weight (Lbs.)
UPA-20	615	1/12	115/230	1	2.4/1.2	60	1550	Custom	Yes	25
UPA-35										27
UPA-50	945				2.7/1.4	50	1300			61
UPA-100										67

Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.

COPPER TUBE CONSTRUCTION

Features

- **Full Line of Sizes and Features**
- **Energy Efficient**
- **High Performance**
- **Medium Flows 80-300 CFM**
- Horizontal Air Flow
- Optional Weatherproof Junction Box
- Floor or Suspended Mounting
- Optional TEFC motor(s)
- Ratings Based on Comprehensive Testing
- Wired for Single Point External Connection
- Detachable Legs (shipped unattached)



Ratings

Maximum Operating Pressure 250 psig

Maximum Operating Temperature 350° F

Materials

Cabinet Galvanized Steel

Core Aluminum Fins on Copper Tubes

Fan Heave Gauge Aluminum with Steel Hub

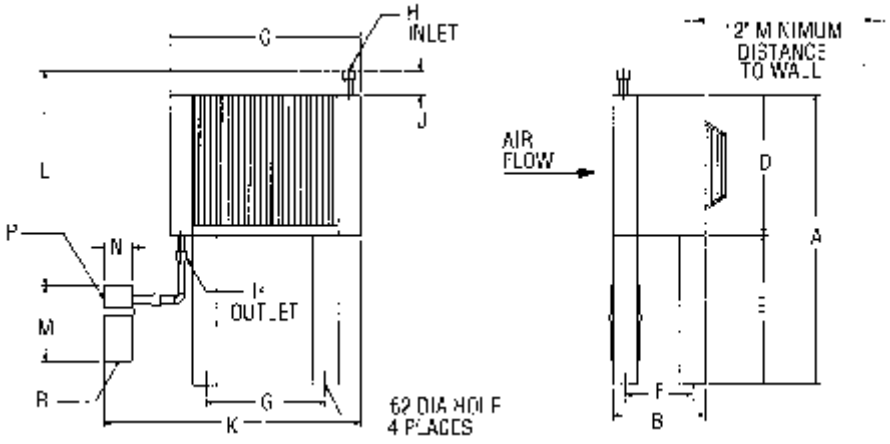
Motor Open Vented

Fan Guard Steel with Baked Enamel Finish

How to Order

AA	–		–	
Model Series AA		**Model Size Selected**		**Specify Motor Required** 0 - No Motor 1 - Single Phase 60 Hz ODP 115 Volt 2 - Single Phase 60 Hz TEFC 115/208-230 Volt 3 - Three Phase 60 Hz TEFC 208-230/460 Volt 5 - Air Motor

Dimensions



Model	A	B	C	D Approx	E	F	G	H NPT	J	K* Approx	L* Approx	Optional Separator M	Optional Separator N	Optional Separator NPT	Optional Separator R	Recommended Optional Separator Model Number
AA-50	46.50	14.75	30.50	22.50	24.00	10.75	19.09	1.00	4.00	41.12	34.50	10.00	4.62	1	1/4	S-100M or AD
AA-80								1.50			35.00					
AA-120			43.50				32.09			54.20	37.10	12.10	4.70	1		S-200M
AA-150											36.60					
AA-240	49.50		47.63	25.50				2.00		58.33	40.60			1-1/2		S-300M
AA-300	55.50		51.68	31.50			36.09			62.38	49.60					

Note: We reserve the right to make reasonable design changes without notice. All Dimensions are in inches.

Capacity Selection Chart Max. SCFM @ 5, 10, 15 and 20°F Approach

Inlet Temp. °F		150				200				250				300				350				Recommended Optional Separator Model Number
Approach Temp. °F		5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	
Model Number	AA-50	34	58	79	99	25	43	59	74	21	36	50	62	18	31	42	52	16	27	38	47	S-100M or AD
	AA-80	50	87	119	150	40	69	94	117	34	59	80	100	30	52	71	89	28	47	65	82	
	AA-120	81	138	190	235	61	105	142	177	51	87	120	150	43	75	102	127	40	69	94	116	S-200M
	AA-150	92	160	220	270	73	125	172	215	63	110	150	187	55	95	130	160	50	86	120	148	
	AA-240	160	275	380	425*	120	207	285	355	100	175	240	300	84	145	204	250	78	135	185	231	
	AA-300	184	318	440	480*	145	250	345	430	125	217	300	375	110	190	257	320	100	175	240	300	S-300M

Above specifications are based on 80 to 125 PSIG operating pressures.
Maximum pressure drop, less than 3 psi. A flexible metal hose must be properly installed between the compressor and aftercooler to validate warranty.
**Maximum ratings restricted by pressure drop, actual thermal capacities are higher.*

Electric Motor & Fan Data

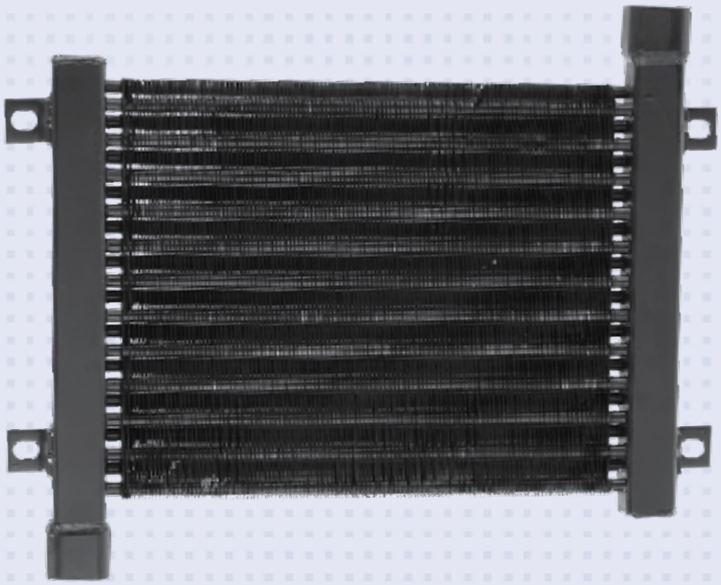
Model	CFM	Motor H.P.	Standard Motor (ODP) Voltage	Standard Motor (ODP) Full Load Amps/Motor	Optional Motor (TEFC) Voltage	Optional Motor (TEFC) Full Load Amps/Motor	Optional Motor (TEFC)* Voltage	Optional Motor (TEFC)* Full Load Amps/Motor	Optional Air Motor PSI(1)	Optional Air Motor CFM(2)	Approx. Shipping Overload (Lbs.)
AA-50	1375	1/4	115/1/60	7.2	115/208 230/1/60	5/2.6-2.5	208-230/ 460/3/60	1.4-1.3/.65	50	13	110
AA-80											120
AA-120	2450										140
AA-150	2350										145
AA-240	4600	1/4(2)									200
AA-300	4700										300

Standard Motor(s) = 1600 RPM, Custom Frame, Equipped with Thermal Overload. Optional Motor(s) = 1725 RPM, Nema 48 Frame, No Thermal Overload.
Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.
****3 phase motors available in 50Hz. Reduce performance by 10%***
(1) Air inlet to motor must be regulated to this pressure.
(2) CFM (Free Air) consumption of the air motor. Lubrication = one drop of oil for every 50-75 CFM of air going through the motor. Use detergent SAE #10 oil. Filter, regulator and lubricators for the air motors are required, but not included.

COPPER TUBE CONSTRUCTION

Features

- **Utilizes Air Flow from Belt Guard on Recip Compressor**
- **Easy to Install**
- **Rugged Construction**
- **Solid Performance**
- Bolt directly on the existing belt guard (some additional support may be required)
- All steel manifolds with sturdy copper tubes and aluminum fins
- Unique turbulator inside each cooling tube assures maximum performance in a compact size



Ratings

Maximum Operating Pressure 300 psi
Maximum Operating Temperature 350° F

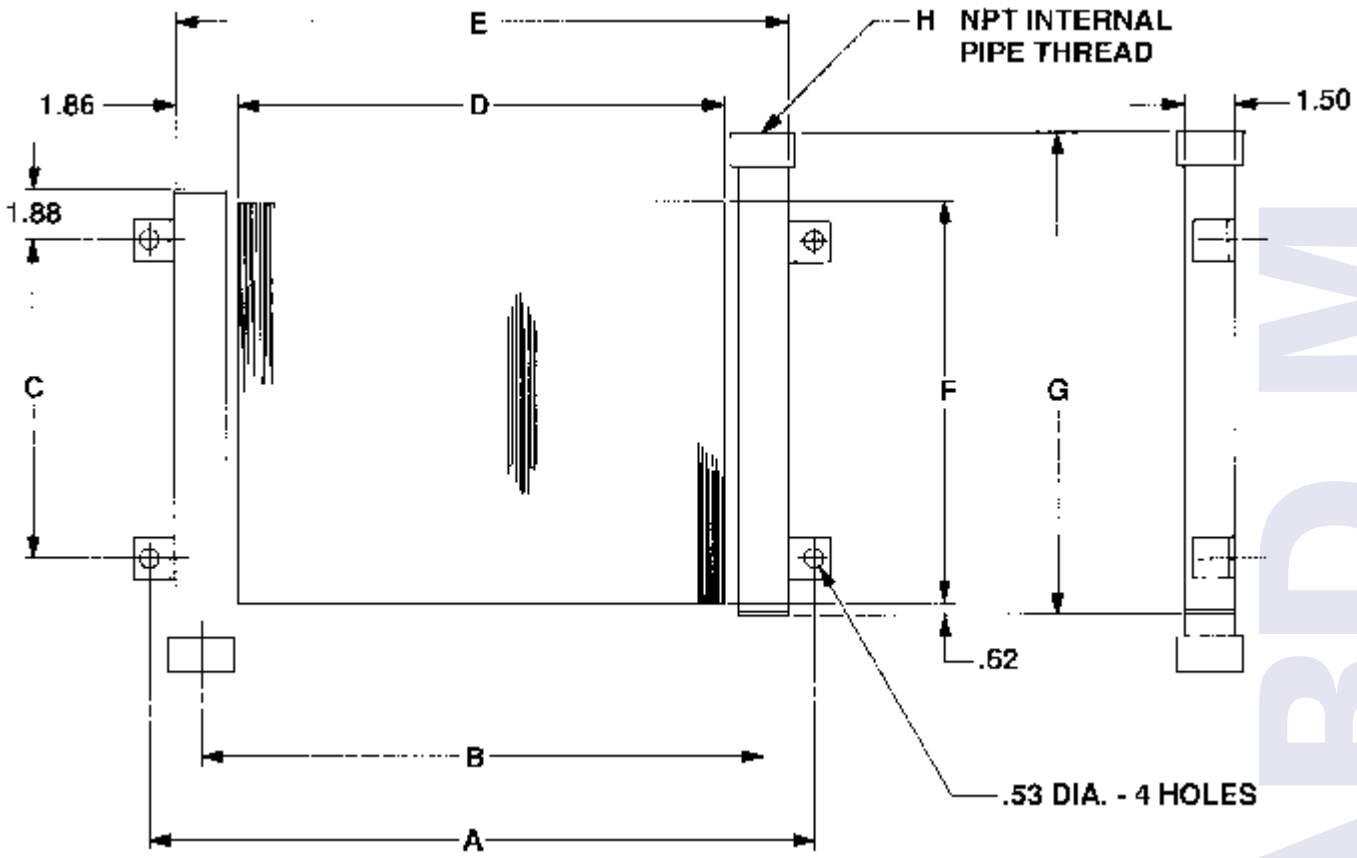
Materials

Tubes Copper
Fins Aluminum
Turbulators Steel
Manifolds Steel

How to Order

M	–	
Model Series		Model Size Selected
M		15-76946 20-76785 25-76878 30-76941

Dimensions



Model No.	A	B	C	D	E	F	G	H N.P.T.
M-15-76946	19.72	16.72	5.50	14.50	18.22	8.00	10.62	1.00
M-20-76785	19.72	16.72	9.50	14.50	18.22	12.00	14.62	1.00
M-25-76878	25.72	22.72	15.50	20.50	24.22	18.00	20.62	1.00
M-30-76941	24.72	21.72	21.50	19.50	23.22	24.00	26.56	1.25

All dimensions are inches. We reserve the right to make reasonable design changes without notice.

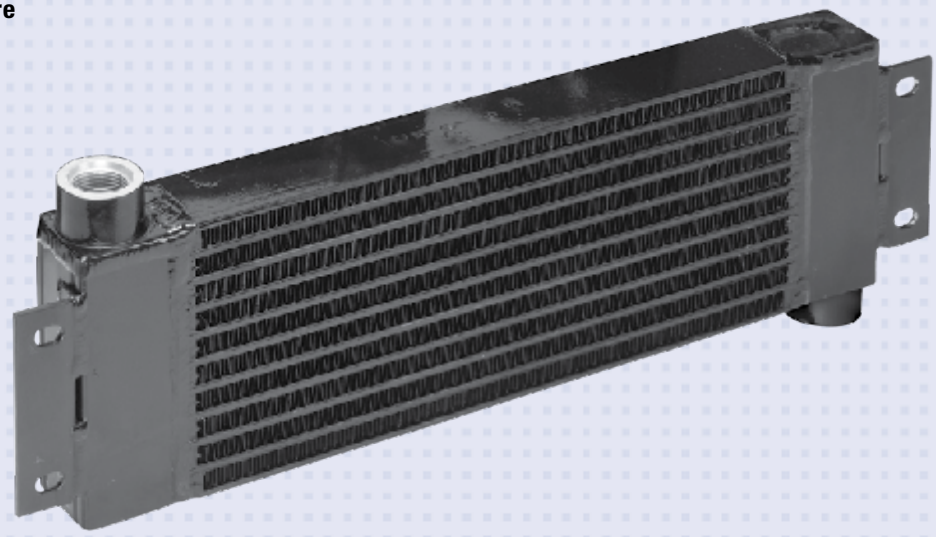
Model No.	Max. S.C.F.M.*	Weight - LBS.
M-15-76946	20	8
M-20-76785	35	11
M-25-76878	75	19
M-30-76941	100	25

**Ratings are based on a 250°F inlet temperature, 100 PSIG., and 500 FPM air face velocity across the ambient side of the aftercooler. Maximum pressure drop is 3 PSI or less—all models. 25°F approach temperature.*

BRAZED ALUMINUM CONSTRUCTION

Features

- Brazed Bar and Plate Aluminum Core
- Energy Efficient
- High Performance
- High Technology Compact Design
- Rugged Heavy Duty Construction
- Excellent for Heat Recovery
- AKG Crossover



Ratings

Maximum Operating Pressure 250 psi

Maximum Operating Temperature 350° F

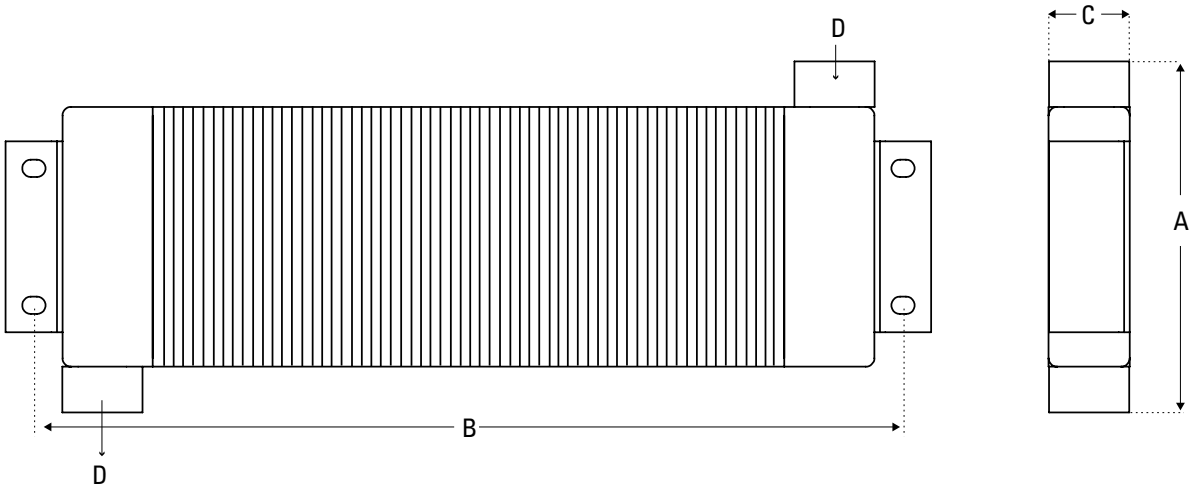
Materials

Core Brazed Aluminum Bar & Plate

How to Order

BGA	–		–	
Model Series		Model Size Selected		Connection Type
BGA		35 60 100		1 - NPT 2 - SAE

Dimensions



Model	A	B	C	D N.P.T.
BGA-35-2/1	6.81	17.68	1.77	1.00
BGA-60-2/1	8.03	17.68	1.77	1.00
BGA-100-2/1	10.43	19.65	1.77	1.00

All dimensions are inches. We reserve the right to make reasonable design changes without notice.

Model No.	Max. S.C.F.M.*	Model Rating Approach Temperature	
BGA-35-2/1	35	5°F for 18 SCFM	15°F for 35 SCFM
BGA-60-2/1	60	10°F for 35 SCFM	25°F for 60 SCFM
BGA-100-2/1	100	13°F for 70 SCFM	25°F for 100 SCFM

**Ratings are based on a 250°F inlet temperature, 100 PSIG, and 500 FPM air face velocity across the ambient side of the aftercooler. Maximum pressure drop is 3 PSI or less—all models. 25°F approach temperature, unless stated otherwise.*

BRAZED ALUMINUM CONSTRUCTION

Features

- **Full Line of Sizes and Features**
- **Brazed Bar and Plate Aluminum Core**
- **Energy Efficient**
- **High Performance**
- **High Flows 400-3500 CFM**
- Vertical (AHP) or Horizontal (AHPH) Air Flow
- High Technology Compact Design
- Optional Air Motor
- Rugged Heavy Duty Construction
- Excellent for Heat Recovery
- Detachable Legs on AHP (shipped unattached)
  Fixed Mounting Feet on AHPH

Ratings

Maximum Operating Pressure 250 psi

Maximum Operating Temperature 350° F

Materials

Cabinet Steel with Baked Enamel Finish

Core Brazed Aluminum Bar and Plate

Fan Aluminum Hub, Polypropylene Blades

Shroud Painted Steel

Motor TEFC

Fan Guard Steel with Baked Enamel Finish

How to Order

AHP – [ ] – [ ]

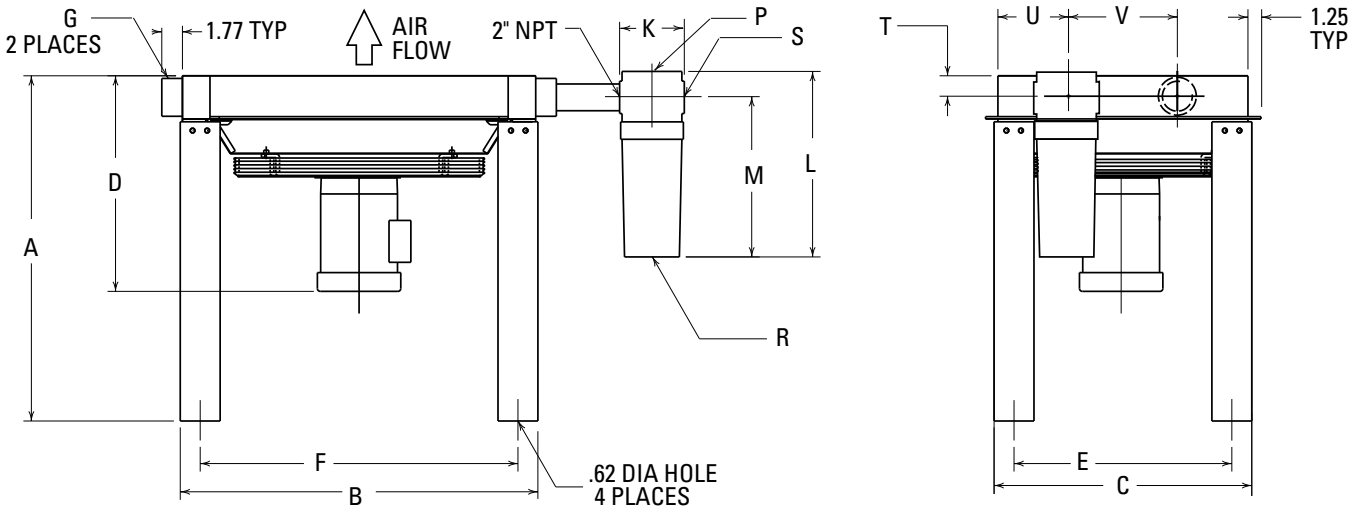
Model Series	Model Size Selected	Specify Motor Required
AHP	400	0 - No Motor
	725	2 - Single Phase 60 Hz TEFC 115/208-230 Volt
	950	3 - Three Phase 60 Hz TEFC 230/460 Volt
	1200	5 - Air Motor
	1600	6 - 575 Volt
	2000	
	2500	
	3000	
	3500	

AHPH – [ ] – [ ]

Model Series	Model Size Selected	Specify Motor Required
AHPH	400	0 - No Motor
	725	2 - Single Phase 60 Hz TEFC 115/208-230 Volt
	950	3 - Three Phase 60 Hz TEFC 230/460 Volt
	1200	5 - Air Motor
	1600	6 - 575 Volt
	2000	

Dimensions

AHP – Vertical Air Flow

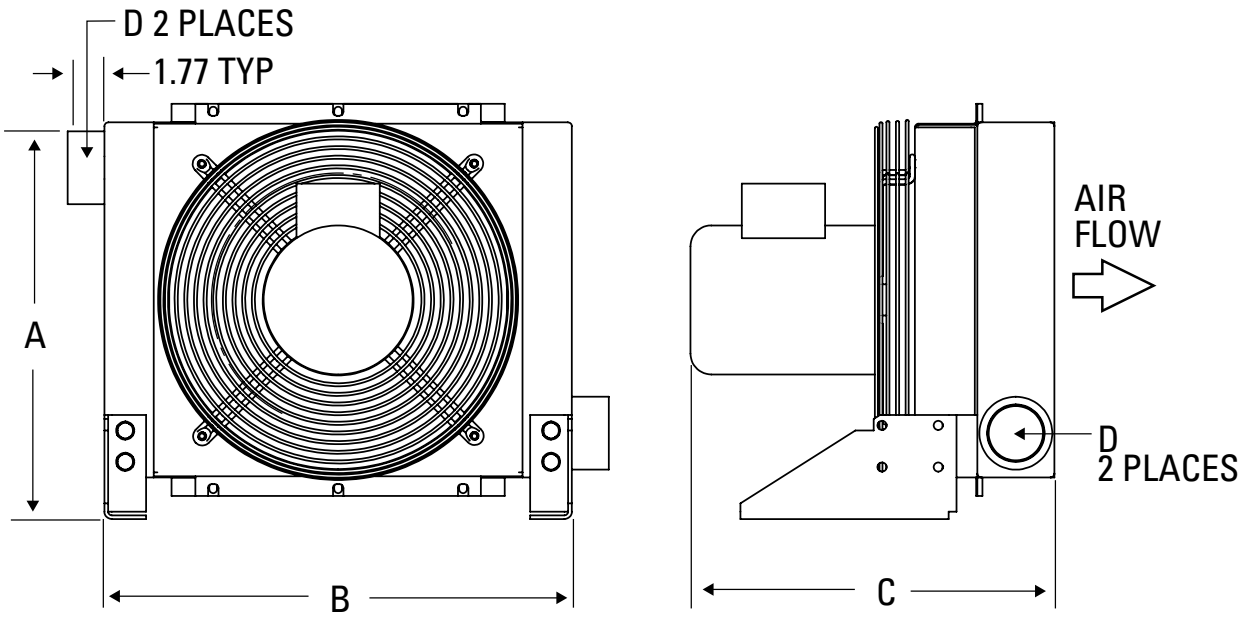


Model	A	B	C	D (Approx.) Electric Motor	D (Approx.) Air Motor	E	F	G NPT	Optional Separator K	Optional Separator L	Optional Separator M	Optional Separator P NPT	Optional Separator R NPT	Optional Separator S NPT	T	U	V	Recommended Optional Separator Model Number
AHP-400	34.20	22.6	17.96	18.01	13.55	13.96	18.68	2.00	4.70	18.60	16.00	N/A	.50	2.00	1.85	6.00	4.92	S-600M
AHP-725	34.20	30.56	22.37	18.01	13.55	18.37	26.56	2.00	4.70	18.60	16.00	N/A	.50	2.00	1.85	6.00	9.34	S-600M
AHP-950	36.01	37.24	26.78	22.76	19.01	22.78	33.24	3.00	8.00	23.00	20.00	N/A	.50	2.00	1.85	6.00	13.76	S-1700M
AHP-1200	36.01	41.19	26.78	25.07	20.50	22.78	37.19	3.00	8.00	23.00	20.00	N/A	.25	3.00	2.76	6.00	13.76	S-1700M
AHP-1600	36.01	41.19	34.89	25.95	17.06	30.89	37.19	3.00	8.00	23.00	20.00	.50	.25	3.00	2.76	8.00	17.86	S-2600M
AHP-2000	36.01	51.04	37.88	27.57	22.23	33.88	47.04	4.09	16.75	30.50	23.25	.50	.25	3.00	2.76	8.00	20.86	S-2600M
AHP-2500	36.01	49.07	43.70	28.01	22.23	39.70	45.07	4.09	16.75	30.50	23.25	.50	.75	4.00	2.76	8.00	26.68	S-2600M
AHP-3000	36.01	51.04	52.52	29.17	23.56	48.52	47.04	4.09	16.75	30.50	23.25	.50	.75	4.00	2.76	8.00	35.50	S-2600M
AHP-3500	36.01	51.04	56.30	29.17	23.56	52.30	47.04	4.09	16.75	30.50	23.25	.50	.75	4.00	2.76	8.00	39.28	S-2600M

Note: We reserve the right to make reasonable design changes without notice. All Dimensions are in inches.

Dimensions

AHPH – Horizontal Air Flow



Model	A	B	C		D	Recommended Optional Separator Model Number
			Electric Motor	Air Motor	NPT	
AHPH-400	17.96	22.60	18.01	13.55	2.00	S-600 M
AHPH-725	22.37	30.56	18.01	13.55	2.00	S-600 M
AHPH-950	26.78	37.24	22.76	19.01	3.00	S-1700 M
AHPH-1200	26.78	41.19	25.07	20.50	3.00	S-1700 M
AHPH-1600	34.89	41.19	25.95	17.06	3.00	S-2600 M
AHPH-2000	37.88	51.04	27.57	22.23	4.00	S-2600 M

Note: We reserve the right to make reasonable design changes without notice. All Dimensions are in inches.

Capacity Selection Chart Max. SCFM @ 5, 10, 15 and 20°F Approach

Inlet Temp. °F		150				200				250				300				350				Recommended Optional Separator Model Number
Approach Temp. °F		5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	
Model	AHP(H)-400	210	384	520	605	175	375	430	500	160	300	400	464	135	250	340	396	125	235	305	355	S-600M
	AHP (H)-725	355	650	890	1025	308	560	760	880	290	545	725	840	245	450	605	701	225	410	540	625	
	AHP (H)-950	480	871	1178	1360	415	754	1020	1180	390	712	950	1100	320	588	785	910	280	520	690	780	S-1700M
	AHP (H)-1200	600	1090	1475	1710	520	950	1290	1460	490	900	1200	1380	405	735	980	1130	355	650	865	990	
	AHP (H)-1600	790	1440	1950	2260	710	1290	1720	1950	660	1200	1600	1860	530	965	1290	1480	460	840	1135	1300	
	AHP (H)-2000	980	1790	2420	2800	870	1580	2140	2460	820	1490	2000	2300	660	1210	1595	1840	572	1040	1400	1610	S-2600M
	AHP-2500	1220	2220	3000	3470	1090	1980	2680	3100	1035	1880	2500	2870	784	1426	1980	2270	705	1290	1725	1980	
	AHP-3000	1450	2650	3580	4120	1295	2360	3200	3710	1243	2260	3000	3450	985	1794	2360	2715	840	1530	2040	2350	
	AHP-3500	1680	3064	4140	4800	1530	2785	3760	4320	1460	2660	3500	4015	1150	2090	2760	3200	950	1740	2350	2700	

Above specifications are based on 80 to 125 PSIG operating pressures. Maximum pressure drop, less than 3 psi. A flexible metal hose must be properly installed between the compressor and aftercooler to validate warranty. In addition, for mobile and other applications where there may be additional stresses to the connections, our 4-bolt SAE Flange should be used. Consult factory for pricing and availability.

Electric Motor & Fan Data

Model	Fan CFM	Motor H.P.	Voltage	Phase	Full Load Amps	Hz	RPM	Nema Frame	Thermal Overload	Approx. Shipping Weight (Lbs.)	Sound dB(A) at 3 ft
AHP(H)-400	2200 1825/2200	1.0	115/208-230 208-230/460	1 3	6.0 3.6/3.2	60 50/60	3450 2850/3450	56C	No	120	97
AHP(H)-725	3600 3025/3600	1.5	115/208-230 208-230/460	1 3	8.5 4.8/4.2	60 50/60	3450 2850/3450			170	100
AHP(H)-950	4700	1.5	115/208-230 208-230/460	1 3	8.6 4.6	60*	1740	145TC		330	92
AHP(H)-1200	7000	5.0	230	1	23.0			184TC		450	94
		3.0	208-230/460	3	8.8			182TC			
AHP(H)-1600	9700	5.0	208-230/460	3	13.4			184TC		515	96
AHP(H)-2000	11000	7.5	230/460		19.6			213TC		600	98
AHP-2500	14000									625	98
AHP-3000	17500	10.0			24.8			215TC		645	102
AHP-3500	17500									750	102

All motors shown are TEFC. Other motor options available upon request. Published electrical ratings are approximate, and may vary because of motor brand. Actual ratings are on motor nameplate.

*Fan motors **must not** be cycled. Outdoor applications must be protected from direct weather. If ductwork or additional static resistance is added to the cooler airstream, an auxiliary air mover may be required.*

**3 phase motors available in 50Hz. Reduce performance by 10%.*

Recommended Typical Installation

1. Support piping as needed. Flexible connectors must be properly installed to validate warranty.
2. Coolers should not operate in ambient temperatures below 35°F (1°C). Consult factory for recommendations.
3. The fan cannot be cycled.
4. AHP coolers operated outdoors must be protected from weather. Consult factory for recommendations.
5. If ductwork or additional static resistance is added to the cooler airstream, an auxiliary air mover may be required.

Air Motor Data

Model	PSI[1]	CFM[2]	Approx. Shipping Wt. (lbs)
AHP(H)-400	60	50	105
AHP(H)-725	85	65	140
AHP(H)-950	60	55	425
AHP(H)-1200	70	100	481
AHP(H)-1600	100	180	595
AHP(H)-2000	90	230	700
AHP-2500	90	230	735
AHP-3000	100	275	795
AHP-3500	100	275	825

Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches.

[1] Air inlet to the air motor must be regulated to this pressure.

[2] CFM (Free Air) consumption of the air motor. Lubrication = One drop of oil for every 50-75 CFM of air going through the motor. Use detergent SAE #10 oil. Filter, regulator and lubricators for the air motors are required, but not included.

BRAZED ALUMINUM CONSTRUCTION

Features

- **Combination Welded Cores – Air & Oil Core**
- **Brazed Aluminum Core/Bar and Plate**
- **Excellent for Field Conversions**
- **Vertical Air Flow**
- **Compact Design**
- **Light Weight**
- Compact, high performance all aluminum core assembly
- Designed specifically for rotary screw compressors
- Ideal for converting water cooled units to air cooled
- Eliminates high water and sewer costs
- Eliminates corrosion problems associated with water cooled units
- Vertical air flow works well for heat recovery
- State-of-the-art heat transfer technology
- Detachable Legs (ACOC) Shipped Unattached Fixed Mounting Feet on ACOCH

Ratings

Maximum Operating Pressure 250 psi

Maximum Operating Temperature 350°F

Materials

Legs Steel with Baked Enamel Finish

Shroud Steel

Core Brazed Aluminum Bar and Plate

Fan Aluminum Hub, Plastic Blades

Motor TEFC

How to Order

ACOC – [ ] – [ ]

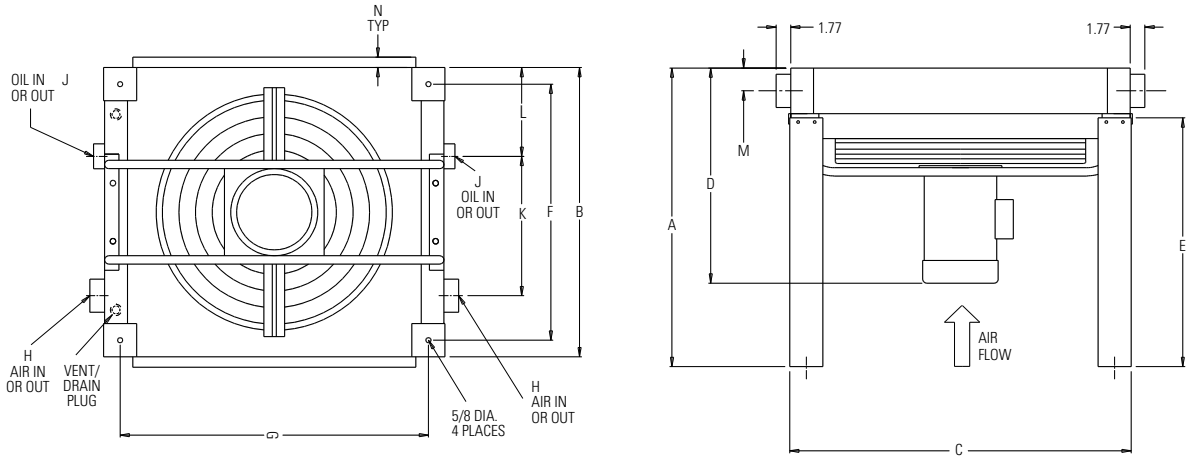
Model Series	Model Size Selected	Specify Motor Required
ACOC	400 725 950 1200 1600 2000 2500 3000 3500	0 - No Motor (includes Fan Blade & Fan Guard) 2 - Single Phase 3 - Three Phase 6 - 575 Volt

ACOCH – [ ] – [ ]

Model Series	Model Size Selected	Specify Motor Required
ACOCH	400 725 950 1200 1600 2000	0 - No Motor (includes Fan Blade & Fan Guard) 2 - Single Phase 3 - Three Phase 6 - 575 Volt

Dimensions

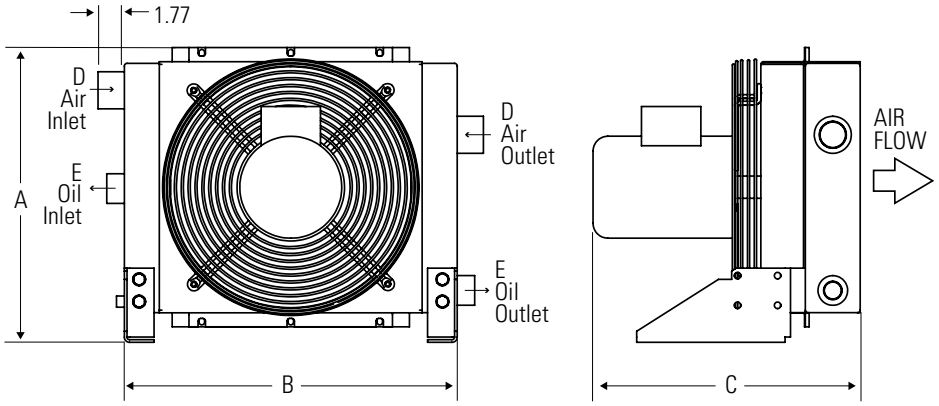
ACOC – Vertical Air Flow



Model	A	B	C	D Approx	E	F	G	H NPT	J NPT	K	L	M	N
ACOC-400	34.20	17.96	22.68	20.86	30.00	13.96	18.68	1.50	1.00	8.35	5.08	1.85	1.25
ACOC-725	34.20	22.37	30.56	20.86	30.00	18.37	26.56	1.50	1.00	10.55	6.34	1.85	1.25
ACOC-950	36.01	26.78	37.24	23.62	30.00	22.78	33.24	2.00	1.25	12.67	7.64	2.76	1.25
ACOC-1200	36.01	26.78	41.19	25.51	30.00	22.78	37.19	2.00	1.25	12.83	7.64	2.76	1.25
ACOC-1600	36.01	34.89	41.19	27.51	30.00	30.89	37.19	2.50	1.50	16.81	10.08	2.76	1.25
ACOC-2000	36.01	37.88	51.04	28.51	30.00	33.88	47.04	2.50	1.50	18.47	10.98	2.76	1.25
ACOC-2500	36.01	43.70	49.07	28.51	30.00	39.70	45.07	3.00	2.00	21.11	12.83	2.76	1.25
ACOC-3000	36.01	52.52	51.04	30.51	30.00	48.52	47.04	3.00	2.00	33.30	8.00	2.76	1.25
ACOC-3500	36.01	56.30	51.04	30.51	30.00	52.30	47.04	4.00	2.50	27.40	18.43	2.76	1.25

Note: We reserve the right to make reasonable design changes without notice. All Dimensions are in inches.

ACOCH – Horizontal Air Flow



Model	A	B	C Approx.	D NPT	E NPT
ACOCH-400	19.88	22.45	20.86	1.50	1.00
ACOCH-725	24.37	30.56	20.86	1.50	1.00
ACOCH-950	28.82	37.24	23.62	2.00	1.25
ACOCH-1200	28.82	41.19	25.51	2.00	1.25
ACOCH-1600	36.89	41.19	27.51	2.50	1.50
ACOCH-2000	39.53	50.79	28.51	2.50	1.50

Note: We reserve the right to make reasonable design changes without notice. All Dimensions are in inches.

Selection Procedure

Step 1 **Determine the Air Compressor's motor horsepower**.

Step 2 **Enter the chart** at the motor horsepower to select the correct model.

Step 3 **Check the aftercooler SCFM.** The SCFM of air discharged from the air compressor must be equal to or less than the value in the chart for the model selected. If it is not, choose a larger model. If the SCFM is unknown, multiply the air compressor's motor horsepower by 4.5 to determine the SCFM capacity required.

Model	Compressor H.P.	Aftercooler Maximum SCFM with 100 PSI Air & A 15°F Approach Temperature
ACOC(H)-400	15-35	175
ACOC (H)-725	40-55	275
ACOC (H)-950	60-85	425
ACOC (H)-1200	90-120	600
ACOC (H)-1600	125-155	775
ACOC (H)-2000	160-225	1125
ACOC-2500	230-275	1375
ACOC-3000	280-325	1625
ACOC-3500	330-360	1800

Sizing

1. Oil flow is .45 GPM/HP.
2. Oil pressure drop - 15 psi or less
3. Oil heat transfer based on 100°F E.T.D.
   (E.T.D. = Entering Temperature Difference)
   (E.T.D. = Oil in Temperature - Ambient Air Temperature)
4. Air aftercooler pressure drop - 3 psi or less.
5. E.T.D. Temperature Correction Factor:

$$HP_{chart} = HP_{compressor} \times \frac{100}{\text{Desired E.T.D.}}$$

Recommended Typical Installation

1. Support piping as needed. Flexible connectors must be properly installed to validate warranty.
2. Coolers should not operate in ambient temperatures below 35°F (1°C). Consult factory for recommendations.
3. The fan cannot be cycled.
4. AHP coolers operated outdoors must be protected from weather. Consult factory for recommendations.
5. If ductwork or additional static resistance is added to the cooler airstream, an auxiliary air mover may be required.

Maintenance

Periodic cleaning of the fins with compressed air is needed to remove the accumulation of dirt and dust. Check the automatic drain on the separator (not included) periodically.

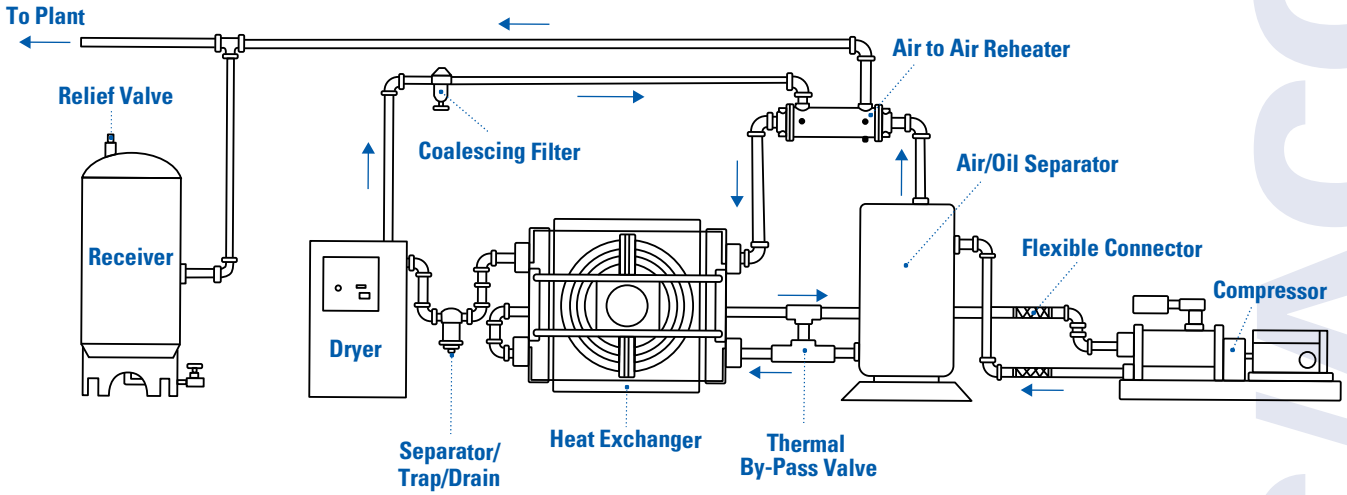
If the inside of the tubes need to be cleaned of oil and carbon, use a chlorinated solvent. Do not use strong solvents. Do not use acids or caustic cleaners.

Electric Motor and Fan Data

Model	Fan CFM	Motor H.P.	Voltage	Phase	Full Load Amps 230V	Hz	RPM	Nema Frame	Thermal Over-load	Net Weight Lbs.	Approx. Shipping Wt. (Lbs.)
ACOC(H)-400	2200 1825/2200	1.0	115/208-230 208-230/460[2]	1 3	6.0 3.6/3.2	60[1] 50/60	3450 2850/3450	56C		105	136
ACOC(H)-725	3600 3025/3600	1.5	115/208-230 208-230/460[3]	1 3	8.5 4.8/4.2	60[1] 50/60	3450 2850/3450			149	155
ACOC(H)-950	4700	1.5	115/208-230 208-230/460	1 3	8.6 4.6	60	1740	145TC	No	223	280
ACOC(H)-1200	7000	5.0	230	1	23.0			184TC		297	410
		3.0	208-230/460	3	8.8			182TC			
ACOC(H)-1600	9700	5.0	208-230/460	3	13.4			184TC		345	495
ACOC(H)-2000	11000	7.5	230/460		19.6			213TC		495	530
ACOC-2500	14000									522	540
ACOC-3000	17500	10.0			24.8			215TC		655	780
ACOC-3500	17500									690	820

All motors shown are TEFC—Other motor options available upon request.
Published electrical ratings are approximate and may vary because of motor brand. Actual ratings are on motor nameplate.
[1] May also be operated at 50 Hz. Consult factory for details.
[2] 50 Hz voltage: 190 - 200 - 208 - 220/380 - 400 - 415 - 440
[3] 50 Hz voltage: 190 - 208/380 - 415

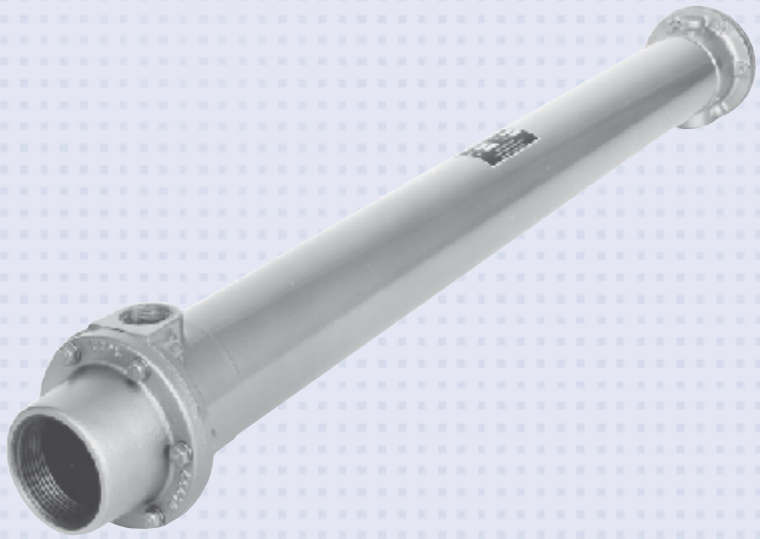
Bottom view of cooler to illustrate piping



COPPER TUBE CONSTRUCTION

Features

- **Compressed Air and Gas Aftercoolers**
- **For Water to Air Cooler**
- All Brass Hubs and Shell Assemblies: Reduce or Eliminate Galvanic and Other Types of Corrosion
- Copper Nickel Tubes Available for Sea Water Service



Ratings

Maximum Operating Pressure

Tubes 250 PSI

Shell 250 PSI

Maximum Operating Temperature 350° F

Materials

Tubes Copper

Shell Brass

End Hubs Brass

End Bonnets Cast Iron

Baffles Brass

Mounting Brackets (optional) Steel

Gaskets Nitrile Rubber

Nameplate Aluminum Foil

Unit Coding

AB - 403 - A4 - 0

Standard Construction	Shell Diameter	Effective Tube Length	Baffle Spacing	Cooling Tube Diameter	Single Pass

How to Order

AB	–		–		–		–	0

Model Series
AB

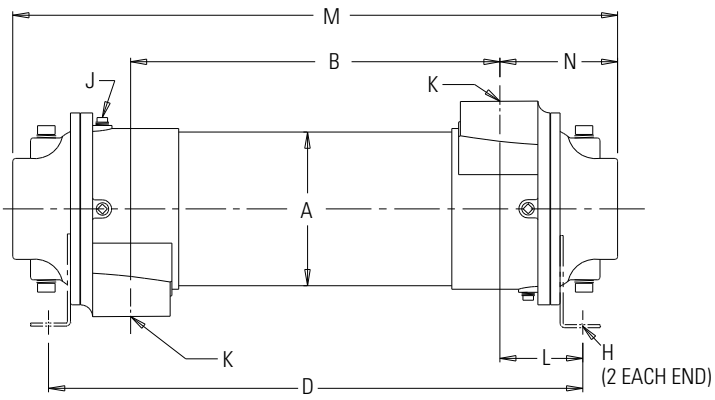
Model Size Selected
403
404
405
705
1006
1206
1207
1606
1607
1608

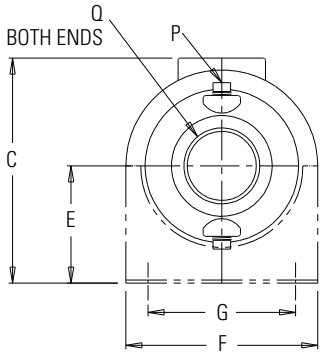
Baffle Spacing
A - 1.125
B - 2.25
C - 4.5
D - 9.0

Tube Diameter Code
4 - 1/4"
6 - 3/8"

Tubeside Passes
0

Dimensions





NOTE: Mounting brackets are optional.

Model	DIA A	B	C	D*	E*	F*	G*	H*	J NPT	K NPT	L	M	N	P NPT	Q NPT	Weight (lbs.)
AB-403-A4-0	2.12	25.62	3.50	29.06	1.94	2.62	1.76	.41 Dia.	—	.50	1.72	33.36	3.87		1.50	13
AB-404-A4-0		34.62		38.06								42.36				16
AB-405-B4-0		43.62		47.06								51.36				18
AB-705-B4-0	3.66	43.00	6.25	48.38	3.62	5.25	3.00	.44x 1.00	(2) .38	1.00	2.69	50.40	3.70		2.50	40
AB-1006-B6-0	5.12	51.50	7.38	57.62	4.00	6.75	4.00		(6) .38	1.50	3.06	59.60	4.05		3.00	80
AB-1206-C6-0	6.12	50.50	8.81	57.38	4.75	7.50	5.00	44x .88		2.00	3.44	60.25	4.88	(4) .50		130
AB-1207-C6-0		59.60		66.38								69.25				150
AB-1606-C6-0	8.00	49.60	12.13	58.38	6.50	8.62	7.00	.44x 1.00		3.00	4.39	62.62	6.52		5.00	259
AB-1607-D6-0		58.60		67.38								71.62				270
AB-1608-D6-0		67.60		76.38								80.62				315

NOTE: We reserve the right to make reasonable design changes without notice. All dimensions in inches.

Capacity Selection

Model	2-Stage Recip 250°F Inlet Air		Rotary Screw 200°F Inlet Air	
	SCFM Capacity* in Tubes	△ P, PSI, at Rated Capacity	SCFM Capacity* in Tubes	△ P, PSI, at Rated Capacity
AB-403-A4-0	40	0.1	58	0.1
AB-404-A4-0	80	0.3	110	0.6
AB-405-B4-0	150	1.2	205	2.0
AB-705-B4-0	310	1.0	439	1.6
AB-1006-B6-0	440	0.3	654	0.5
AB-1206-C6-0	640	0.3	955	0.6
AB-1207-C6-0	1250	1.1	1690	1.9
AB-1606-C6-0	1600	0.5	2280	0.9
AB-1607-D6-0	2100	1.0	3080	1.7
AB-1608-D6-0	2800	1.6	3170	2.0

**Based on ambient air at 60°F, 14.7 psia, and 50% relative humidity. Compressed air cooled to within 15°F of inlet water temperature. Water flow rate 3 GPM per 100 SCFM air flow. For single stage compressor type, 300°F inlet, use 2-stage SCFM capacities with a 15% reduction.*

Selection Example

Specified

Two stage compressor with a 340 SCFM air delivery at 100 psig and a 250°F discharge temperature. Maximum allowable pressure loss is 2 psi. Water flow rate to be determined.

Solution

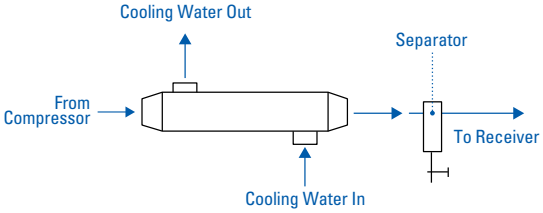
STEP 1 From the 2-stage compressor column select model **AB-1006-B6-0** with 440 SCFM capacity.

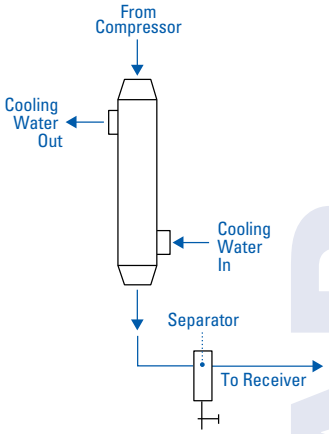
STEP 2 To determine △ P: Read column to right of SCFM capacity selected. **△ P = 0.3 PSI**

STEP 3 Water flow rate required **340 SCFM x .03 = 10.2 GPM**

Piping Diagrams

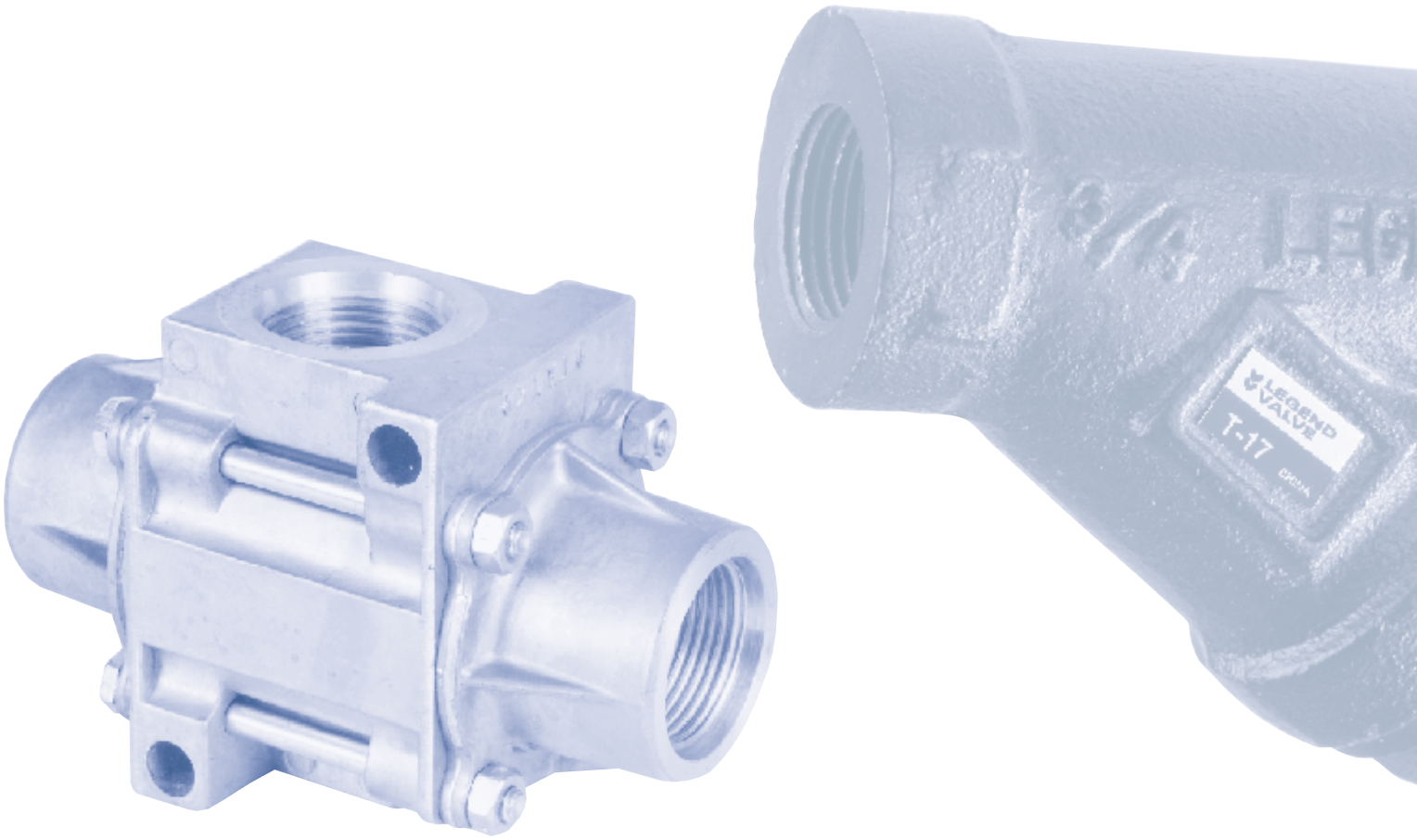
Thermal Transfer Aftercoolers can be mounted in either of the positions shown. Separators should be used as shown. Consult factory for separator recommendations.





ACCESSORIES

Thermal Transfer Products provides an array of highly engineered accessories that function with our integrated cooling modules, as well as copper, aluminum and steel heat exchangers.



4

Modulating Water Valves and Bulb Wells

Water Strainers

Three-Way Thermostatic Valves

Thermal Bypass Assembly

Electronic Temperature Control & Bulb Well Assembly (AC)

Thermostatic Temperature Controller (DC)

Temperature Sensors

Compressed Air Separators

Automatic Float Drain

Flexible Metal Hose

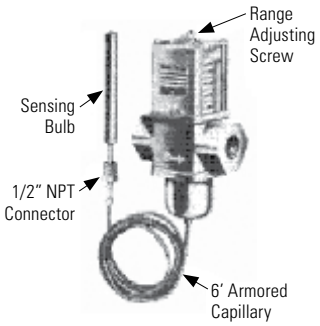
Thermal Transfer Products

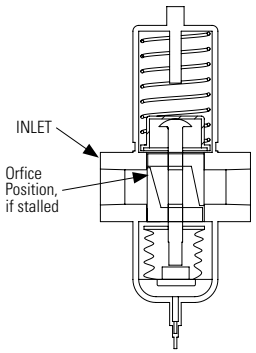
A ThermaSys® Company

a global leader in manufacturing highly engineered heat transfer products

Modulating Water Valves and Bulb Wells

APPLICATION: These modulating valves regulate the flow of water to the heat exchanger to maintain a desired exiting oil temperature. They open automatically when temperature increases at the sensing bulb. **No** external power source is required to actuate the valve. **Not to be** used for salt water service.



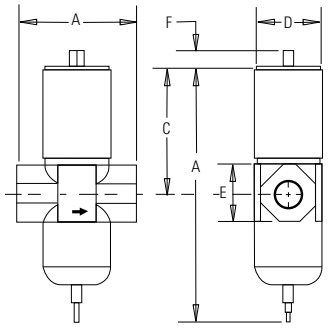


WATER VALVES					BULB WELLS
PART NUMBER	PIPE SIZE (NPT)	RANGE (OPENING POINT)	SENSING BULB SIZE DIAMETER x LENGTH	MAXIMUM WATER FLOW	RECOMMENDED SIZE
65293	1/2"	115°F to 180°F	11/16" x 3-1/4"	25 GPM	L-65140
65127	3/4"			40 GPM	
65128	1"		11/16" x 6"	55 GPM	L-65141
65146	1-1/4"			75 GPM	
65511	1/2"	75°F to 135°F	11/16" x 10"	25 GPM	L-65280
65253	3/4"			40 GPM	
65254	1"		11/16" x 16-1/4"	55 GPM	L-67438
65255	1-1/4"			75 GPM	
66100	1-1/2" ASME			90 GPM	
67173	2" ASME	75°F to 115°F	11/16" x 43"	150 GPM	L-67808

*Working pressure to 150 PSI Maximum. *For additional protection of the bulb well stem, use the next longer bulb well.*

ADJUSTMENT: 1/2" to 1-1/4" valves can be adjusted with a screwdriver, 1-1/2" and 2" have a 1/2" square shaft. Turn the adjusting screw clockwise to **decrease** opening temperature; and counterclockwise to **increase** opening temperature. Valves are not calibrated, so final desired temperature setting must be established experimentally. Valve is fully open 36°F above opening point.

Water Valves



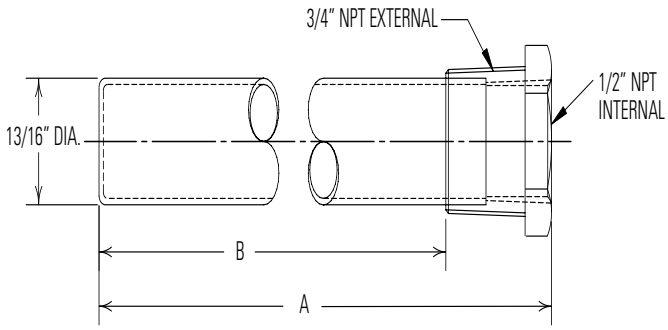
Standard temperature elements are furnished with 6' capillary. Longer capillary lengths not available. Valve Disc: Buna N in brass disc retainer.

VALVE SIZE	DIMENSIONS IN INCHES						APPROXIMATE SHIP WEIGHT
	A	B	C	D	E	F	
1/2"	3-1/4	7	3-3/8	1-27/32	1-1/2	13/32	4.3 lbs.
3/4"	3-9/16	7-29/64	3-51/64	2-1/32	1-3/4		5.8 lbs.
1"	4-27/32	10-13/16	5-31/64	2-5/8	2	1/2	10 lbs.
1-1/4"	4-55/64	10-37/64	5-43/64		2-3/8		12 lbs.
1-1/2"	5-5/16				See Flange Below		18 lbs.
2"	6-5/8	12-33/64	6-15/32	3-1/2			27 lbs.

VALVE SIZE	FLANGE SPECIFICATIONS–INCHES			
	# OF BOLT HOLES	BOLT HOLE SIZE	BOLT CIRCLE	FLANGE DIAMETER
1/2"	4	5/8	3-7/8	5
2		3/4	4-3/4	6

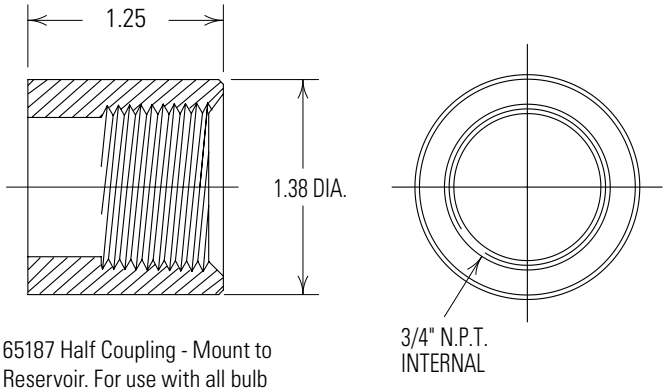
Modulating Water Valves and Bulb Wells

Bulb Wells



BULB WELL PART NUMBER	DIMENSIONS IN INCHES A	DIMENSIONS IN INCHES B	APPROXIMATE SHIPPING WEIGHT	MATERIALS
65140	4-15/32"	3-15/32"	1 lb.	Tube - Copper Fitting- Brass
65141	7-7/32"	6-7/32"		
65280	11-7/32"	10-7/32"		
67438	17-15/32"	16-15/32"		
67808	44-3/8"	43-3/8"		

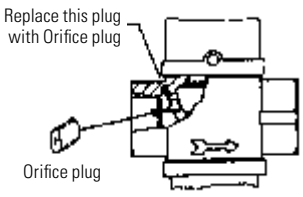
Custom Bulb Well lengths available. Consult factory for additional information.



65187 Half Coupling - Mount to Reservoir. For use with all bulb wells shown above.

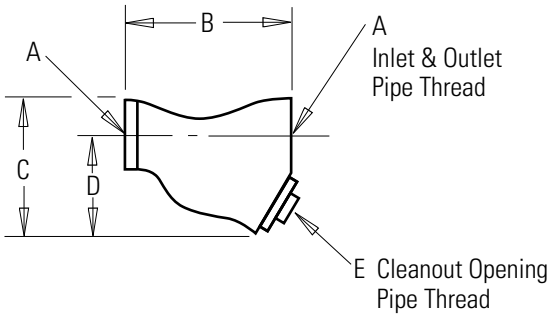
WATER VALVE PART NUMBER	BY-PASS ORIFICE DIAMETER	MAXIMUM BULB TEMPERATURE °F	OPENING TEMPERATURE (FACTORY SETTING) °F
65293	.062"	200	135
65127			
65128	.093"		
65146			
65511	.062"	155	103

WATER VALVE PART NUMBER	BY-PASS ORIFICE DIAMETER	MAXIMUM BULB TEMPERATURE °F	OPENING TEMPERATURE (FACTORY SETTING) °F
65253	.062"	200	135
65254			
65255	.093"		
66100			
67173	.125"	155	103



All stock valves are supplied with a drilled and tapped internal by-pass in the regulator body. A solid plug is installed in this hole for 100% shut-off. A drilled orifice plug is packed in an envelope with each valve for field installation, if continuous minimum flow is required.

Water Strainers



TYPE	PART NUMBER	A NPT	DIMENSIONS (INCHES) B	C	D	E	WEIGHT (LBS.)
BRONZE 300 psi Max. 20 Mesh 304 Stainless Steel Wire Screen	65294	3/8	3.08	2.52	1.88	1/4	.758
	65295	1/2					.738
	65296	3/4	3.87	3.07	2.32		1.22
	65297	1	4.44	3.77	2.81	3/8	1.80
	65301	1-1/4	5.25	4.32	3.18		2.87
	65302	1-1/2	6.25	5.10	3.77	1/2	4.05
	65303	2	7.63	6.25	4.65		6.35

How to Order

					– Water Strainer

Part Number

All shipments FOB Racine, WI USA

ACCESSORIES

Three-Way Thermostatic Valves

1/2", 3/4", 1", 1-1/2" & 2" NPT Ports*

Features

- **Self-Contained**
- **Wide Range of Temperatures**
- **Rugged Construction**
- **Non-Adjustable**
- **Heavy Duty**
- **Operate in Any Position**
- **Tamper-Proof**
- **Replaceable Element**
- **Compact**

Materials

Housing Grey Iron (steel or bronze optional)
125 PSI maximum operating pressure

O-Ring Seals Viton (Buna N optional)

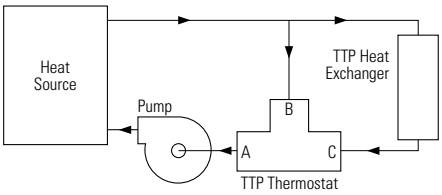
**3", 4" and 6" Flange Models also available.*

Operation

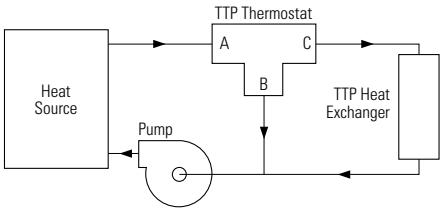
TTP thermostatic valves use the principle of expanding wax. A self-contained power element activates a stainless steel sliding valve that provides a positive three-way valve action. All temperature settings are factory set. Elements are field replaceable to obtain the same, or a new bypass temperature setting.

On starting, total flow is in the bypass mode. As the fluid temperature rises, some fluid is diverted to the cooling system. As fluid temperature continues to rise, more flow is diverted until the valve is fully stroked. At this point, all the flow is diverted to the cooler. With respect to temperature ranges, the "nominal" temperature represents the "operating temperature." The first figure in the temperature range represents the valve opening point, and the second figure represents the full open point.

Valves are acceptable for oil or water service.



Mixing Application



Diverting Application

Applications

Three Way Thermostatic Valves may be installed for either mixing or diverting modes of operation at the preference of the user. They may be mounted in any plane.

When installed as a mixing valve, it is on the cold side of the application, and mixes hot liquid with cooled liquid to discharge the proper temperature fluid to the process.

When installed as a diverting valve, it is on the hot side of the application, and bypasses the cold liquid allowing the system to warm up, then directs the hot liquid to the cooler.

Temperature settings are nominal. 110°F and 140°F are standard. Other settings are available upon request. The valves begin to "shift" (open) about 10°F below the nominal temperature setting and are fully shifted about 10°F above.

Typical Installation

Hydraulic Power Units Diverting mode 110°F

Air Compressors Mixing mode 140°F

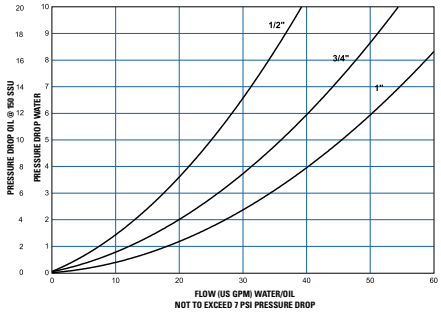
Mobile Oil Coolers Diverting mode 110°F

Radiators Diverting mode 190°F

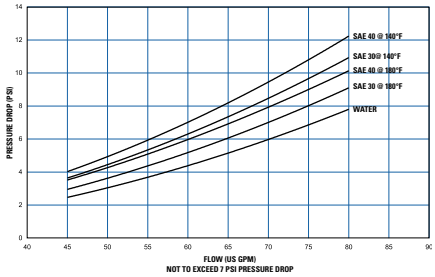
Three-Way Thermostatic Valves

Pressure Drop Curves

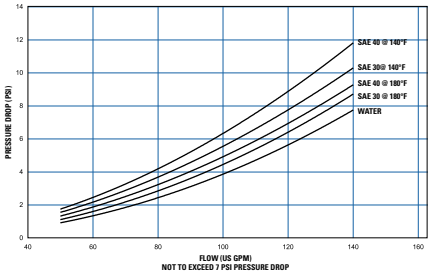
1/2" - 3/4" - 1"



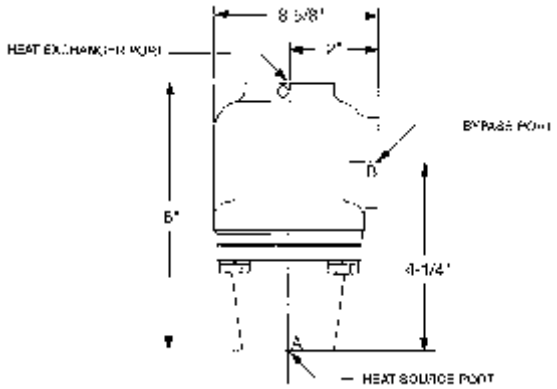
1-1/2"



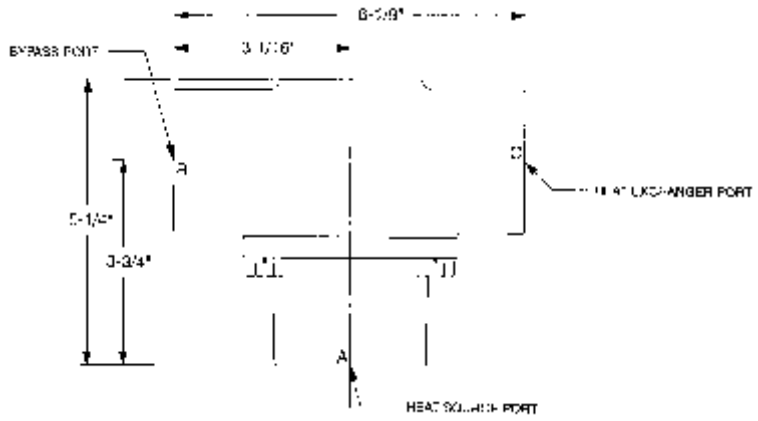
2"



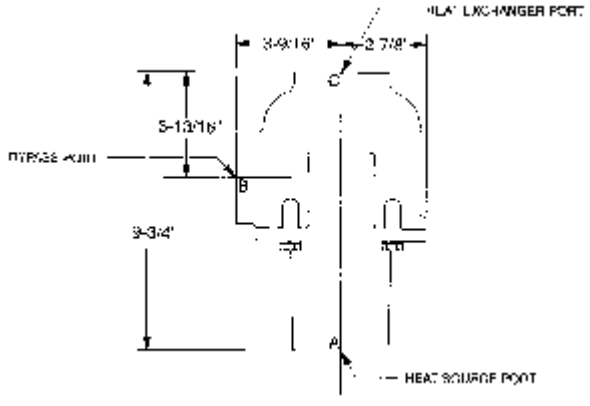
Dimensions and Part Numbers



PORT SIZE	PART NUMBER
1/2" NPT	66037-110°F
1/2" NPT	66037-140°F
3/4" NPT	66038-110°F
3/4" NPT	66038-140°F
1" NPT	66039-110°F
1" NPT	66039-140°F
#16 SAE	67365-110°F
#16 SAE	67365-140°F



PORT SIZE	PART NUMBER
1-1/2" NPT	66040-110°F
1-1/2" NPT	66040-140°F
#24 SAE	67760-110°F



PORT SIZE	PART NUMBER
2" NPT	66041-105°F
2" NPT	66041-140°F

NOTE: All three ports on any one valve have the same thread size.

Three-Way Thermostatic Valves

Special Temperature Ranges

1/2" – 3/4" – 1" NPT PART NUMBERS	1 1/2" NPT PART NUMBERS	2" NPT PART NUMBERS
65974	65977	65978
65975	66040	66041
65976	67760	
66037	(#24 SAE)	
66038		
66039		
67365		
(#16 SAE)		

1/2" – 3/4" – 1" NPT		1 1/2" NPT		2" NPT	
NOMINAL	TEMPERATURE RANGE (°F)	NOMINAL	TEMPERATURE RANGE (°F)	NOMINAL	TEMPERATURE RANGE (°F)
80	77-88	80	70-88	75	70-85
90	80-100	90	80-100	90	85-105
110	100-120	110	100-120	105	100-116
120	110-130	120	110-130	120	110-130
130	120-140	130	120-140	130	124-140
140	130-150	140	130-150	140	135-150
150	140-160	150	140-160	150	145-160
160	150-170	160	150-170	155	150-165
170	163-180	170	163-180	160	155-172
185	175-190	175	170-185	165	160-175
195	185-200	180	175-190	170	165-180
200	190-210	190	185-200	180	175-190
		200	190-210	195	188-208
				210	200-215

EXAMPLE: 1" NPT, Part Number 66039-90 indicates the 1" NPT valve with a nominal shift temperature of 90°F. The actual operating temperature range in this example is 80-100°F. The valve begins to open at 80°F, and is fully open at 100°F.

How to Order *Consult factory for pricing and lead time*

					–				°F

Valve Part Number **Nominal Temperature Setting**

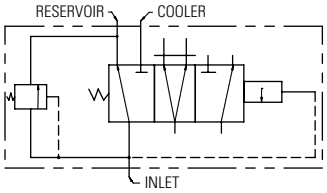
Thermal Bypass Assembly

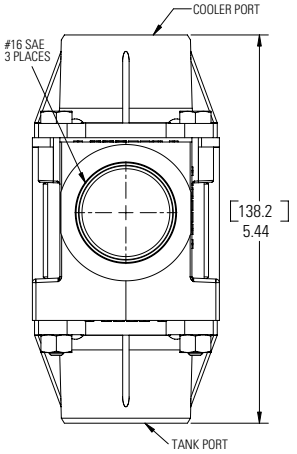
This thermal bypass valve is ideally suited for hydrostatic drive circuits which require fast warm-up, controlled fluid temperature, and low return line back pressure. When installed in the return line of a hydraulic circuit that employs and oil cooler, this device will modulate fluid temperature by either shifting return line flow through the cooler, or bypassing directly to the reservoir. In addition, a built-in pressure relief function automatically relieves excess pressure to the reservoir should the cooler become restricted and resultant pressure drop become too high for the cooler circuit.

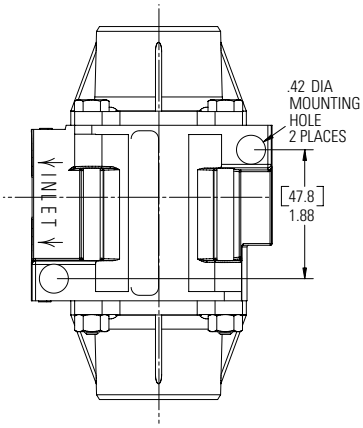
Features

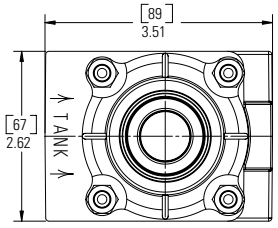
1. **Operating Characteristics**
   - **A.** Mode #1: At temperatures below the shift temperature oil flows from inlet to tank port.
   - **B.** Mode #2: At temperatures between the start of shift and full shift the flow from the inlet port is divided between the cooler and tank ports.
   - **C.** Mode #3: At temperatures above the full shift temperature inlet flow is through the cooler port.
   - **D.** Mode #4: At temperatures above the full shift temperature the excess pressure is relieved through the tank port.
2. **Standard Shift Temperatures** 100°F (38°C) 120°F (49°C) 140°F (60°C) 160°F (71°C)
3. **Full Shift (Cooler Port Open) Temperatures** Shift temperature plus 25°F (14°C)
4. **Relief Valve Setting** 65 psi (4.5 bar) Consult factory for other pressure settings.
5. **Maximum Operating Pressure** 250 psi (17 bar)
6. **Proof Pressure** 300 psi (21 bar)
7. **Minimum Burst Pressure**
   - **A.** Up to the full shift temperature: 325 psi (22 bar).
   - **B.** Above the full shift temperature: 600 psi (41 bar).
8. **Minimum Operating Temperature** -30°F (-34°C)
9. **Maximum Operating Temperature** Shift temperature plus 75°F (24°C)
10. **Maximum Flow Rating** 60 gpm (227 l/m)
11. **Leakage @ 250 psi (17 bar) and 60 gpm (227 l/m) Inlet Flow**
    - **A.** Cooler Port:
      1. 0.5 gpm (2 l/m) maximum up to 5°F (3°C) before shift temp.
      2. 1.0 gpm (4 l/m) maximum from 5°F (3°C) before shift to shift.
    - **B.** Tank Port: 0.10 gpm (0.4 l/m) maximum
12. **Operating Fluid** Mineral base hydraulic fluids
13. **Construction** Aluminum die-cast housing

Graphic Symbol

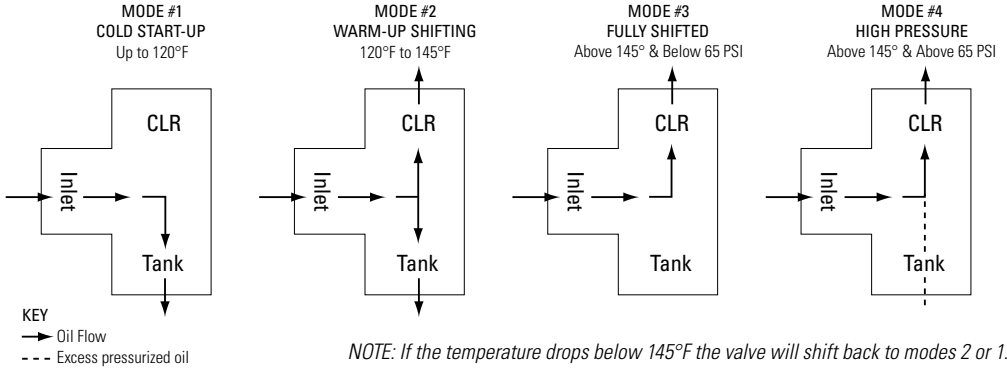








For 120° F Shift Temperature

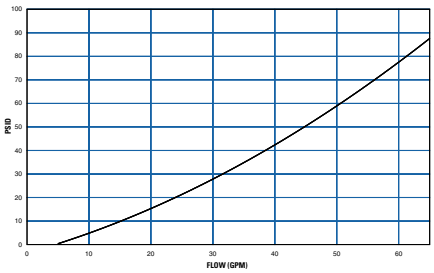


NOTE: If the temperature drops below 145°F the valve will shift back to modes 2 or 1.

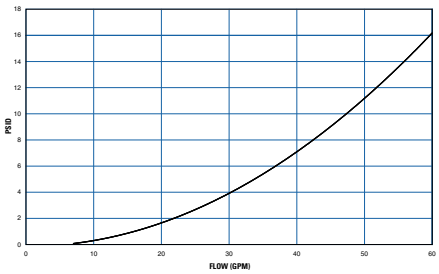
Thermal Bypass Assembly

Pressure Drop (Mobile DTE 26 OIL)

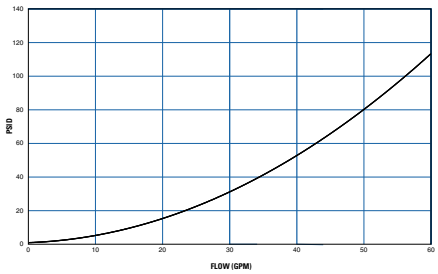
Inlet Port Thru Tank Port @ 100°F (38°C) (300 SUS)



Inlet Port Thru Cooler Port @ 145°F (63°C) (110 SUS)



Inlet Port Over Integral Relief Valve @ 170°F (77°C) (78 SUS)



NOTE: Pressure drop shown is added to relief valve crack pressure for total pressure drop.

PART NUMBER	SHIFT TEMPERATURE
65654	100°F (38°C)
65655	120°F (49°C)
65656	140°F (60°C)
65657	160°F (71°C)

How to Order *Consult factory for pricing and lead time*

					–			–	Thermal Bypass Assembly

Part Number

Pressure Setting
65 = Standard, 65 PSI
Optional pressure settings available in 5 PSI increments, up to 85 PSI.

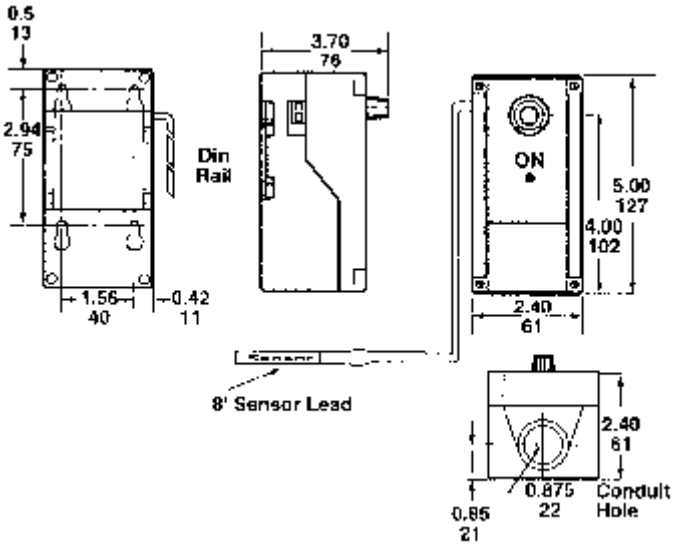
Electronic Temperature Control & Bulb Well Assembly (AC)

Part Number 86816

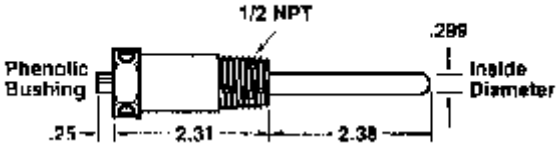
This is a line voltage single-stage electronic temperature control with single-pole, double-throw relay output and LED indication. It is designed with heating or cooling modes of operation, adjustable differential, and an interchangeable temperature sensor. The control couples electronic accuracy with remote sensing capability in a NEMA 1 high-impact plastic enclosure suitable for surface or DIN-rail mounting.

Pilot Duty Relay needed for 460V not offered by Thermal Transfer Products.

67428 Control Dimensions In/mm.



67429 Bulb Well Dimensions



Specifications

Product	Electronic Temperature Control			
Setpoint Range	100°F to 220°F (38°C to 105°C)			
Differential Range	1°F to 30°F (0.5°C to 17°C)			
Input Voltage	120 or 208/240 VAC, 50/60 Hz			
Current Draw	1.8 VA			
Relay Electrical Ratings	SPDT	120V NO (NC)	280V NO (NC)	240V NO (NC)
	Horsepower:	1 (0.25) hp	1 (0.33) hp	1 (0.5) hp
	Full Load Amps:	16 (5.8) A	9.2 (4.0) A	8.0 (4.9) A
	Locked Rotor Amps:	96 (3) A	55 (24) A	48 (29) A
	Non-Inductive Amps:	15 (10) A	10 (10) A	10 (10) A
	Pilot Duty: 125 VA (NO) @ 24-240 VAC, 125 VA (NC) @ 120-240 VAC, 50 VA (NC) @ 24 VAC			
Sensor Type	Replaceable Thermistor with Reference Resistance of 2.25 K ohms at 77°F (25°C)			
Control Ambient	Operating: –30°F to 140°F (–34°C to 60°C)			
Temperature	Shipping: –40°F to 185°F (–40°C to 85°C)			
Ambient Humidity	0 to 95% RH Non-Condensing, Maximum Dew Point: 85°F (29°C)			
Control Material	Case and Cover: NEMA 1 High Impact Lexan 950® Plastic.			
Agency Listings	UL Listed: File E27734, Guide XAPX (Temperature Indicating and Regulating Equipment) CSA Approved File LR948 Class 4813-02			

Lexan 950 is a registered trademark of the General Electric Company. The performance specifications are nominal.

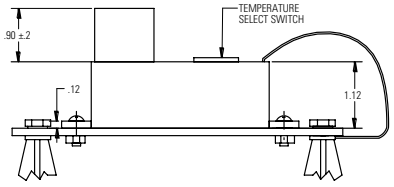
Thermostatic Temperature Controller (DC)

Features

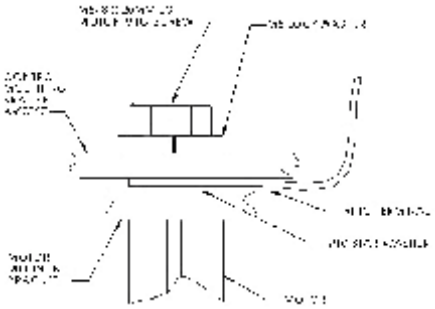
- **12 or 24 volt operation**
- **Temperature sensor provided**
- **Mounting hardware included**
- **For use with 1 or 2 fan models**
  (Relay needed for 2 fan models – not offered by Thermal Transfer Products)
- **Wiring provided for remote manual override**
- **Adjustable temperature settings range from 100°F thru 210°F in 20°F increments**

This controller was designed to mount on the cooler without requiring extensive wiring or plumbing. It provides accurate temperature control by cycling the cooling fan(s) to maintain desired oil temperature.

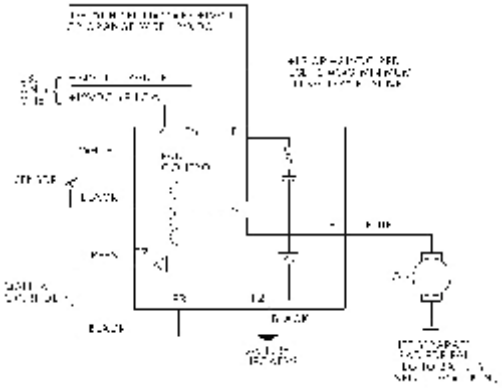
Connection Assembly



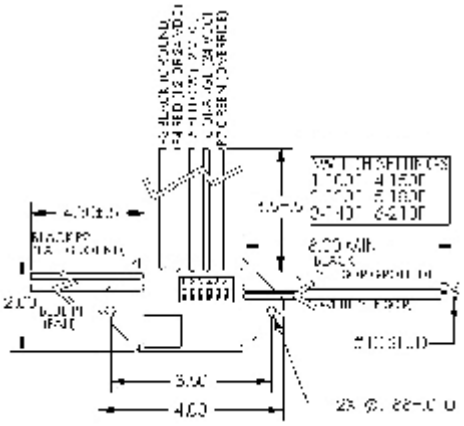
Control Dimensions

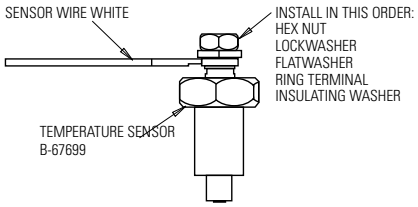


Electrical Schematic



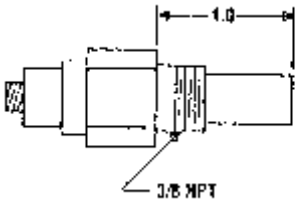
Wiring Diagrams





NOTE: This switch should be fused to prevent damage if ground is lost. A 30 Amp Fuse is required in the power supply.

Sensor Dimensions



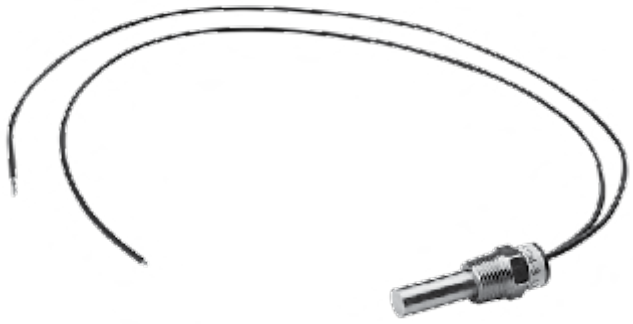
How to Order

Part Number

96171	Electronic Fan Control Kit
68790	Replacement Control Only

Temperature Sensors

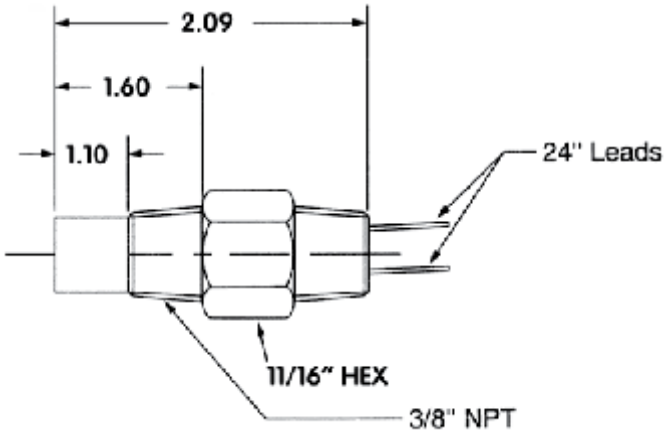
Normally Open (Closed on temperature rise)



Contact Rating	6 AMPS AT 120 VAC 4 AMPS AT 240 VAC
Voltage	0.1 to 240 volts AC or 12 VDC 8 AMPS, 24 VDC 4 AMPS
Pressure	1,000 PSI operating
Material	303 Stainless Steel Housing

PART NUMBER	SET TEMPERATURE (°F)
65769	140
65769	120

**Switching temperature ranges from one (1) to six (6) °F. Other temperature settings are available. Consult factory for options. For DC applications, do NOT wire directly to motor. (Relay needed.)*



How to Order *Consult factory for pricing and lead time*

					–				–	Temperature Sensor
Part Number						Set Temperature				
						140				
						120				

All shipments FOB Racine, WI USA

ACCESSORIES

Compressed Air Separators

S-50 and S-100 Models

Two Models:

One with a built-in automatic float style drain, the second with a 1/8" NPT connection with manual shut off valve. Rugged cast zinc housing. Equipped with quick disconnect bowls for easy service.

S-200 thru S-1700 Models

Four models to fit most applications. Unique high efficiency design provides wide SCFM capacity range without loss in performance. Sturdy, lightweight aluminum construction for long dependable service. NPT threaded drain connection for installation of an electronic, manual or automatic float style drain. Low differential pressure at maximum flow ratings. Externally and internally epoxy painted for maximum corrosion protection.

Model S-2600-M/S-2600-4F

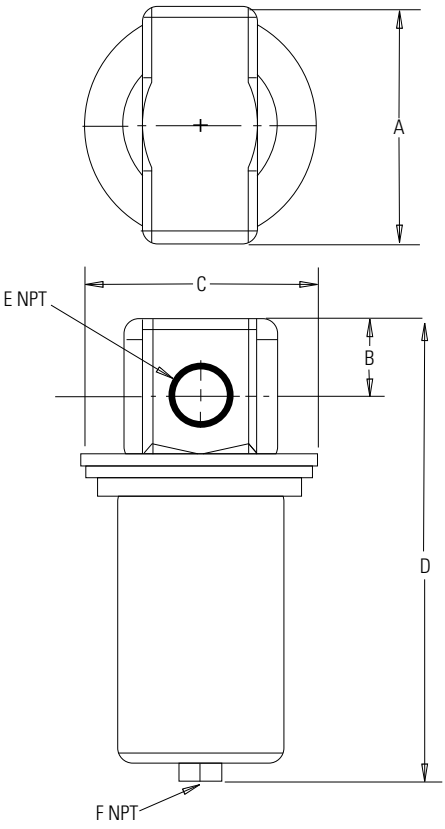
1500 thru 3500 SCFM capacity. Consult factory for details on larger models thru 16,000 SCFM. (S-2600-4F shown above.)

MAINTENANCE

1. Depressurize unit before removing bowl.
2. A. If unit is equipped with a manual petcock, drain bowl at least once per workshift. More frequent draining may be required

   B. If unit is equipped with an automatic float drain attached to the bowl, clean by turning bowl upside down, tapping on table top, and blow clean with airblow gun.
3. If bowl seal is cracked, damaged, or deteriorated, replace with approved seal.

Compressed Air Separators



Dimensions

MODEL NUMBER	A	B	C	D	E (NPT)	F (NPT)	WEIGHT LBS.
S-50 M	3.25	0.98	3.25	7.20	1/2"	1/8"	2.9
S-50 AD	3.25	0.98	3.25	7.35	1/2"	1/8"	3.1
S-100 M	4.62	1.00	4.75	10.00	1"	1/8"*	6.0
S-100 AD	4.62	1.00	4.75	10.00	1"	1/8"	6.0
S-200 M	5.10	1.60	4.38	10.80	1"	1/2"	4.8
S-300 M	6.70	2.00	4.38	17.00	1-1/2"	1/2"	11.2
S-600 M	6.70	2.00	6.00	17.00	2"	1/2"	11.2
S-1700 M	8.10	2.40	7.75	19.90	3"	1/2"	22.00
S-2600 M	13.75	7.25	8.62	30.50	4"	3/4"	85
S-2600 4F	13.75	7.25	8.62	30.50	4" Flg	3/4"	100

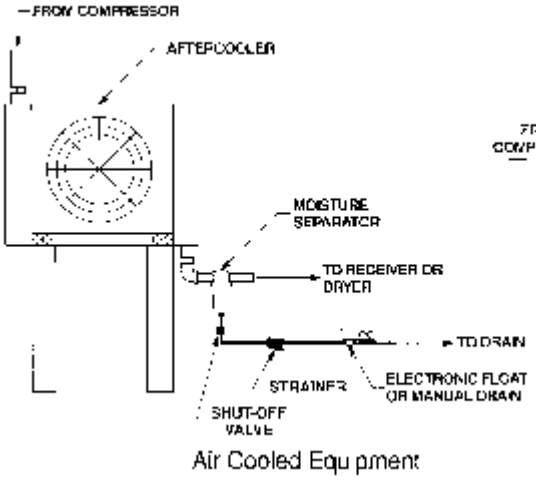
**Supplied with manual shut off valve.*

Specifications

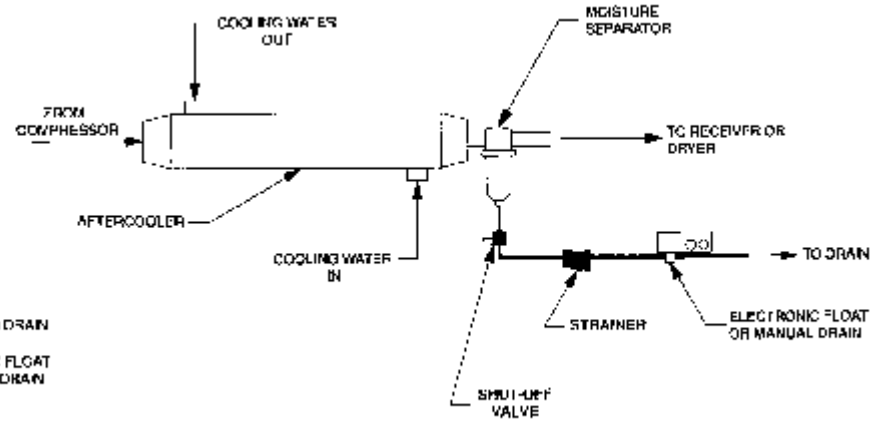
MODEL NUMBER	SCFM RANGE C100 PSIG MIN.	MAX	△P AT MAX SCFM	PSI MAX	TEMP °F MAX	BOWL TYPE	DRAIN TYPE
S-50 M	5	50	0.5	200	175	Cast Zinc	Manual
S-50 AD	5	50	0.5			Cast Zinc	Automatic with Internal Float
S-100 M	11	120	0.5			Cast Zinc	Manual
S-100 AD	11	120	0.5			Cast Zinc	Automatic with Internal Float
S-200 M	11	233	0.7	232	176	Aluminum	Manual
S-300 M	60	472	1.0			Aluminum	Manual
S-600 M	100	742	1.3			Aluminum	Manual
S-1700 M	260	1700	1.0			Aluminum	Manual
S-2600 M	1500	3500	1.5			Carbon Steel	Manual
S-2600 4F				150		Carbon Steel	Manual

MINIMUM OPERATING TEMPERATURE - 35°F
Specifications and dimensions subject to change without notice.

Recommended Typical Installation

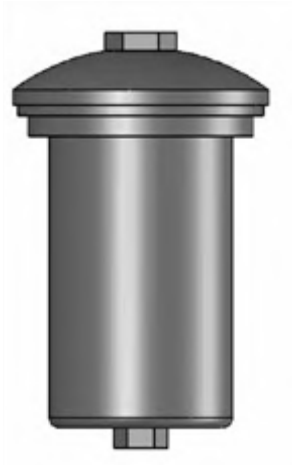


Air Cooled Equipment



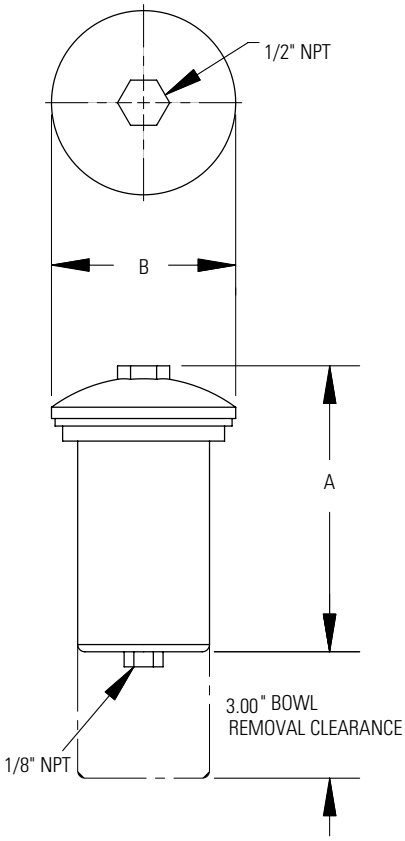
Water Cooled Equipment

Automatic Float Drain



FD-25 and FD-50 Models

Two Models to fit most applications. Rugged zinc cast housing. Equipped with quick disconnect bowls for easy servicing. Economical cost.



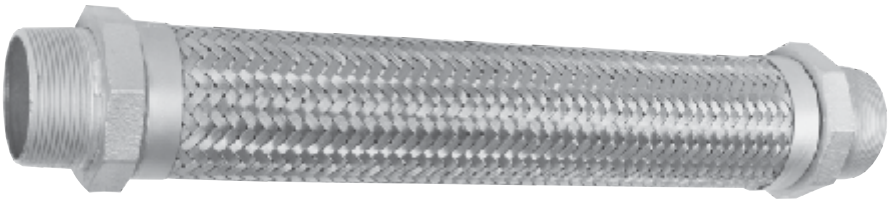
Dimensions

MODEL NUMBER	A	B
FD-25	4.75	3.06
FD-50	8.50	4.75

Specifications

MODEL NUMBER	PART NUMBER	PSI MAX	TEMP °F MAX	WEIGHT LBS (APPROX)
FD-25	66278	200	175	2.0
FD-50	66279			5.0

Flexible Metal Hose



Features

Designed to isolate damaging vibration, dampen noise and absorb thermal expansion from pumps and compressors to other related equipment. Hose is of corrosion resistant type 304 stainless steel. Connectors are carbon steel schedule 40 external NPT with hex nut attachments on both ends for easy installation. Couplings are welded to assure dependable leak free operation.

Specifications & Dimensions

PART NUMBER	CONNECTIONS NPT	HOSE INSIDE DIAMETER	OVERALL LENGTH	WORKING PRESSURE PSI			FITTING LENGTH (EACH END)	SHIPPING WT (APPROX)
				AT 70°	AT 300°	AT 400°		
67492	.5	.5	10	1000	900	863	2.00	2.0
66271	1.0	1.0	12	525	460	435	1.75	2.0
66272	1.5	1.5	16	450	395	370	2.00	3.0
66273	2.0	2.0	18	400	350	330	2.00	4.5
66274	2.5	2.5	20	285	250	235	2.50	8.5
67442	3.0	3.0	22	265	230	220	3.00	12.5
66275	4.0	4.0	24	260	225	215	4.00	14.5

All dimensions are inches. Maximum operating temperature 1500°F. Other sizes and lengths available—consult factory.

Dimensions

PART NUMBER	DESCRIPTION
67492	.5 x 10 Flex Hose
66271	1 x 12 Flex Hose
66272	1.5 x 16 Flex Hose
66273	2 x 18 Flex Hose
66274	2.5 x 20 Flex Hose
67442	3 x 22 Flex Hose
66275	4 x 24 Flex Hose

All shipments FOB Racine, WI USA

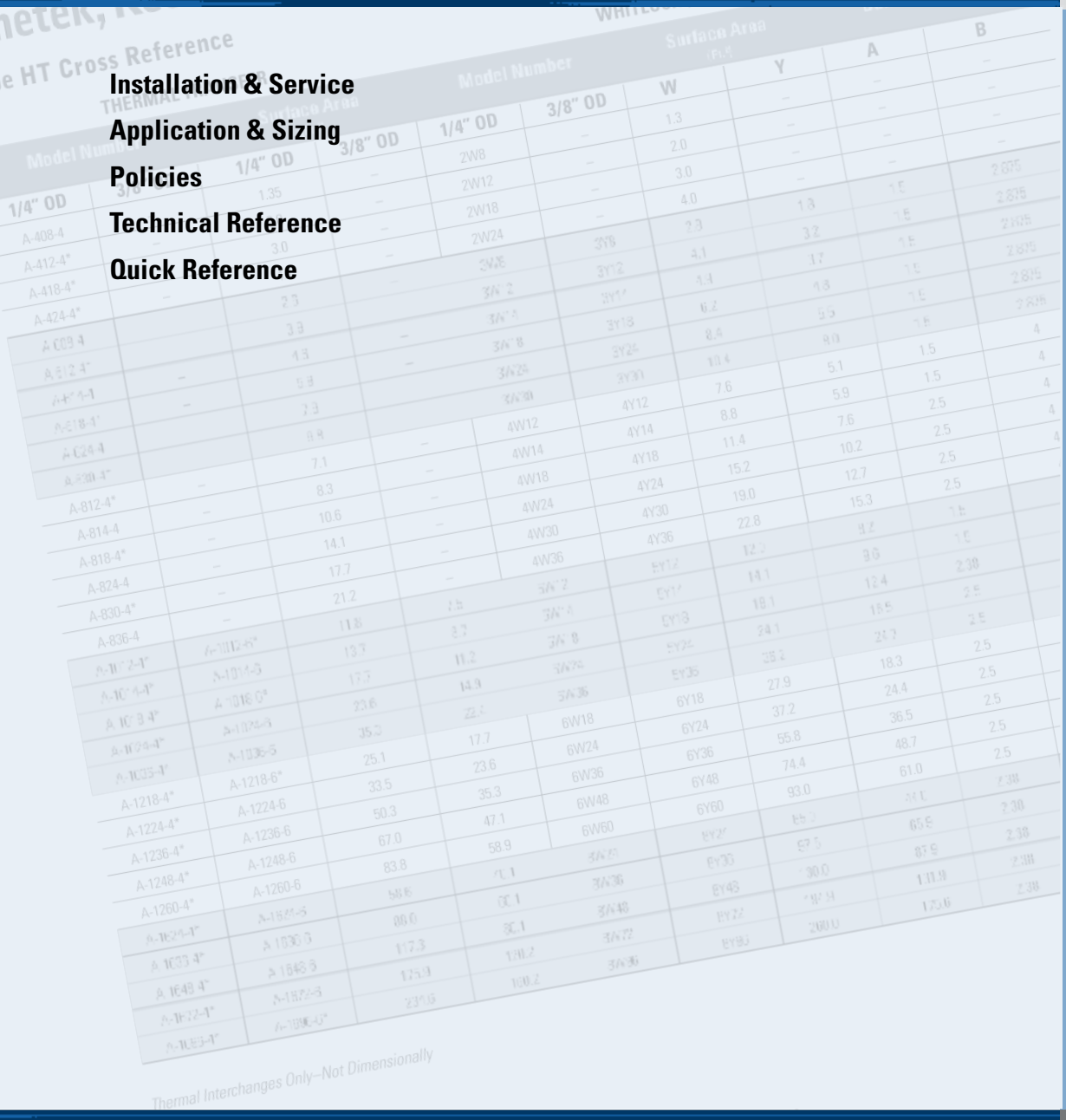
Installation

The satisfactory performance of flexible hoses is dependent upon certain precautions which must be taken at the time of installation.

1. Install the flexible hose directly on the pump, compressor or other equipment. If this is not practical, install as close as possible to the source of vibration.
2. **Do not** compress, twist or stretch during installation. Premature failure will result.
3. Flexible hoses must be installed so that its length is perpendicular to the direction of the vibration.
3. Support piping as needed to eliminate stress to the flexible hose. It must support only its own weight.

TECHNICAL & MISCELLANEOUS REFERENCES

5

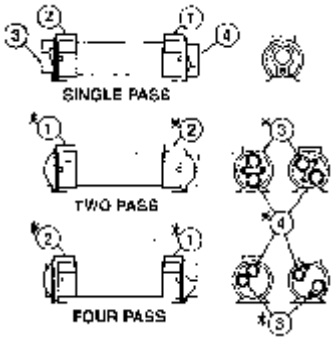


Thermal Transfer Products

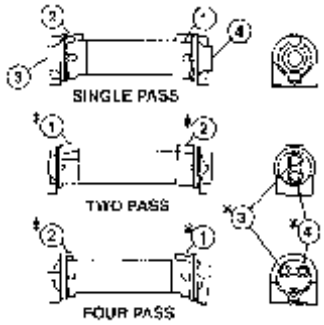
A ThermaSys® Company

a global leader in manufacturing highly engineered heat transfer products

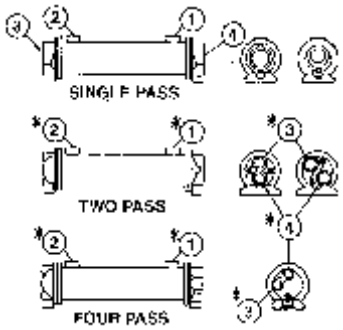
Heat Exchanger Piping Hook-up



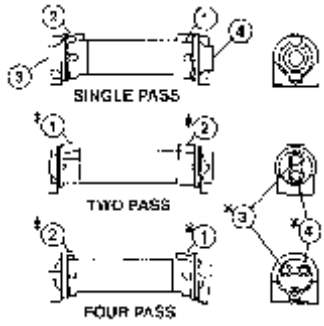
A Series



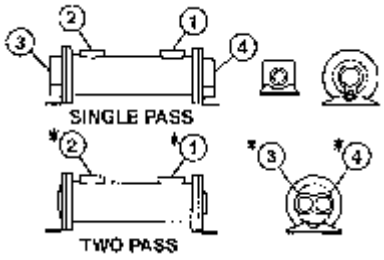
B Series



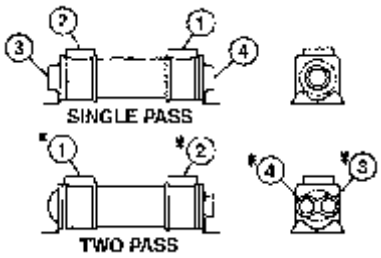
C Series



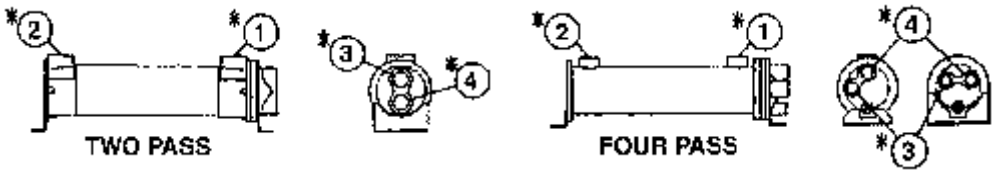
SLE, SL & R Series



EK, EKS & EKM Series



K & KN Series



U, UC & UR Series

Note baffle location when inserting bundle into shell assembly after cleaning.

(1) **Hot Fluid In**

(2) **Cooled Fluid Out**

(3) **Cooling Water In**

(4) **Cooling Water Out**

*Note: For all two pass and four pass heat exchangers: connections (1) and (2) may be reversed, and connections (3) and (4) may be reversed with no effect on performance.

Shell & Tube Heat Exchanger Installation & Service Recommendations

Installation The satisfactory use of this heat exchange equipment is dependent upon precautions which must be taken at the time of the installation.

1. Connect and circulate the hot fluid in the shell side (over small tubes) and the cooling water in the tube side (inside small tubes). Note piping diagrams.
2. If an automatic water regulating valve is used, place it on the INLET connection of the cooler. Arrange the water outlet piping so that the exchanger remains flooded with water, but at little or no pressure. The temperature probe is placed in the hydraulic reservoir to sense a system temperature rise. Write the factory for water regulating valve recommendations.
3. There are normally no restrictions as to how this cooler may be mounted. The only limitation regarding the mounting of this equipment is the possibility of having to drain either the water or the oil chambers after the cooler has been installed. Both fluid drain plugs should be located on the bottom of the cooler to accomplish the draining of the fluids. Drains are on most models.
4. It is possible to protect your cooler from high flow and pressure surges of hot fluid by installing a fast-acting relief valve in the inlet line to the cooler
5. It is recommended that water strainers be installed ahead of this cooler when the source of cooling water is from other than a municipal water supply. Dirt and debris can plug the water passages very quickly, rendering the cooler ineffective. Write the factory for water strainer recommendations
6. Fixed bundle heat exchangers are generally not recommended for steam service. For steam applications, a floating bundle exchanger is required. Note: When installing floating bundle unit, secure one end firmly and opposite end loosely to allow bundle to expand and contract. Consult factory for selection assistance.
7. Piping must be properly supported to prevent excess strain on the heat exchanger ports. If excessive vibration is present, the use of shock absorbing mounts and flexible connectors is recommended.

Service Each heat exchanger has been cleaned at the factory and should not require further treatment. It may be well to inspect the unit to be sure that dirt or foreign matter has not entered the unit during shipment. The heat exchanger should be mounted firmly in place with pipe connections tight.

Caution If sealant tape is used on pipe threads, the degree of resistance between mating parts is less, and there is a greater chance for cracking the heat exchanger castings. Do not overtighten. When storing the unit, be sure to keep the oil and water ports sealed. If storage continues into cold winter months, the water chamber must be drained to prevent damage by freezing.

Performance information should be noted and recorded on newly installed units so that any reduction in effectiveness can be detected. Any loss in efficiency can normally be traced to an accumulation of oil sludge, or water scale.

Recommendations Replace gaskets when removing end castings. It is recommended that gaskets be soaked in oil to prevent corrosion and ensure a tight seal.

Salt water should not be used in standard models. Use salt water in special models having 90/10 copper-nickel tubes, tube sheets*, bronze bonnets and zinc anodes on the tube side. Brackish water or other corrosive fluids may require special materials of construction.

When zinc anodes are used for a particular application, they should be inspected two weeks after initial startup.

At this time, by visual inspection of the anode, determination of future inspection intervals can be made, based on the actual corrosion rate of the zinc metal.

The zinc anodes must be replaced when 70% of the zinc volume has been consumed.

It may be necessary to drain the water chambers of the exchanger to protect it from damage by freezing temperatures. Drains are provided in most standard models.

The oil chamber of the exchanger may become filled with sludge accumulation and require cleaning. It is recommended that the unit be flooded with a commercial solvent and left to soak for one-half hour. Backflowing with the solvent or regular oil will remove most sludge. Repeated soaking and backflowing may be required, depending on the degree of sludge buildup.

It may be necessary to clean the inside of the cooling tubes to remove any contamination and/or scale buildup.It is recommended that a fifty-fifty percent solution of inhibited muriatic acid and water may be used. For severe problems, the use of a brush through the tubes may be of some help. Be sure to use a soft bristled brush to prevent scouring the tube surface causing accelerated corrosion. Upon completion of cleaning, be certain that all chemicals are removed from the shellside and the tubeside before the heat exchanger is placed into service.

When ordering replacement parts or making an inquiry regarding service, mention model number, serial number, and the original purchase order number.

**Available on C/CA Series models only.*

Max S & T Flow Rates

CAUTION Incorrect installation can cause this product to fail prematurely, causing the shell side and tube side fluids to intermix. Maximum allowable flow rates are as charted below.

B Series Model No. Example: B-702-A4-F

Unit Size	Shell Side (GPM)/Baffle Spacing A	B	C	D	E	Tube Side (GPM) O	T	T
400	9.6					25		
700	17	29	29			61	31	15
1000	24	48	69	69		146	73	37
1200	29	57	115	115		224	112	56
1600	37	74	149	253		363	181	91
2000			187	347*	457*	652	326	163

**281 GPM maximum for all B-2005-D **500 GPM maximum for all B-20080-E and 562 GPM maximum for all B2006-E6 or B-2006-E10*
562 GPM maximum for all B-2006-E6 or B-2006-E10

A Series Model No. Example: A-1024-2-6-F

Unit Size	Baffle Spacing	Shell Side (GPM)	Tube Side (GPM) O	T	F
400	.75, 2	7, 19	18	———	———
600	1, 1.5, 2, 4	14, 21, 29, 29	48	24	12
800	1.5, 2, 3, 4	29, 38, 57, 69	87	43	21
1000		32, 42, 60, 69	146	73	37
1200	2, 3, 4, 6	51, 77, 103, 115	224	112	56
1600		66, 100, 133, 200	280	203	101

K & EK Series Model No. Example: EK or K-712-F

Unit Size	Shell Side (GPM)	Tube Side (GPM) O	T
500	20	13	
700	70	24	12
1000	100	56	28

C Series Model No. Example: C-1024-2-6-F

Unit Size	Baffle Size	Shell Side (GPM)	Tube Side (GPM) O	T	F
600	1.38, 2, 3	19, 29, 29	48	24	12
800	1.38, 1.7, 2, 3, 4	26, 32, 38, 57, 69	84	42	21
1000	1.38, 2, 3, 5	24, 41, 64, 69	146	23	37
1200	2.5, 3, 3.62, 5, 6	60, 77, 93, 115, 115	224	112	56
1700	3.5, 4, 4.5, 5, 6, 7, 8.4	125, 143, 161, 179, 215, 251, 253	465	232	116

SLE Series Model No. Example: SLE-1236-6-F

Unit Size	Baffle Size	Shell Side (GPM)	Tube Side (GPM) O	T	F
1000	4, 6, 8	55, 70, 70	66	33	15
1200	4, 6, 8, 12	65, 100, 115, 115	120	60	28
1700	4, 6, 8, 12	90, 140, 190, 255	220	110	52

AOC Series

Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Description AOC series forced air oil coolers are used for high-efficiency oil cooling in hydraulic systems. Units utilize the latest in heat transfer technology to reduce the physical size and provide the ultimate in cooling capacity. By maintaining a lower oil temperature, hydraulic components and fluids work better and have a longer life expectancy.

General Safety Information

1. Do not exceed the pressure rating of the oil cooler, nor any other component in the hydraulic system.
2. Do not exceed the published maximum flow rates as the potential can result in damage to the hydraulic system.
3. Release all oil pressure from the system before installing or servicing the oil cooler.
4. These oil coolers are not suitable for use in hydraulic systems operating with water-glycol or high water base fluids without a corrosion inhibitor suitable for aluminum and copper component protection.

Unpacking After unpacking the unit. inspect for any loose, missing or damaged parts. Any minor damage to the cooling fins can generally be corrected by gently straightening them.

WARNING Do not exceed the maximum pressure of 300 PSI, or the maximum temperature of 350°F as oil cooler failure can occur.

1. These hydraulic oil coolers should be installed on either the low pressure return line, or a dedicated recirculation cooling loop.
2. Turn off the hydraulic system and drain any oil from the return lines before installing these coolers.
3. A strainer located ahead of the cooler inlet should be installed to trap scale, dirt, or sludge that may be present in piping and equipment, or that may accumulate with use. A thermostatic or spring loaded bypass/relief valve installed ahead of the cooler may be helpful to speed warm-up and relieve the system of excessive pressures.

   CAUTION Use of a back-up wrench is recommended to prevent twisting of the manifolds when installing the oil piping. If pipe sealant is used on threads, the degree of resistance between mating parts is less, and there is an increased chance for cracking the heat exchanger fittings. Do not over tighten.
4. Piping must be properly supported to prevent excess strain on the heat exchanger ports.

Operation Once unit is installed, turn the fan by hand to eliminate possible part interference because of damage in shipment or installation. Observe the fan operation upon initial startup. The system may then be operated.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surfaces Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with compressed air. Should the surface be greasy, the cooler should be brushed or sprayed with a mild alkaline solution, or a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam cleaner may also be used effectively. Do not use caustic cleaners.

Casing Fan and Motor Dirt and grease should be removed. Rusty or corroded surfaces should be sanded clean and repainted.

Internal Cleaning At least once a year piping should be disconnected and degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full thermal capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pumps and accessories. The strainer or any filtering devices should be removed and serviced following this cleaning operation.

Trouble Shooting Chart

Symptom	Possible Cause	Corrective Action
Not cooling adequately	1. Not enough air flow 2. Unit is fouled 3. Unit is undersized	1. Consult specifications and adjust if required 2. Clean exchanger (see maintenance) 3. Check specifications and change size if necessary
Leaking at connections	1. Not tight 2. No thread sealant	1. Tighten carefully 2. Remove pipe, apply thread sealant and reinstall

Heat Exchangers – AO, AOVH, AOHM, AOF, & AOVHM Series

General Information

1. Air cooled oil coolers are built for operation with maximum oil pressures of 300 psi and temperatures of 400°F.
2. The motors furnished are specially built for fan duty. They are guaranteed by the manufacturer for operation in a maximum ambient temperature of 104°F. Consideration should be given to installation location so motors are not subjected to temperatures above this level.
3. Air/oil coolers that are to be installed for utilization of waste heat for the space heating should be mounted 7 to 14 feet above the floor depending on the structure, for proper heat distribution.

Installation

1. "AO" and "AOF" coolers are designed for suspension by eye bolts or threaded hangar rods screwed into the upper and lower covers in 1/2" to13 threaded holes; "AOVH" coolers have 6 to 12 holes (0.56" diameter) in the base for mounting. Refer to product page for location and quantity.
2. Units should not be located in corrosive atmospheres as rapid deterioration of casing, cooling coil, fan and motor may take place resulting in reduced life.
3. For proper air flow, a minimum of 12" should be allowed between the oil cooler fan and any walls or obstructions.
4. Piping should be sized based on oil flow and pressure drop requirements and not on the oil coolers supply and return connection size. Piping should also be properly supported to prevent excessive strain to connection, manifolds, etc.
5. Filter located ahead of the cooler should be installed to trap scale, dirt or sludge that may be present in piping and equipment, or that may accumulate with use. A thermostatic or spring loaded by-pass relief valve installed ahead of the cooler may be helpful to speed warm-up and relieve the system of excessive pressure. All accessories should be considered in the original heat rejection and piping calculations.
6. Electric Motors: CAUTION To prevent possible electrical shock, it is important to make sure this unit is grounded properly. Connect motor only to a power supply of the same characteristics as shown on the motor nameplate. Voltage may vary 10% of nameplate voltage. Be sure to provide proper fusing to prevent possible motor burnout. Follow wiring diagram printed on motor nameplate or in terminal box. Before starting motor, follow motor manufacturer recommendations. Turn fan manually to eliminate possible motor burn out in the event the fan has become damaged in shipment. Observe operation carefully after motor is started for the first time.
7. Hydraulic Motors: Connect motor, port B, to inlet oil line and return line to port A for correct rotation. A filter is highly recommended upstream of the motor rated at 25 micron nominal. Controlling oil flow rate as specified on motor data sheet with cooler is very important. Maximum oil pressure to motor is 2000 psi, minimum pressure is shown on motor data sheet. Do not allow dirty oil to enter the motor. Excessive flows will cause fan blade failure. Insufficient flows to motor will reduce cooling capacity.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surface Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with an air hose. Should the surface be greasy, the motor should be removed and the fins and tubes brushed or sprayed with a mild alkaline solution, or a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam hose may also be used effectively.

Casing, Fan and Motor: Dirt and grease should be removed from these parts. Rusty or corroded surfaces should be sanded clean and repainted.

Internal Cleaning: At lease once a year piping should be disconnected and a degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer of any filtering devices should be removed and serviced following this cleaning operation.

Electric Motor Keep outside surface free of dirt and grease so motor will cool properly. Make sure cooling air over motor is not obstructed. Prelubricated ball bearing motors are normally furnished and require no grease for about 5 to 10 years. Sleeve bearing motors require oil after three years.

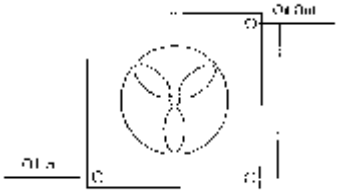
Hydraulic Motor Change any oil filter(s) in the motor circuit as frequently as necessary to assure that good, clean oil is maintained.

Units with Replaceable Air Filters Examine filters for dirt and grease accumulation twice yearly, or more if operating conditions dictate. If disposable filters are used, replace as required. If the washable aluminum filters are used, wash with a warm water and soap solution that will remove dirt and cut grease build-up. Make sure that the aluminum filter is completely dry before replacing the unit. This filter can be made more effective if treated with a lightweight oil before placing in service. It is recommended that a spare aluminum filter be kept in stock to minimize downtime during the filter cleaning operation.

Repair or Replacement of Parts When ordering replacement parts or making inquiry regarding service, mention model number, serial number and the original purchase order number. Any reference to the motor must carry full nameplate data.

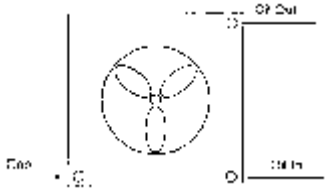
Air/Oil Heat Exchangers

One Oil Pass



AO, AOF & AOHM Models	One Pass Flow in GPM	AOVH & AOVHM Models	One Pass Flow in GPM
5	2-80	5	4-160
10	3-80	10	6-160
15	4-80	15	8-160
20	5-80	20	10-160
25	6-100	25	12-200
30	7-100	30	14-200
35	8-112	35	16-220
40	9-118	40	18-230

Two Oil Passes



AO, AOF & AOHM Models	Two Pass Flow in GPM	AOVH & AOVHM Models	Two Pass Flow in GPM
5	2-25	5	4-50
10	2-30	10	4-60
15		15	
20	2-40	20	4-80
25		25	
30		30	
35	3-40	35	6-80
40	4-40	40	8-80

GRESEN HYDRAULIC MOTOR SPECIFICATIONS

Models	Maximum Fan Speed (rpm)	Oil Flow Required (gpm)	Displacement (cu. in./rev)	Minimum Operating Pressure (psi)
AOHM-5	1725	1.6	.22	300
AOHM-10				
AOHM-15				
AOHM-20				
AOHM-25	1140	1.1		400
AOHM-30				
AOHM-35				900
AOHM-40				
AOVHM-5	3450	3.3		300
AOVHM-10				
AOVHM-15				
AOVHM-20				
AOVHM-25	1725	3.4	.45	500
AOVHM-30				
AOVHM-35		5.2	.70	1000
AOVHM-40				

Maximum operating pressure 2000 psi. Stated minimum operating pressure is at inlet port of motor. 1000 psi allowable downstream back pressure.

Air Cooled Oil Coolers — AOL/BOL/OCA Models

General Information

1. Air cooled oil coolers are built for operation with maximum oil pressure of 250 psi (17.2 BAR) and temperatures of 350°F (176°C).
2. The motors furnished are built for fan duty. Consideration should be given to the installation location so motors are not subjected to extreme temperatures.
3. Oil coolers are not to be operated in ambient temperatures below 35°F (1°C).
4. The fan cannot be cycled.
5. AOL coolers operated outdoors must be protected from weather. Consult factory for recommendations.

Installation

1. Air cooled oil coolers should not be located in corrosive atmospheres as rapid deterioration of fan shroud, cooling coil, fan and motor may take place.
2. Piping should be sized based on oil flow and pressure drop requirements, not on the oil cooler's supply and return connection sizes.
3. A filter located ahead of the oil cooler should be installed to trap dirt or sludge that may be present in piping and equipment, or that may accumulate with use.
4. Flexible connectors should be installed to prevent the stressing of manifolds. (Must be properly installed to validate warranty.)
5. For proper air flow, a minimum of 12" should be allowed between the oil cooler fan and any walls or obstructions.

Electrical

1. CAUTION To prevent possible electrical shock, it is important to make sure this unit is properly grounded.
2. Connect motor only to a power supply of the same characteristics as shown on the motor nameplate. Be sure to provide proper fusing to prevent possible motor burnout. Before starting motor, follow manufacturer's recommendations. Turn fan manually to eliminate possible motor burnout in the event the fan has been damaged in shipment. Observe operation after motor is started for the first time.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surface Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with an air hose. Should the surface be greasy, the motor should be removed and the fins and tubes brushed or sprayed with a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam hose may also be used effectively. Do not clean with caustic cleaners.

Fan Shroud, Fan and Motor Dirt and grease should be removed from these parts. Rusty or corroded surfaces should be sanded clean and repainted.

Internal Cleaning Once a year piping should be disconnected and a degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer of any filtering devices should be removed and serviced following this cleaning operation.

Motor Keep outside surface free of dirt and grease so motor will cool properly. Ball bearing equipped motors are sealed, and do not require greasing. Motors with Alemite fittings require lubrication every 6 months. Clean tip of fitting and apply grease gun. Use 1 to 2 full strokes on motors in NEMA 215 frame and smaller. Use 2 to 3 strokes on NEMA 254 through NEMA 365 frame. Use 3 to 4 strokes in NEMA 404 frame or larger. CAUTION Keep grease clean. Lubricate motors at standstill. Do not mix petroleum grease and silicone grease in motor bearings.

Repair or Replacement of Parts When ordering replacement parts or making inquiry regarding service, mention model number, serial number and the original purchase order number. Any reference to the motor must carry full nameplate data.

RM Series

Unpacking Instructions

Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Description RM series forced air oil coolers are used for high-efficiency oil cooling in hydraulic systems. Units utilize the latest in heat transfer technology to reduce the physical size and provide the ultimate in cooling capacity. By maintaining a lower oil temperature, hydraulic components and fluids work better and have a longer life expectancy.

General Safety Information

1. Do not exceed the pressure rating of the oil cooler, nor any other component in the hydraulic system.
2. Do not exceed the published maximum flow rates as the potential can result in damage to the hydraulic system.
3. Release all oil pressure from the system before installing or servicing the oil cooler.
4. These oil coolers are not suitable for use in hydraulic systems operating with water-glycol or high water base fluids without a corrosion inhibitor suitable for aluminum and copper component protection.

Unpacking After unpacking the unit. inspect for any loose, missing or damaged parts. Any minor damage to the cooling fins can generally be corrected by gently straightening them.

WARNING Do not exceed the maximum pressure of 300 PSI, or the maximum temperature of 350°F as oil cooler failure can occur.

1. These hydraulic oil coolers should be installed on either the low pressure return line, or a dedicated recirculation cooling loop.
2. Turn off the hydraulic system and drain any oil from the return lines before installing these coolers.
3. A strainer located ahead of the cooler inlet should be installed to trap scale, dirt, or sludge that may be present in piping and equipment, or that may accumulate with use. A thermostatic or spring loaded bypass/relief valve installed ahead of the cooler may be helpful to speed warm-up and relieve the system of excessive pressures.

   CAUTION
   Use of a back-up wrench is recommended to prevent twisting of the manifolds when installing the oil piping.

   If pipe sealant is used on threads, the degree of resistance between mating parts is less, and there is an increased chance for cracking the heat exchanger fittings. Do not over tighten.
4. Piping must be properly supported to prevent excess strain on the heat exchanger ports.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surfaces Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with compressed air. Should the surface be greasy, the cooler should be brushed or sprayed with a mild alkaline solution, or a non-flammable degreasing fluid. Follow with hot water rinse and dry thoroughly. A steam cleaner may also be used effectively. Do not use caustic cleaners.

Casing Dirt and grease should be removed. Rusty or corroded surfaces should be sanded clean and repainted.

Internal Cleaning At least once a year piping should be disconnected and decreasing agent or flushing oil circulated through the unit to remove sludge form turbulators and internal tube surfaces to return the unit to full thermal capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pumps and accessories. The strained or any filtering devices should be removed and serviced following this cleaning operation.

Trouble Shooting Chart

Symptom	Possible Cause	Corrective Action
Not cooling adequately	1. Not enough air flow 2. Unit is fouled 3. Unit is undersized	1. Consult specifications and adjust if required 2. Clean exchanger (see maintenance) 3. Check specifications and change size if necessary
Leaking at connections	1. Not tight 2. No thread sealant	1. Tighten carefully 2. Remove pipe, apply thread sealant and reinstall

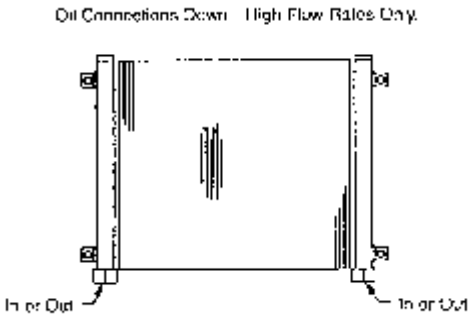
M Series & MR Series

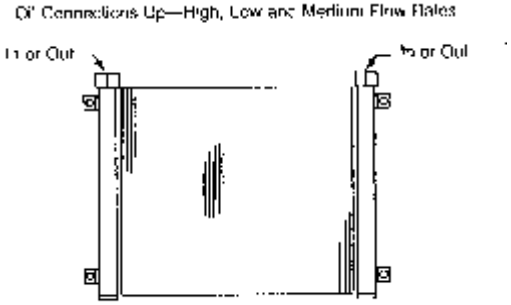
General Information

1. Air Cooled Mobile Series coolers are built for operation with maximum oil pressures to 300 psi and temperatures to 400°F.
2. Care must be taken to reduce or eliminate dirt and debris from blocking the cooling surface as overheating could result.

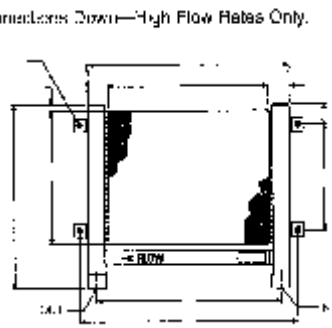
Heat Exchanger Piping Hook-up

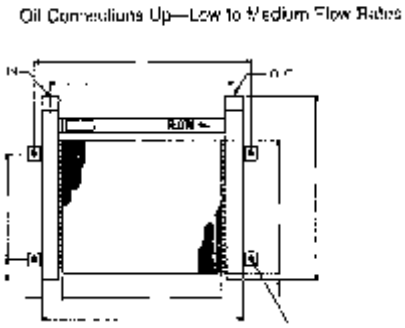
M Series





MR Series





Installation

1. Mobile Series coolers are designed for mounting by "L" shaped brackets attached to the sides of the manifolds.
2. It is recommended that these units be installed with the oil ports positioned, based on oil flow rates.
3. Units should not be located in corrosive atmospheres as rapid deterioration of cooling coil, and/or manifolds may take place resulting in reduced service life (corrosion resistant coatings available—consult factory).
4. Piping should be sized based on oil flow and pressure drop requirements, not on the oil coolers port sizes. It should also be properly supported to prevent excessive strain to connections, manifolds, etc.

NOTE: Oil port position is at customer option, however, the cooler must be flooded with oil to take full advantage of cooling potential.

Maintenance

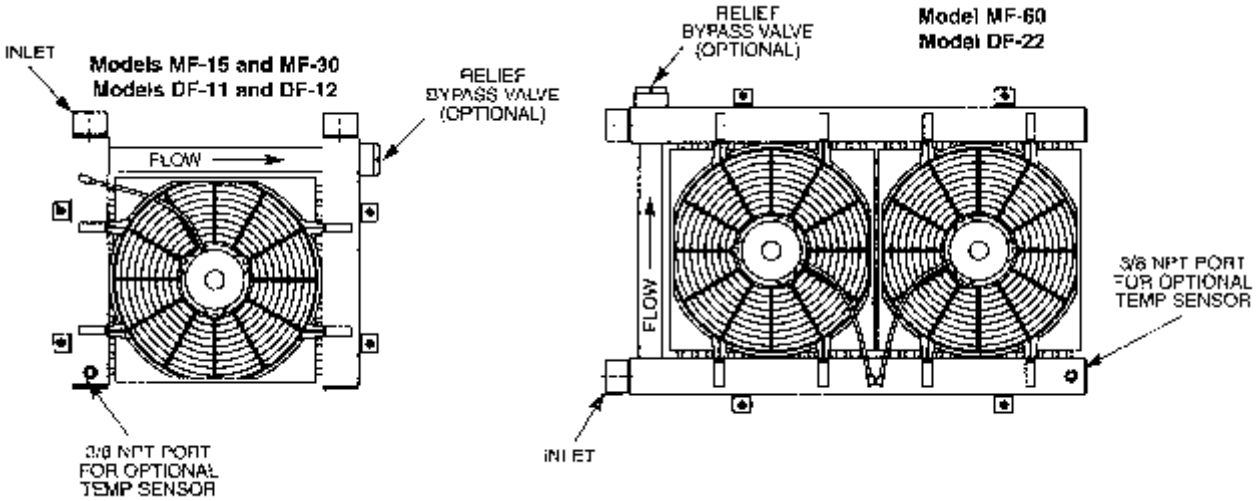
1. The unit should be inspected regularly for corrosion and dirty or clogged heat transfer surface. Dirt and dust can be removed by washing, brushing or blowing out with compressed air. Should the surface be greasy, the fins and tubes can be brushed or sprayed with a non-flammable degreasing fluid which is safe on copper, steel and aluminum. Follow with a hot water rinse and dry thoroughly. A steam cleaner can also be used effectively.
2. Once a year, or as required by the application, piping should be disconnected and a degreasing agent circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer or any filtering devices should also be serviced following this operation.
3. When ordering replacement parts or inquiring on service, mention the model number, serial number and the original purchase order number.
4. Check valve cartridge (MR Series) is not serviceable. Install oil filter ahead of unit to keep foreign particles from rendering the cartridge ineffective.

MF Series & DF Series

General Information

1. Air Cooled "MF and "DF" Mobile Series coolers are built for operation with maximum oil pressures to 300 psi and temperatures to 350°F.
2. Care must be taken to reduce or eliminate dirt and debris from blocking the cooling surface as overheating could result.

Heat Exchanger Piping Hook-up



Installation

1. These coolers are designed for mounting by "L" shaped brackets attached to the sides of the manifolds.
2. It is recommended that these units be installed with the oil ports positioned as shown below.
3. Units should not be located in corrosive atmospheres as rapid deterioration of cooling coil, and/or manifolds may take place resulting in reduced service life.
4. Piping should be sized based on oil flow and pressure drop requirements, not on the oil coolers port sizes.
5. Turn fan blade manually to assure proper clearance before motor start-up in case it has been damaged in shipment.

NOTE: Oil port position is at customer option, however, the cooler must be flooded with oil to take full advantage of cooling potential.

Maintenance

1. The cooler should be inspected regularly for corrosion and dirty or clogged heat transfer surface. Dirt and dust can be removed by washing, brushing or blowing out with compressed air. Should the surface be greasy, the fins and tubes can be brushed or sprayed with a non-flammable degreasing fluid which is safe on copper, steel and aluminum. Follow with a hot wash rinse and dry thoroughly. A steam cleaner can also be used effectively.
2. Once a year, or as required by the application, piping should be disconnected and a degreasing agent circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer or any filtering devices should also be serviced following this operation.
3. Twelve volt DC motors are not serviceable and must be replaced if problems occur..
4. When ordering replacement parts or inquiring on service, mention the model number, serial number, and the original purchase order number.

Brazed Plate — BP Series & BPS Series

Liquid To Liquid Service

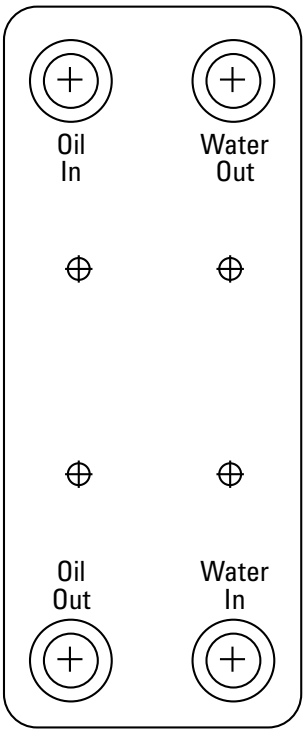
Installation Units may be mounted in any orientation. The only limitation regarding the mounting of this equipment is the possibility of having to drain the unit after installation. It may be necessary to drain the fluids to protect the unit from damage by freezing temperatures.

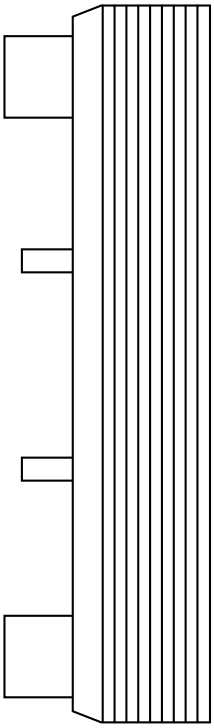
Water Strainer A water strainer should be installed in the water inlet to protect the unit from particulate matter. 16-20 mesh minimum (20-40 mesh best choice).

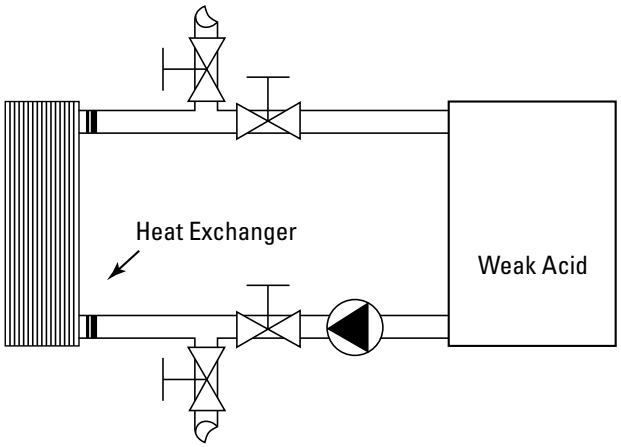
Piping Piping must be properly supported to prevent excess strain on the heat exchanger ports. Type 304 Stainless steel is typically not satisfactory for salt water service.

Cleaning In some applications, the fouling tendency could be very high; for example when using extremely hard water. It is always possible to clean the exchanger by circulating a cleaning liquid. Use a tank with a weak acid. 5% phosphoric acid, or if the exchanger is frequently cleaned, 5% oxalic acid. Pump the cleaning liquid through the exchanger. For optimum cleaning, the cleaning solution flow rate should be a minimum of 1.5 times normal flow rate, preferably in a backflush mode. Afterwards rinse with large amounts of fresh water in order to get rid of all the acid before starting up the system again. Clean at regular intervals.

BPM Series







Cleaning in place

Air Cooled Compressed Air Aftercoolers — AA-35 – AA-300 & UPA-20 – UPA-100

General Information

1. Air cooled aftercoolers are built for operation with maximum air pressure of 250 psi and temperature of 350°F.
2. The motors furnished are built for fan duty. Consideration should be given to the installation location so motors are not subjected to extreme temperatures.
3. Air cooled aftercoolers are generally installed at floor level. If the unit is to be used to reclaim waste heat for space heating, it is recommended that the unit be mounted 7 to 14 feet above the floor, depending on the structure, for proper heat distribution.

Installation

1. Air cooled aftercoolers are designed for mounting either by mounting legs, or by suspension from brackets attached to the cabinet. (Hanger rod not included.)
2. Aftercoolers should not be located in corrosive atmospheres as rapid deterioration of casing, cooling coil, fan and motor may take place resulting in reduced life.
3. Piping should be sized based on air flow and pressure drop requirements and not on the aftercooler's supply and return connection size. The piping must also be properly supported to prevent manifold stress.
4. A strainer located ahead of the aftercooler should be installed to trap scale, dirt or sludge that may be present in piping and equipment, or that may accumulate with use.
5. A separator/trap/drain should be installed in the outlet piping of the aftercooler to remove condensate.
6. Flexible connectors should be installed to prevent the stressing of manifolds. (Must be properly installed to validate warranty.)
7. Arrange the outlet pipe so that the moisture that condenses within the aftercooler can drain freely by gravity.
8. For proper air flow, a minimum of 12" clearance should be allowed between the aftercooler fan and any wall or obstructions.

Electrical

1. CAUTION To prevent possible electrical shock, it is important to properly ground this unit using grounding screw provided. Be sure not to disconnect the motor grounding wire when making this connection.
2. Connect motor only to a power supply of the same characteristics as shown on the motor nameplate. Be sure to provide proper fusing to prevent possible motor burnout. Before starting motor, follow manufacturer's recommendations. Turn fan manually to eliminate possible motor burnout in the event the fan has been damaged in shipment. Observe operation after motor is started for the first time.
3. In a typical compressor aftercooler installation, the aftercooler is interlocked to the compressor so it runs whenever the compressor is turned on.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surface Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with an air hose. Should the surface be greasy, the motor should be removed and the fins and tubes brushed or sprayed with a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam hose may also be used effectively.

Casing, Fan and Motor Dirt and grease should be removed from these parts. Rusty or corroded surfaces should be sanded clean and repainted.

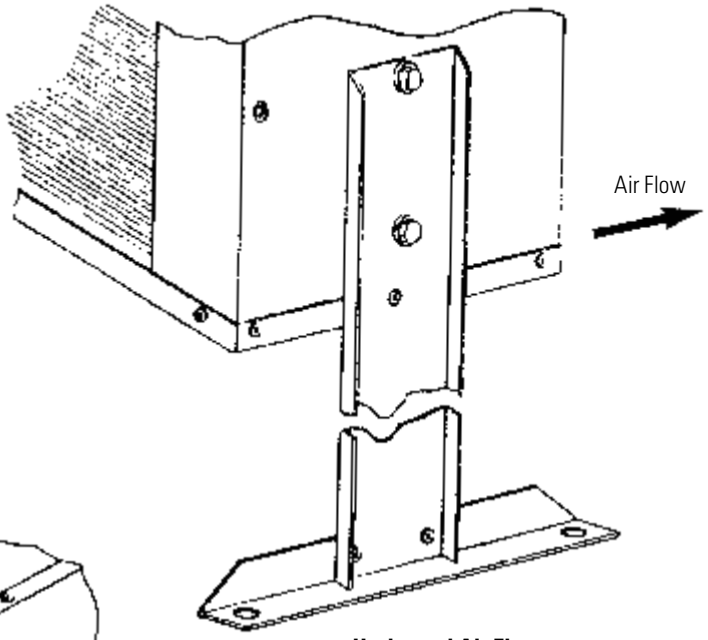
Internal Cleaning Once a year piping should be disconnected and a degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer of any filtering devices should be removed and serviced following this cleaning operation. Caustic cleaners should not be used to clean these heat exchangers.

Motor Keep outside surface free of dirt and grease so motor will cool properly. Make sure cooling air over motor is not obstructed. Sleeve bearing motors are normally furnished and require lubrication every 6 months. Add a few drops of SAE 20 oil to each bearing. When TEFC Motors are furnished, they are normally prelubricated ball bearing motors and require no grease for about 5 to 10 years.

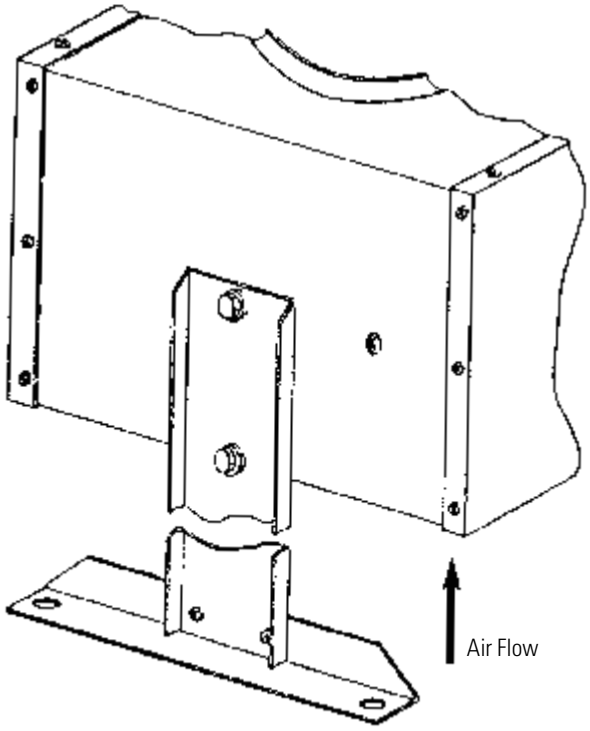
Repair or Replacement of Parts When ordering replacement parts or making inquiry regarding service, mention model number, serial number and the original purchase order number. Any reference to the motor must carry full nameplate data.

Models UPA 50 & UPA 100

Leg Installation



Horizontal Air Flow
Leg Installation



Vertical Air Flow
Leg Installation

Air Cooled Compressed Air Aftercoolers — AHP(H) Models

General Information

1. Air cooled aftercoolers are built for operation with maximum air pressure of 250 psi (17.2 BAR) and temperature of 350°F (176°C).
2. The motors furnished are built for fan duty. Consideration should be given to the installation location so motors are not subjected to extreme temperatures.
3. AHP Coolers are not to be operated in ambient temperatures below 35°F (1°C).
4. The fan cannot be cycled.
5. AHP coolers operated outdoors must be protected from weather. Consult factory for recommendations.

Installation

1. Aftercoolers should not be located in corrosive atmospheres as rapid deterioration of fan shroud, cooling coil, fan and motor may take place resulting in reduced life.
2. Piping should be sized based on air flow and pressure drop requirements, and not on the aftercooler's supply and return connection size.
3. A strainer located ahead of the aftercooler should be installed to trap scale, dirt or sludge that may be present in piping and equipment, or that may accumulate with use.
4. A separator/trap/drain should be installed in the outlet piping of the aftercooler to remove condensate.
5. Flexible connectors should be installed to prevent the stressing of manifolds. (Must be properly installed to validate warranty.)
6. Arrange the outlet pipe so that the moisture that condenses within the aftercooler can drain freely by gravity.
7. For proper air flow, a minimum of 12" clearance should be allowed between the aftercooler fan and any wall or obstructions.

Electrical

1. CAUTION To prevent possible electrical shock, it is important to make sure this unit is grounded properly.
2. Connect motor only to a power supply of the same characteristics as shown on the motor nameplate. Be sure to provide proper fusing to prevent possible motor burnout. Before starting motor, follow manufacturer's recommendations. Turn fan manually to eliminate possible motor burn out in the event the fan has been damaged in shipment. Observe operation after motor is started for the first time.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surface Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with an air hose. Should the surface be greasy, the motor should be removed and the fins and tubes brushed or sprayed with a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam hose may also be used effectively. Do not clean with caustic cleaners

Fan Shroud, Fan and Motor: Dirt and grease should be removed from these parts. Rusty or corroded surfaces should be sanded clean and repainted.

Internal Cleaning Once a year piping should be disconnected and a degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer of any filtering devices should be removed and serviced following this cleaning operation.

Motor Keep outside surface free of dirt and grease so motor will cool properly. Ball bearing equipped motors are sealed, and do not require greasing. Motors with Alemite fittings require lubrication every 6 months. Clean tip of fitting and apply grease gun. Use 1 to 2 full strokes on motors in NEMA 215 frame and smaller. Use 2 to 3 strokes on NEMA 254 through NEMA 365 frame. Use 3 to 4 strokes in NEMA 404 frame or larger.

CAUTION Keep grease clean. Lubricate motors at standstill. Do not mix petroleum grease and silicone grease in motor bearings.

Repair or Replacement of Parts When ordering replacement parts or making inquiry regarding service, mention model number, serial number and the original purchase order number. Any reference to the motor must carry full nameplate data.

Combination Oil Cooler/Aftercooler Side By Side Air Cooled — ACOC(H) Models

General Information

1. Side by side units are built for operation with maximum air and oil pressure of 250 psi and temperature of 350°F (176°C).
2. The motors furnished are built for fan duty. Consideration should be given to the installation location so motors are not subjected to extreme temperatures.
3. The "ACOC" coolers are not to be operated in ambient temperatures below 35°F (1°C).
4. The fan cannot be cycled.
5. "ACOC" coolers operated outdoors must be protected from weather. Consult factory for recommendations.

Installation

1. Units should not be located in corrosive atmospheres as rapid deterioration of fan shroud, cooling coil, fan and motor may take place resulting in reduced life.
2. Piping should be sized based on air flow and pressure drop requirements, and not on the aftercooler's supply and return connection size.
3. A strainer located ahead of the aftercooler should be installed to trap scale, dirt or sludge that may be present in piping and equipment, or that may accumulate with use.
4. A separator/trap/drain should be installed in the outlet piping of the aftercooler to remove condensate.
5. Flexible connectors should be installed to prevent the stressing of manifolds. (Must be properly installed to validate warranty.)
6. Arrange the outlet pipe so that the moisture that condenses within the aftercooler can drain freely by gravity.
7. For proper air flow, a minimum of 12" clearance should be allowed between the aftercooler fan and any wall or obstructions.

Electrical

1. CAUTION To prevent possible electrical shock, it is important to make sure this unit is properly grounded.
2. Connect motor only to a power supply of the same characteristics as shown on the motor nameplate. Be sure to provide proper fusing to prevent possible motor burnout. Before starting motor, follow manufacturer's recommendations. Turn fan manually to eliminate possible motor burn out in the event the fan has been damaged in shipment. Observe operation after motor is started for the first time.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surface Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with an air hose. Should the surface be greasy, the motor should be removed and the fins and tubes brushed or sprayed with a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam hose may also be used effectively. Do not clean with caustic cleaners

Fan Shroud, Fan and Motor Dirt and grease should be removed from these parts. Rusty or corroded surfaces should be sanded clean and repainted.

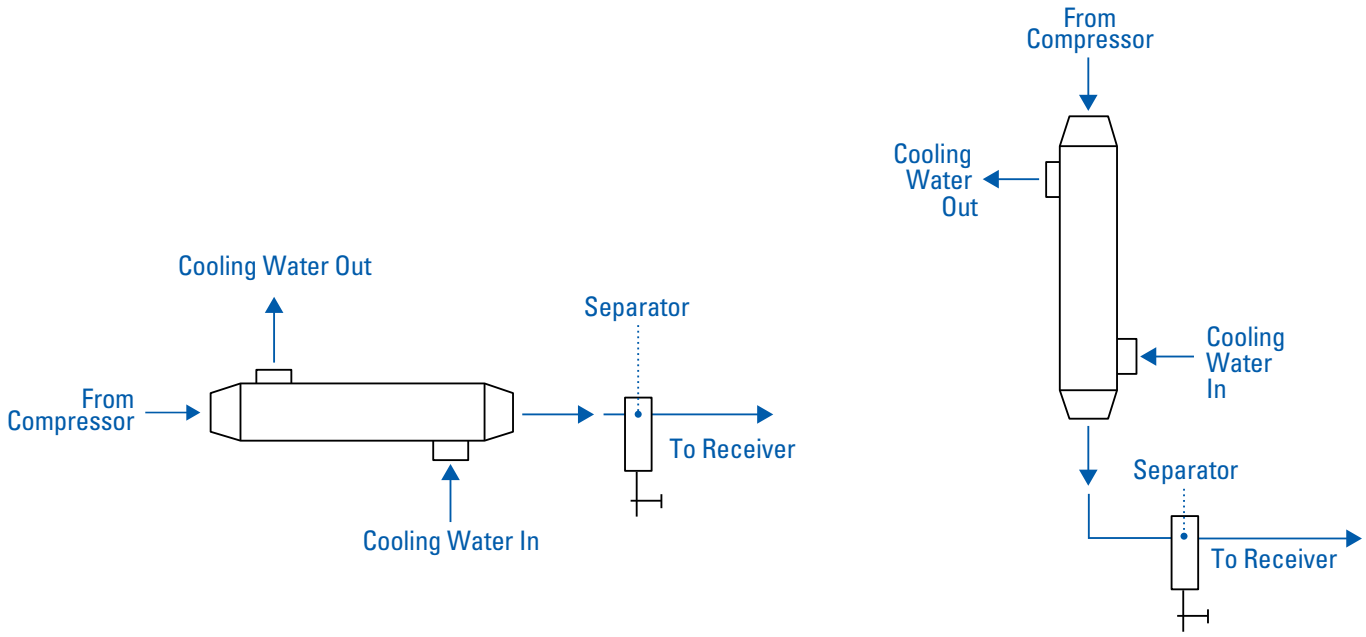
Internal Cleaning Once a year piping should be disconnected and a degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer of any filtering devices should be removed and serviced following this cleaning operation.

Motor Keep outside surface free of dirt and grease so motor will cool properly. Make sure cooling air over motor is not obstructed. Ball bearing motors are normally furnished and require lubrication every 6 months. If the motor is equipped with Alemite fitting, clean tip of fitting and apply grease gun. Use 1 to 2 full strokes on motors in NEMA 215 frame and smaller. Use 2 to 3 strokes of NEMA 254 through NEMA 365 frame. Use 3 to 4 strokes on NEMA 404 frames and larger. On motors having drain plugs, remove grease drain plug and operate motor for 20 minutes before replacing drain plug. On motors equipped with slotted head grease screw, remove screw and apply grease tube to hole. Insert 2 to 3 inch length of grease string into each hole on motors in NEMA 215 frame and smaller. Insert 3 to 5 inch length on larger motors. On motors having grease drain plugs, remove plug and operate motor for 20 minutes before replacing drain plug. CAUTION Keep grease clean. Lubricate motors at standstill. Do not mix petroleum grease and silicone grease in motor bearings.

Repair or Replacement of Parts When ordering replacement parts or making inquiry regarding service, mention model number, serial number and the original purchase order number. Any reference to the motor must carry full nameplate data.

Water Cooled Compressed Air Aftercooler — AB Models

Installation The satisfactory use of this heat exchange equipment is dependent upon certain precautions which must be taken at the time of the installation.



1. Aftercoolers can be mounted in either of the positions shown. Separators should be used as shown above.
2. If an automatic water regulating valve is used, place it on the INLET end of the cooler. Arrange the water outlet piping so that the exchanger remains flooded with water, but at little or no pressure. The temperature probe is placed in the air line from the aftercooler to sense a system temperature rise. Please contact factory for water regulating valve recommendations.

   It is recommended that a water strainer be installed ahead of this aftercooler when the source of cooling water is from other than a municipal water supply. Dirt and debris can plug the water passages very quickly, rendering the aftercooler ineffective. Please contact factory for water stainer recommendations.
3. A separator/trap/drain should be installed in the outlet piping of the aftercooler to remove the condensate.
4. All piping to the aftercooler should be properly aligned and supported to avoid stress to the unit. A flexible metal hose should also be installed between the aftercooler and compressor to isolate damaging vibration.
5. CAUTION If sealant tape is used on pipe threads, the degree of resistance between mating parts is less, and there is a greater chance for cracking the aftercooler castings. Do not over tighten.
6. Never exceed maximum flow rates or ratings.

Service Each aftercooler has been cleaned at the factory and should not require further treatment. It may be well to inspect the unit to be sure that dirt or foreign matter has not entered the unit during shipment. The aftercooler should be mounted rigidly in place with pipe connections tight.

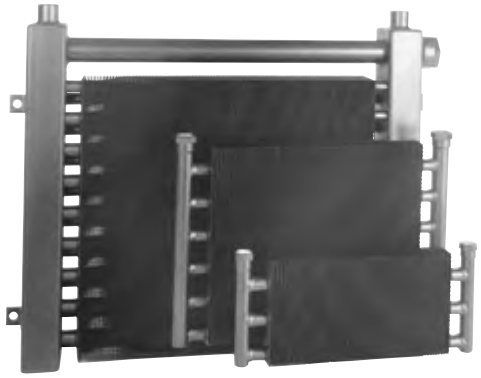
Performance information should be noted and recorded on newly installed units so that any reduction in effectiveness can be detected. Any loss in efficiency can normally be traced to an accumulation of water scale or deposits.

When storing the unit, be sure to keep the air and water ports sealed. If storage continues into the cold winter months, the water chamber must be drained to prevent damage by freezing.

Replace gaskets when removing end castings.

DH Series

Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.



Description DH series mobile oil coolers are used for high-efficiency oil cooling in hydraulic systems. Units utilize the latest in heat transfer technology to reduce the physical size and provide the ultimate in cooling capacity. By maintaining a lower oil temperature, hydraulic components and fluids work better and have a longer life expectancy.

General Safety Information

1. Do not exceed the pressure rating of the oil cooler, nor any other component in the hydraulic system.
2. **Do not exceed** the published maximum flow rates as the potential can result in damage to the hydraulic system.
3. Release all oil pressure from the system before installing or servicing the oil cooler.
4. These oil coolers are not suitable for use in hydraulic systems operating with water-glycol or high water base fluids without a corrosion inhibitor suitable for aluminum and copper component protection.

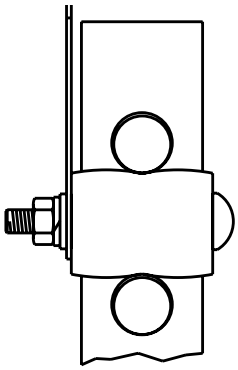
Unpacking After unpacking the unit. inspect for any loose, missing or damaged parts. Any minor damage to the cooling fins can generally be corrected by gently straightening them.

Installation

WARNING Do not exceed the maximum pressure of 300 PSI, or the maximum temperature of 350°F as oil cooler failure can occur.

1. These hydraulic oil coolers should be installed on either the low pressure return line, or a dedicated recirculation cooling loop.
2. Turn off the hydraulic system and drain any oil from the return lines before installing these coolers.
3. Installation of a fast acting relief/bypass valve is recommended to protect the oil cooler from excessive pressure and/or oil flow rates.
4. These coolers are normally installed in front of the engine radiator to obtain the coolest possible air flow.
5. There are no restrictions as to how the unit may be mounted; however, the unit must be flooded with oil to obtain the full cooling potential.
6. Mount the unit with the brackets* by installing them between any two adjacent exchanger tubes. Use the most convenient tubes for your specific location. See figure 1 below for details.

Figure 1
Shock Mounting Kit
(brackets are optional)



CAUTION If pipe sealant is used on threads, the degree of resistance between mating parts is less, and there is an increased chance for cracking the heat exchanger fittings. Do not overtighten.

Operation Once unit is installed, the system may be operated normally. If the source of cooling air is other than the main engine fan, be sure that the fan is running.

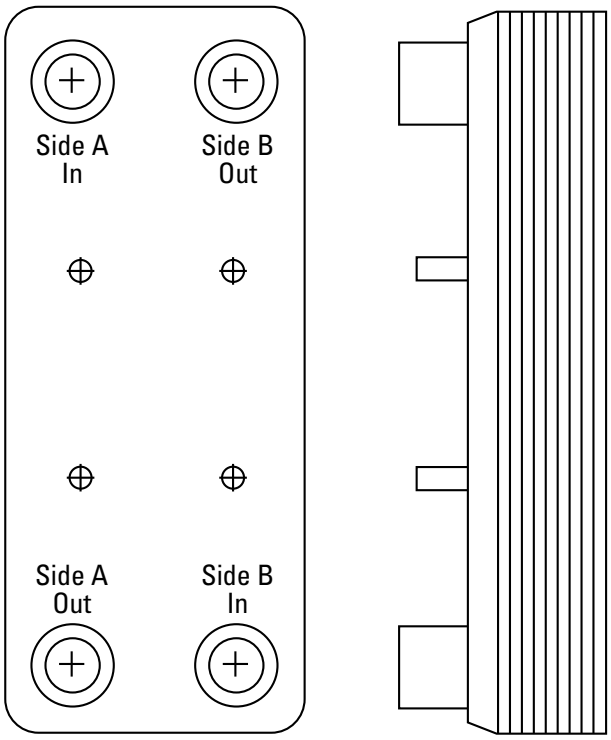
Maintenance

1. Performance information should be noted on newly installed units so that any reduction in effectiveness can be detected.
2. Inspect the unit regularly for corrosion and dirty or clogged heat transfer surfaces. Dirt and dust can be removed by washing, brushing, or blowing out with compressed air. A steam cleaner is also effective in cleaning dirty or greasy surfaces. Do not use caustic cleaners.
3. The oil chamber may become filled with sludge accumulation and require cleaning. It is recommended that the unit be flooded with a commercial solvent, and left to soak for one-half hour. Repeated soakings and back flowing may be required, depending on the amount of sludge accumulated.

Trouble Shooting Chart

Symptom	Possible Cause	Corrective Action
Not cooling adequately	1. Not enough air flow	1. Consult specifications and adjust if required
	2. Unit is fouled	2. Clean exchanger (see maintenance)
	3. Unit is undersized	3. Check specifications and change size if necessary

Condensing and Evaporative Service — Brazed Plate BPCH Series



Installation Unit MUST be installed in a vertical position, Dx (Freon Distribution Tube) inlet on lower position.

Water Strainer water strainer SHOULD be installed in the water inlet to protect the unit from particulate matter. 16 to 20 mesh minimum (20 to 40 mesh best choice).

Flow Switch A pressure differential switch or flow switch MUST be installed to prevent possible freeze up. Leaving temperature sensors and low pressure cut outs are not adequate to keep up with the fast reaction time of plate type heat exchangers.

Internal Distributor An optional built-in Dx distributor tube with orifices is offered to improve unit performance. This tube assures equal refrigerant distribution to all plates. It is typically used on BP plate sizes 12 x 5 and 20x 5 with more than 40 plates. It is also suggested for use on BP models 20 x 10 with more than 24 plates. When used, there is a 25 psi pressure drop at the Dx gas entrance area. The expansion valve for models with this feature should be oversized to compensate for the distributor pressure drop.

-10°F to 50°F Suction Dx inlet at bottom connections, no oil return problems. <-10°F Suction Dx inlet at bottom connections, possible oil return problems below -20°F depending upon gas velocities, or, Dx inlet at top connection; no oil return problem; use suction accumulator.

Piping Dx inlet piping sized to 500 fpm (liquid) (2.54 m/s).

Sealing Plate All models have a Sealing Plate as a standard feature to prevent moisture and frost freezing (unlike other brands). Frost buildup will not damage the unit. Recommend 1/2" to 3/4" insulation.

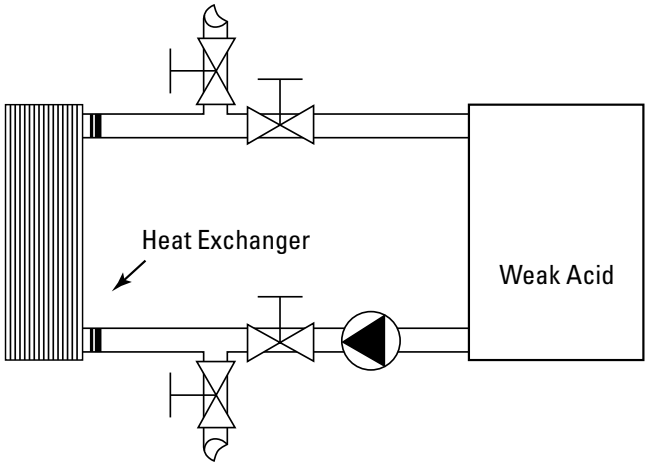
Sweat Connections Use 45% Silver Solder. Use cold rag around base of connection. Do not overheat. Purge with nitrogen optional.

Soldering Instructions

1. Use wet rags to protect lower fitting area.
2. Use 45% Silver solder.
3. Do not apply excessive heat.

Cleaning In some applications, the fouling tendency could be very high; for example when using extremely hard water. It is always possible to clean the exchanger by circulating a cleaning liquid. Use a tank with a weak acid. 5% phosphoric acid, or if the exchanger is frequently cleaned 5% oxalic acid. Pump the cleaning liquid through the exchanger. For optimum cleaning, the cleaning solution flow rate should be a minimum of 1.5 times normal flow rate, preferably in a backflush mode. Afterwards, rinse with large amounts of fresh water in order to get rid of all the acid before starting up the system again. Clean at regular intervals.

Cleaning in place



AHP(H), AOL, ACOC(H) and CL Series

1. The cooler storage area should be dry and maintained at a constant room temperature.
2. In order to minimize and/or eliminate condensation (on both the inside and outside surfaces of the cooler), coolers should not be moved from warm areas to cold areas without prior adjustment of the room temperature in order to minimize the temperature changes which result in condensation. If this criteria cannot be met, the cooler shall be sealed in plastic bags with desiccant added.
3. For coolers which will be stored up to a maximum of 6 months: No specific internal corrosion protection procedures are required. All cooler openings shall be sealed with plastic plugs.
4. For coolers which will be stored from 6 months to 24 months: These coolers should be internally flushed with oil and all cooler openings sealed with plastic plugs.
5. For coolers which will be stored for more than 24 months: These coolers should be completely filled with oil and sealed. These coolers should then be flushed, inspected, refilled with oil, and sealed every 24 months.
6. For compressor aftercoolers after installation:
   - 6.1 Any condensation should be thoroughly removed from the aftercooler after the initial trial run of the compressor.
   - 6.2 In the event a compressor is to be stored, or not used for a period of 6 months to 24 months, the aftercooler should be internally flushed with oil, and all cooler openings sealed.
   - 6.3 In the event a compressor is to be stored, or not used for a period of more than 24 months, the aftercooler should be completely filled with oil and sealed. the aftercooler should then be flushed, inspected, refilled with oil, and sealed every 24 months.
   - 6.4 Prior to compressor start-up, any corrosion protection oil should be removed from the aftercooler.

Heresite Corrosion Protection

Heresite is a unique baked phenolic coating thermal Transfer uses to protect air cooled heat exchangers from external corrosion.

The following information has been supplied to Thermal Transfer by Heresite-Saekaphen Inc.:

Introduction The first HERESITE coating application to the exterior surfaces of finned tube coils took place over thirty years ago. Since that time, the HERESITE baking phenolic coating has effectively demonstrated its value in protecting heat transfer coils from corrosive attack, hereby appreciably increasing equipment service life. the excellent chemical and temperature resistance coupled with the good heat transfer properties of the HERESITE coating have made possible the outstanding results being obtained.

Description The HERESITE coating of finned tube coils is accomplished by a multiple coat application of dipping and baking resulting in complete coating coverage of the fins, tubes, headers, casings, etc. Consequently, protection against corrosion is provided for the entire coil. Due to specialized surface preparation techniques plus the good adhesive properties of the HERESITE coating, it is possible to efficiently HERESITE coat all the usual metals used in fabricating finned tube coils.

The HERESITE coating applied to finned tube coils is a Flexible Brown Baking Phenolic Coating. This coating is applied to either aluminum, copper or steel with equal results.

We feel it is important to emphasize that HERESITE baking phenolic coatings are manufactured and sold only by HERESITE-SAEKAPHEN, INC. Further, the application of the HERESITE baking phenolic coating to finned tube coils is performed only at our plant in, Manitowoc, Wisconsin.

Practically all types of finned tube coils used for oil, water, air, gas and process cooling (and heating) as well as large condensing coils can be HERESITE protected against damaging environments. Currently, the HERESITE coating of air-conditioning and industrial process coils exposed to corrosive fumes and salt atmosphere is on the increase.

HERESITE coating offers a more economical solution than special metals for these applications. For example, we understand that aluminum fin coils coated with HERESITE are more economical than copper fin coils. Special metal casing materials are unnecessary since the HERESITE coating is applied to the casing as well as to the finned tubes. Additionally, HERESITE coating aluminum fins will resist attack from most cleaning agents more successfully than copper fin coils. It is noted that the HERESITE coating is applied to both plate fin coils as well as spiral wound tubing.

Chemical Resistance The HERESITE baking phenolic coating will withstand exposure to practically all corrosive and chemical fumes with the exception of strong alkalis such as sodium hydroxide, strong oxidizing agents such as aqua regia and concentrations of bromine, chlorine, and fluorine in excess of 100 parts per million. Complete chemical resistance data is shown on the following page.

Temperature Resistance Maximum temperature resistance of 450°F. However, HERESITE baking phenolic coatings cannot be recommended for all chemical atmospheres at temperatures up to 450°F since corrosive activity and permeation may be greater at higher temperatures depending upon the chemicals involved. Excellent adhesion and flexibility enable HERESITE coating to withstand thermal shock. Also, the HERESITE lining will operate at sub zero temperatures without loss of chemical and mechanical properties.

Thermal Conductivity The HERESITE baking phenolic coating is a good thermal conductor and its thermal conductivity is expressed as approximately 2000 BTU per hour per square foot per degree Fahrenheit based on an average 3 mil coating thickness. The "K" factor = 6.0.

Coil manufacturers have indicated there is no need to add additional heating or cooling surface due to the presence of the HERESITE coating.

Guide to Chemical Resistance of HERESITE Bake Phenolic Linings: HERESITE baked phenolic linings will withstand exposure to practically all corrosive atmospheres with the exception of strong alkalis, strong oxidizers and wet bromine, chlorine and fluorine in concentrations greater than 100 PPM. Due to the fact that resistance of HERESITE is dependent upon conditions of service, environment, fabrication details plus other factors, Thermal Transfer Products, Ltd. should be consulted for specific recommendation.

HERESITE Advantages

- Elimination of costly metals
- Extended service life
- Smooth surface - reduced cleaning
- Complete coverage by dipping
- Good thermal conductor
- Good abrasion resistance
- Resistant to many corrosive environments
- Good temperature resistance

Note

4-5 week lead time adder

HERESITE

HERESITE is resistant to Fumes of the Following

acetates - all
acetic acid
acetone
acetylene
acrylonitrile
alcohols - all
aldehydes - all
alum
amines - all
ammonia
ammonium hydroxide
ammonium nitrate
aniline
benzoic acid
benzol
boric acid
brine
butane
carbolic acid
carbonates - all
carbon monoxide
carbon tetrachloride
chlorides - all
chlorinated solvents - all
chlorine - less than 100 ppm
chloroform
chromic acid
citric acid
coke oven gas
esters - all
ethers - all
ethylene oxide
fatty acids
fluosilicic acid
formaldehyde
formic acid
freon
fuels - all
gases - inert
gases - manufactured
gases - natural
glycerin
glycols - all
hydrocarbons - all
hydrochloric acid
hydrogen
iodides - all
ketones - all
lacquers
lactic acid
maleic acid
malic acid
methanol
methylene chloride
naphthalene
nitrates - all
nitric acid (dilute)
nitrates - all
nitrobenzene
nitrogen fertilizers
oils, mineral and vegetable - all
oxalic acid
oxygen
perchloric acid (dilute)
phenol
phosphoric acid
picric acid
propane
salicylic acid
silicic acid
steam vapor
stearic acid
sulfate liquors
sulfonic acid
sulfur dioxide
sulfuric acid
sulfurous acid
surfactants
tannic acids
tetraethyl lead
toluene
trisodium phosphate
urea
saltwater
water
xylene

HERESITE is not resistant to Fumes of the Following

aluminum fluoride
ammonium fluoride
aqua regia
bleaching compounds
brass plating solutions
bromine - over 100 ppm
bronze plating solutions
cadmium cyanide
calcium hypochlorite
caustic soda
chlorine - over 100 ppm
cyanide plating solutions
fluorine - over 100 ppm
hydrofluoric acid (conc.)
hydrogen peroxide
hypochlorites
nitric acid (conc.)
nitrogen oxides
potassium hydroxide
sodium fluoride (conc.)
sodium hydroxide (conc.)

High Elevation — Air Cooled Oil Coolers

When sizing air cooled heat exchangers for high elevation applications, consideration should be given to the loss in performance because of the lower density of the cooling air. Use one of the following formulas that has an added factor CE1 or CE1 to offset this loss of performance. The net result of these calculations is a larger cooler.

C_{E1}

1. For AO (Bulletin 15.02), ACOC (Bulletin 17.02), AOVH (Bulletin 18.01), Air or Gas Aftercoolers (Air Cooled - Bulletin 32.06) coolers, AOC - Industrial (Bulletin 13.02) and RM (Bulletin 24.02)

$$\frac{\text{Horsepower to be removed x 2545 x Cv x CE1}}{\text{°F (Oil Leaving - Ambient Air Entering)}}$$

C_{E2}

2. For AOL (Bulletin 16.01), ACOC (Bulletin 34.01), Mobile (Bulletin 25.04), AOC - Mobile (Bulletin 21.02), MF (Bulletin 25.04), DF (Bulletin 36.02, DH (Bulletin 28.03), and AOHM and AOVHM (Bulletin 19.04)

HORSEPOWER AT ELEVATION = HORSEPOWER HEAT LOAD X C_{E2}

Elevation	C_{E1}	C_{E2}
0	1.00	1.00
1000	1.03	1.02
2000	1.05	1.04
3000	1.08	1.07
4000	1.10	1.08
5000	1.12	1.10
6000	1.14	1.11
7000	1.16	1.12
8000	1.18	
9000	1.20	1.13
10000	1.22	1.14
11000	1.24	
12000	1.25	1.15
13000	1.27	
14000	1.28	
15000	1.30	1.16

Product Warranty

Thermal Transfer Products warrants its products to be free of any defects in workmanship or materials under what is considered to be normal service for 12 months from the date of manufacture from our plant in Racine, Wisconsin.

All obligations and liabilities are limited to the repair or replacement of the defective part at our option. Thermal Transfer Products accepts no liability for consequential damage or reinstallation labor.

Any accessories or components furnished by other manufacturers shall be subject to the manufacturer's particular warranty.

Thermal Transfer Products reserves the right to revise or improve any products with no obligation to incorporate these changes in any products manufactured prior to such revisions or improvements. The company will not assume responsibility for contingent liability through any alleged failure or failure of any of its products or accessories.

This 12-month warranty does not apply to failures, which result from:

- Over-pressurization,
- Improper application,
- Improper installation or mounting design, which permits excessive vibration and causes failure or breakage of parts due to material fatigue or deterioration.
- Damages as a result of freezing.
- Shipping Damage
- Failure due to corrosion or damage from storage in corrosive atmospheric conditions.
- Failure to follow the factory provided installation and service instructions.

To obtain warranty approval, the customer must first obtain a Return Goods Authorization (RGA) number from the Thermal Transfer Products distributor through whom the product was originally purchased.

All units must be held for inspection by a factory representative or at the discretion of the Thermal Transfer Products Service Dept. returned to the factory for evaluation. (See the Warranty Return Policy for further details.)

Unauthorized Field Service
If a buyer secures unauthorized field service on a product or its accessory, the buyer shall be responsible for all time and expenses incurred therein. This includes charges for freight, labor and service, together with any other expenses incurred.

Questions?
Refer all questions about this policy to:
Warranty & Returns Manager
Phone:(262)554-8330 x248
Fax: (262)554-8773

Warranty Return Policy

Policy Overview
The TTP Limited Product Warranty is included in the sale of all products sold through authorized OEM and Distributors. Liability for defective workmanship and material shall be limited to the repair or replacement (at the option of TTP) of any parts found to be defective within the warranty period.

Items NOT covered under warranty are as follows:

- Freight Damage
- Corrosion
- Over-Pressurization
- Improper Installation
- Excessive Vibration

Standard Product Warranty
TTP products are warranted for a period of 12 months from the date of manufacture to all authorized distributors and OEM's.

Warranty Claim Authorization
To be considered for warranty repair or credit all units must be held for inspection by a factory representative or at the discretion of the Service Dept. returned to the factory for warranty evaluation.

To obtain warranty approval, the customer must first contact the authorized distributor where the product was originally purchased, to obtain a Return Goods Authorization (RGA) number. The RGA number will be valid for 14 days only.

Shipping Instructions
Prior to shipment the unit must have all external plumbing and hardware removed and be thoroughly drained of all fluids. Failure to do so will result in a clean-up charge billed at $77 per hour. Units are to be shipped prepaid with RGA clearly marked on outside of package. Units received at TTP shipped freight collect or without a RGA number will be refused and returned to the shipper at his expense.

The ship-to address is as follows
Thermal Transfer Products
5215 21st Street
Racine, WI 53406 - 5096
Attn: Service Department

Inspection
Upon inspection if a unit is found to have a defect in materials and/or workmanship, a credit for the cost of the unit plus all incoming shipping charges (excluding air freight charges) will be issued.

If a unit has been misapplied or is beyond the warranty period, the customer will be notified and the unit will be returned, shipped freight collect or disposed of locally at the discretion of the customer.

Questions?
Refer all questions about this policy to:
Warranty & Returns Manager
Phone:(262)554-8330 x248
Fax: (262)554-8773

Product Return Policy

Policy Overview
Thermal Transfer will, at it's discretion, accept units for return only with a value greater than $100, from it's authorized customers for credit, less a 25% restock charge. Units must be not older than 90 days from date of original shipment, in like-new condition and in original packaging to be considered for return under this policy. Specially engineered units are not returnable.

Return Authorization
Authorized distributors and OEM's must obtain a Return Goods Authorization Number (RGA) prior to the return of any products. The following information will be required when requesting authorization:

- Date of Purchase
- Your P.O. Number
- Reason for Return

Shipping Instructions

This product must be in the original packaging and in like-new condition. Units are to be shipped freight prepaid. Units received at Thermal Transfer shipped freight collect or without a RGA number will be refused and returned to the customer at his expense.

The shipping address is as follows
Thermal Transfer Products
5215 21st Street
Racine, WI 53406-5096
Attn: Service Department (Include RGA Number on packaging)

NOTE
RGA number is valid for 14 days only and must be clearly noted on the packaging of the return unit.

Inspection
Upon inspection, if a unit is found to be in un-saleable condition, the unit will be reworked to new condition. Any rework costs will be deducted from the return credit and/or billed back to the customer.

Questions?
Refer all questions about this policy to:
Warranty & Returns Manager
Service Dept. Manager
Phone: (262)554-8330

NOTE
RGA valid for 14 days only.
Policy subject to change without notice.

Damaged/Mis-shipped Goods Policy

Policy Overview
All shipments are F.O.B. our plant. Thermal Transfer Products is responsible for delivering products and accessories in good order to the carrier in the correct models and quantities as documented on the carriers freight bill.

The carrier signs documents indicating the models, quantities and condition of goods to be delivered. All claims for damage should be made with the freight carrier.

Customer Responsibilities
The customer is responsible for assuring that a notation of discrepancies is made on the bill of lading, at the time of delivery, thereby enabling a claim or credit to be issued.

The customer is responsible for inspecting goods immediately upon receipt to verify correct models and quantities, as well as the condition of the goods.

Errors in Shipments
Errors in shipments include:

- Incorrect Goods
- Shortage of Goods
- Overshipment of Goods

Carriers formally acknowledge the quantity and the type of goods placed in their possession at the time they accept the load. Customers are expected to inspect goods upon receipt and to notify TTP in writing, including all proper documentation for shortages and overages with regard to the packing list.

If TTP sends the incorrect goods or created an over-shipment of goods with regard to what the customer ordered, the customer may make a claim against TTP by submitting the following documentation to the TTP Sales Department within 30 days after receiving a shipment:

- A copy of the packing list
- A copy of the TTP invoice

Send the above documentation to:
Thermal Transfer Products
5215 21st Street
Racine, WI 53406 - 5024

If the customer does not want to keep the goods that were shipped in error or overshipped, the customer should contact the Sales Department to make a formal request to return the goods to the factory or origin and receive written authorization to do so.

Under no circumstances are goods to be returned to the factory without prior written authorization. Goods returned to the factory are to be in like-new condition and in original packaging.

Damaged Goods

All shipments are F.O.B. our plant. TTP makes every attempt to manufacture, handle and load goods with the utmost care. Carriers formally acknowledge goods are free from damage at the time they accept the goods. Customers are expected to inspect goods upon receipt and to make claims against the carrier for damage to goods.

All claims for damage should be make with the freight carrier.
Under no circumstances are damaged goods to be returned to the factory without prior written authorization.

Questions?
Refer all questions about this policy to:
Warranty & Returns Manager
Phone:(262)554-8330 x248
Fax: (262)554-8773

Notes

Related Formulas

MASS FLOW RATE = VOL FLOW RATE x DENSITY

CENTIPOSE = CENTISTOKES x SPECIFIC GRAVITY

SCFM = FACE AREA (ft^2) x FACE VELOCITY (sfpm)

$$\text{PRESSURE (psi)} = \frac{\text{FORCE (pounds)}}{\text{AREA (in}^2\text{)}}$$

$$\text{VOL FLOW RATE(gpm)} = \frac{\text{VOLUME (gallons)}}{\text{TIME (minutes)}}$$

$$\text{INPUT POWER (hp)} = \frac{\text{PRESSURE (psig) x FLOW (gpm)}}{1714}$$

$$\text{VEL THROUGH PIPING (ft/s)} = \frac{0.3208 \text{ x FLOW RATE (gpm)}}{\text{INTERNAL AREA (in}^2\text{)}}$$

$$\text{COMPRESSIBILITY OF OIL} = \frac{\text{PRESSURE (psig) x VOL OF OIL UNDER PRESSURE}}{\text{250,000 (approx)}}$$

In additional required oil to reach pressure

$$\text{COMPRESSIBILITY OF A FLUID} = \frac{1}{\text{BULK MODULUS OF THE FLUID}}$$

$$\text{SPECIFIC GRAVITY OF A FLUID} = \frac{\text{WT OF ONE CUBIC FT OF FLUID}}{\text{WT OF ONE CUBIC FT OF WATER}}$$

$$\text{PUMP OUTLET FLOW (gpm)} = \frac{\text{RPM x PUMP DISPLACEMENT (in}^2\text{/rev)}}{231}$$

$$\text{PUMP INPUT POWER (hp)} = \frac{\text{FLOW RATE OUTPUT (gpm) x PRESSURE (psig)}}{\text{1714 x OVERALL EFFICIENCY}}$$

$$\text{OVERALL PUMP EFFICIENCY (\%)} = \frac{\text{OUTPUT HORSEPOWER x 100}}{\text{INPUT HORSEPOWER}}$$

OVERALL PUMP EFFICIENCY (%) = VOL EFF. X MECHANICAL EFF.

$$\text{VOL PUMP EFFICIENCY (\%)} = \frac{\text{ACTUAL FLOW RATE OUTPUT (gpm) x 100}}{\text{THEORETICAL FLOW RATE OUTPUT (gpm)}}$$

$$\text{MECHANICAL PUMP EFFICIENCY (\%)} = \frac{\text{THEORETICAL TORQUE TO DRIVE x 100}}{\text{ACTUAL TORQUE TO DRIVE}}$$

$$\text{PUMP DISPLACEMENT (in}^3\text{/rev)} = \frac{\text{FLOW RATE (gpm) x 231}}{\text{PUMP RPM}}$$

$$\text{PUMP TORQUE (inlbs)} = \frac{\text{HORSEPOWER x 63025}}{\text{RPM}}$$

$$\text{PUMP TORQUE (inlbs)} = \frac{\text{PRESSURE (psig) x PUMP DISPLACEMENT (in}^3\text{/rev)}}{2\pi}$$

$$\text{RESERVOIR COOLING CAPACITY (BTU/hr)} = \text{2 x } \triangle\text{T BETWEEN RESERVOIR WALLS AND AIR (°F) x RESERVOIR AREA (ft}^2\text{)}$$

$$\text{HEAT IN HYDRAULIC SYSTEM DUE TO UNUSED FLOW/PRESSURE (btu/hr)} = \text{FLOW RATE(gpm) x 1.485 x PRESSURE DROP (psig)}$$

Heat Transfer in Fluids

General

Most fluid power systems require a method of heat transfer (dissipation or absorption).

Producing Heat

Whenever burning fuel or energy expended by the sun produces energy, the results of energy production are work and loss. The energy loss is caused by inefficiencies of the energy process. This energy loss is either released into the atmosphere or transferred to other objects such as a fluid or a reservoir. Some of these losses contribute to the fluid heating (i.e. a fluid pump submerged in the reservoir). Heat is also produced by passing pressurized fluid through orifices, valves, and piping where a pressure drop occurs. Servo drive systems are not possible for this since large pressure drops are used for control. Keeping these pressure drops to a minimum conserves performance and costs. The following table shows the types of systems that will have losses to the fluid and/or the reservoir:

System	% Loss
Simple circuits with minimal valves	25%
Simple circuits with cylinders	28%
Simple circuits with fluid motors	31%
Hydrostatic transmissions	35-40%
Servo based systems	55%
Low pressure fluid transfer systems	15%

These losses are expressed in terms of Horsepower, British Thermal Units (BTU's) or Kilowatts. Heat problems are usually expressed Horsepower in terms of the work expanded and losses absorbed. Cooling problems are usually expressed in BTU/hr and heating problems are expressed in Kilowatts.

Heat Dissipation from Reservoir Walls

When a fluid is heated by the loss of the system the walls of the reservoir will start to absorb heat. This heat will move outward to the outside walls if the air temperature is less than the fluid. If the fluid temperature is less, heat will pass through the wall and heat the fluid.

The general rate at which heat passes is dependent on the wall material, the amount of circulating air temperature difference between the air and the fluid, and fluid type. The general equation for this is:

$$\text{BTU/hr} = 2 \times \triangle T \times \text{reservoir area (ft}^2\text{)}$$

Reservoir Design

Background
Most fluid power systems have a reservoir to store the system fluid. It also includes the following:
- Heat dissipation
- Heat absorption
- Accessory mounting

Design
The available space as well as the strength of the structure must be determined first. The reservoir must be able to withstand any internal pressure developed during operation. The structure must also be able to withstand the weight of not only the system fluid, but mounted accessory components as well. These components include the fluid pump and the driver. Once all the weight is accounted, a structural analysis should be done in order to find structural minimums. These minimums include wall sizes and base structure.

Size
The reservoir needs to be large enough to hold all of the fluid of the system. This includes the amount to fill reserve and piping in order to keep the intake lines submerged. It must also include the amount for the differential volume of fluid that occurs when accumulators or cylinders are filled during operation.

Dissipate Heat
Inefficiencies in a fluid power system will heat the reservoir fluid as it re-circulates. Some of the heat will be dissipated through the reservoir walls through radiation and convection. In order to obtain maximum heat rejection:
- Locate the reservoir near air circulation
- Select a material with coefficient of heat transfer
- Use a light color for the reservoir exterior
- Include cooling fins on the exterior
- Select a location where the ambient temperature is less than the operating temperature
- Keep reservoir from direct sunlight

Mounting Accessories
The reservoir surface is an excellent place to mount several fluid conditioning devices. Some of these include:
- Fluid level gauge
- Oil sample port
- Drain valve
- Temperature gauge
- Fluid cooler/heater
- Breather filler cap with fine filter

Heat Absorption
In some cases, heat must be added to create the proper initial conditions. The most common way to do this is to install a thermostat-controlled electric heater. These heaters need to match the heated fluid to prevent oxidation. Heaters with a 18-20 watt per square inch capacity is most common for hydro carbon-based fluids. In some conditions it may be necessary to insulate the reservoir walls. When installing this heater, make sure it is in a spot that will maximize heat input and circulation

**The information above was taken from the* FLUID POWER DESIGNERS LIGHTING® REFERENCE HANDBOOK *Eight edition.*

General Motor Information

NEMA Voltage Standards

NEMA Motor Nameplate Voltage	Satisfactory Operating Voltage Range (at rated frequency)	Nominal System Voltage
200	180-220	208
230	207-253	240
460	414-506	480
575	518-633	600

Motor Windings for 60 hz Power Systems

General Location	Nominal Power System Voltages	Motor Winding Specifications
US city commercial areas	208/3/60	200/400/3/60
US, parts of Canada, most of Mexico, parts of South America	220/40/3/60 230/460/3/60 240/480/3/60	230/460/3/60
Southeast & northeast US, parts of Canada	550/3/60 575/3/60 600/3/60	575/3/60

- 230/460 or 230 volt motors should not be used on 208 volt systems unless it is within the limits of motor nameplate specs.
- Motors can be wound for other 60hz hertz power suppliers.
- Dual voltage motors should be used for dual voltage power systems. This ensures the best possible adaptability to various starting methods.

Motor Windings for 50 hz Power Systems

General Location	Nominal Power System Voltages	Motor Winding Specifications
British commonwealth nations	230/400/3/60 240/415/3/50	230/400/3/50 240/415/3/50
Continental Europe, some east Mediterranean, some African countries some South American countries	220/380/3/50	220/380/3/50
Japan	200/400/3/50	200/400/3/50
Various countries	550/3/50	550/3/50

NEMA standards state that motors will successfully operate at the rate load under the following:

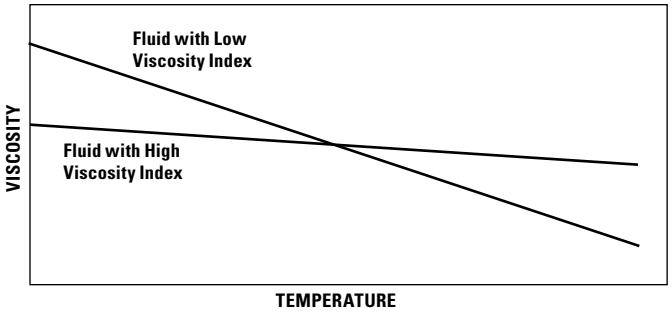
- A ± 10% variation or rated voltage at rated frequency. This will be within the standard voltage range, however this variation of voltage will alter the performance from the rated voltage.
- A ± 5% variation of rated frequency at rated voltage.
- Provided the frequency variant does not exceed ± 5%, a combined variation of ± 10% of voltage and frequency (absolute values).

Effects of Voltage Unbalance
Unbalanced currents will flow in the stator windings when the line voltages are not constant on all phases. This could lead to a higher winding temperature, thus potentially damaging the motor. Use a voltmeter to balance the voltages as much as possible. If there is an unbalance, notify the power company so it can be corrected. An example of this is if there is an unbalance of 3.5%, the winding temperature could increase as much as 25%.

Operating Temperature Range of Common Fluids

Fluid Temperature Range	Oil Grade
5W, 5W-20, 5W-30	-10°F to +130°F / -23°C to +54°C
10W	0°F to 180°F / -18°C to +83°C
10W-30 10W-40	0°F to 210°F / -18°C to +99°C
ISO VG 22	-5°F to +140°F / -21°C to +60°C
ISO VG 32	+5°F to +170°F / -15°C to +77°C
ISO VG 46	+15°F to +190°F / -9°C to +88°C
ISO VG 68	+30°F to +210°F / -1°C to +99°C

High and Low Viscosity Index



Oil Properties Example

COMPANY NAME	CATEGORY	BRAND NAME	GRADE/ CALLOUT	POUR POINT °F	FLASH POINT °F	SUS AT 100°F	SUS AT 210°F	ISO VG GRADIENT	VISC INDEX	SPECIFIC GRAVITY
MOBILE OIL CORP.	PREMIUM HYDRAULIC OIL	MOBIL DTE 10 SERIES	11	-50	329	90	40	22	155	0.864
			13	-50	329	150	46	32	150	0.876
			15	-50	329	205	50	46	150	0.878
			16	-50	329	300	60	68	120	0.881
			18	-40	329	480	69	100	120	0.884
			19	-40	329	765	89	150	120	0.891
	GENERAL HYDRAULIC OIL PURPOSE FOR GEARS, BEARINGS, & CIRCULATION	VACTRA NAMED	LIGHT	10	350	150/165	43	32	90	0.8708
			MEDIUM	10	375	215/240	48	46	95	0.8762
			MED HEAVY	10	400	315/355	54	68	95	0.8816
			HEAVY	10	410	470/520	65	100	90	0.8871
			XTRA HEAVY	15	420	710/790	76	150	92	0.8899
			BB	15	440	1000/1165	92	220	95	0.8927
			AA	20	450	1530/1705	114	320	95	0.8986
			HH	25	460	2215/2460	148	460	95	0.9013
	HYDROSTATIC DRIVE FLUID	MOBIL FLUID	350	-40	370	195	52	32/46	163	0.887
			423	-50	395	267	56	46/68	160	0.8927
	AUTOMATIC TRANS. FLUID	ATF (TYPE F) DEXTRON II	210	-50	350	185	52	32/46	180	0.868
			220	-50	320	187	50	32/46	159	0.867
	CIRCULATING OIL	DTE NAMED SERIES	LIGHT	20	395	150/165	44	32	100	0.871
			MEDIUM	20	400	215/240	48	46	100	0.876
			MED HEAVY	20	400	315/355	55	68	100	0.879
			HEAVY	20	410	410/440	60	68/100	100	0.882
			XTRA HEAVY	25	420	710/790	76	150	95	0.887
			BB	25	440	1045/1165	93	220	95	0.89
			AA	25	460	1530/1700	110	320	95	0.897
			HH	25	520	2215/2460	138	460	95	0.9
	COMPRESSOR LUBE OIL	DTE	103	-5	390	575	58	100/150	-	0.922
			105	15	435	1400	84	320	-	0.919
			107	25	450	2300	113	460	-	0.916
	STEAM CYLINDER WORM GEAR	CYLINDER OIL	600W	40	540	2000	142	320/460	99	0.9013
			600W SUPER	40	540	2500	155	460	95	0.899
			EXTRA HECLA	40	565	3650	198	680	95	0.9056
			MINERAL	40	590	4500	230	680/1000	95	0.9042
	ROCK DRILL OIL	ALMO 500 SERIES	525	-10	370	215/245	46	46	90	0.8888
			527	-20	390	535/565	100	100	85	0.8944
			529	-10	400	750/800	150	150	90	0.8967
			532	0	450	1450/1600	320/460	320/460	90	0.8967

Conversion and Formula Summary

There are many conversions and formulas used in selecting oil coolers. This will be a brief summary of those most commonly used.

Conversions

A. HP = (BTU's/hr) / 2545 = (BTU's/min) / 42.4 = KW/.746, or BTU's/hr = HP x 2545; BTU's/min = HP x 42.4; KW = HP x .746

B. GPM = (L/min) / 3.78 or L/min = GPM x 3.78

C. °F = (1.8 x °C) + 32 or °C = (°F - 32) / 1.8

D. Mobil Series: Air Velocity SFPM = SCFM/Face Area in Ft^2, or SCFM = Ft^2 Face Area x Face Velocity SFPM

Methods to Determine Heat Loads

A. Hydraulic oil cooling: Assume 30% of the input horsepower will be rejected to heat. If the input horsepower is unknown, this formula may be used: BTU/HR = (System PSI) x (GPM Flow) x 1.8 x .3

B. Hydrostatic oil cooling: Assume 25% of the input horsepower will be rejected to heat.

C. Automatic transmission: Assume 30% of the engine horsepower will be rejected to heat.

D. Engine oil cooling: Assume 10% of the engine horsepower will be rejected to heat.

Heat Loads

A. BTU's/hr = (Input Horsepower) x (2545) x (.25 — .5)

B. BTU's/hr = (System GPM Capacity) x (System Pressure) x (1.8) x (.25 —.5)

C. BTU's/hr = (PSI Pressure Drop) x (GPM Oil Flow) x (1.5) x (% Time)

D. BTU's/hr = (Horsepower to Gearbox) x (2545 x (.05 — .5)

E. BTU's/hr = (Compressor HP) x (1.1) x (.85) x (2545)

F. BTU's/hr = (Max Temp. Rise °F/hr) x (Gallons of Oil Changing Temp.) x (3.5)

G. BTU's/hr = (GPM Oil Flow) x (Oil △T) x (210)

Conversions

°F = (1.8 x °C)+32

BARS = psi ÷ 14.5

BTU/hr = WATTS ÷ .2931

BTU/min = KW ÷ .01757

$ft^2 = in^2 \div 144$

$ft^2 = mm^2 \div 92900$

GPM = L/min ÷ 3.78

HP = BTU/hr ÷ 2545

HP = BTU/min ÷ 42.41

HP = KW ÷ 0.746

$in^2 = mm^2 \div 645.2$

in^3 = GAL ÷ .004329

in^3 = LITERS ÷ .01639

m^3 = GAL ÷ 264.2

m^3 = LITERS ÷ 1000

mm = 25.4 x in

psig = psia - 14.7

Temperature Changes

A. Oil △T = (BTU's/hr) / (GPM Oil Flow x 210)

B. Water △T = (BTU's/hr) / (GPM Water Flow x 500)

C. 50/50 Ethylene Glycol △T = (BTU's/hr) / (GPM Flow x 432)

D. Air △T = (BTU's/hr) / (SCFM Air Flow x 1.08)

Temperature Changes

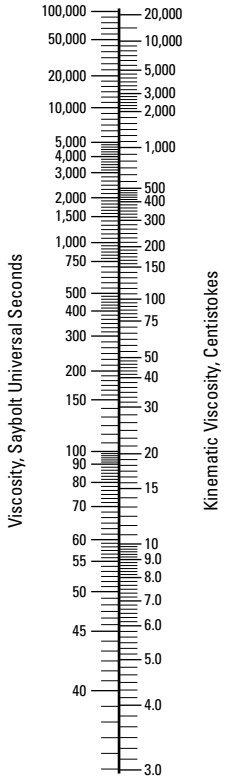
Water Cooled: $\frac{\text{HP curve} = \text{HP Heat} \times 40 \times \text{Correction A}}{\text{(Oil outlet °F - Water inlet °F)}}$

AO Series (except AOL): $\frac{\text{HP curve} = \text{HP Heat} \times 100}{\text{(Oil outlet °F - Ambient air °F)}}$

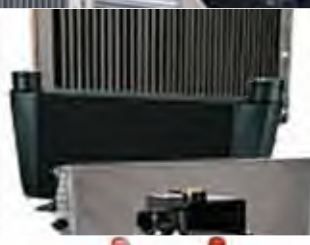
AOL Series: $\frac{\text{HP curve} = \text{HP Heat} \times 100}{\text{(Oil inlet °F - Ambient air °F)}}$

Mobile Series: $\frac{\text{BTU's/hr curve} = \text{HP Heat} \times 2545 \times 100}{\text{(Oil inlet °F - Ambient air °F)}}$

Centistokes to Saybolt Universal Seconds Conversion



Our Businesses

	PRODUCTS & CAPABILITIES	MARKETS SERVED	
Thermal Transfer Products A ThermaSys® Company	■ Brazed aluminum cooling modules ■ Copper round tube and fin ■ Air and shell/tube heat exchangers ■ Expert applications support	■ Oil cooler, radiators, charge air, aftercoolers ■ T-BAR, P-BAR, S-BAR ■ Mobile hydraulics ■ Industrial hydraulics ■ Compressed air ■ Process industries	
ThermaSys Heat Exchangers A ThermaSys® Company	■ Controlled atmospheric brazing ■ Radiators, condensers and oil coolers ■ Complete module assemblies ■ Patented condenser manifolds	■ Custom designed and engineered products ■ Condensers ■ Lawn and garden ■ ATV ■ HVAC	
General ThermoDynamics A ThermaSys® Company	■ Heavy duty bolted and soldered radiators ■ Mechanically bonded radiators ■ Cu/Br and aluminum products ■ Combination modules ■ Charge air and oil coolers	■ Construction equipment ■ Diesel powered electric generators ■ Military ■ Rail locomotive ■ Timber harvesting	
Covrad Heat Transfer Ltd. A ThermaSys® Company	■ Compressor coolers ■ Charge air coolers ■ Oil coolers ■ Aluminum and Cu/Br radiators ■ Heat sinks	■ Truck and bus ■ Off-highway ■ Compressors ■ Power generation	
Serck Heat Transfer A ThermaSys® Company	■ Shell and tube oil coolers ■ Charge air coolers	■ Marine ■ Rail ■ Industrial heat transfer	
ARUP Alu-Rohr und Profil GmbH A ThermaSys® Company	■ Seam welded aluminum round tube and profiles ■ Charge air cooler tubes ■ Condenser manifolds ■ Heat-exchange applications	■ Automotive and non-automotive ■ HVAC ■ Industrial ■ European, African and Pacific Rim markets	
ThermaSys Tubing Products A ThermaSys® Company	■ Brass and aluminum seam welded tubing ■ Charge air cooler tubing	■ Automotive ■ Industrial ■ Heat transfer ■ North and South America	
大连通用热力系统有限公司 ThermaSys (Dalian) Company, Ltd. A ThermaSys® Company	■ Precision multiport extruded aluminum tubing ■ Condensers ■ Radiators, charge air coolers and oil cooling profiles	■ Automotive HVAC and heat exchangers ■ Residential ■ Commercial ■ Global supplier	

Thermal Transfer Products

A ThermaSys® Company

5215 21st Street
Racine, Wisconsin 53406-5096

TEL (262) 554-8330
FAX (262) 554-8536
E-MAIL TTPSales@thermasys.com
WEBSITE thermaltransfer.com

We COOL what you POWER