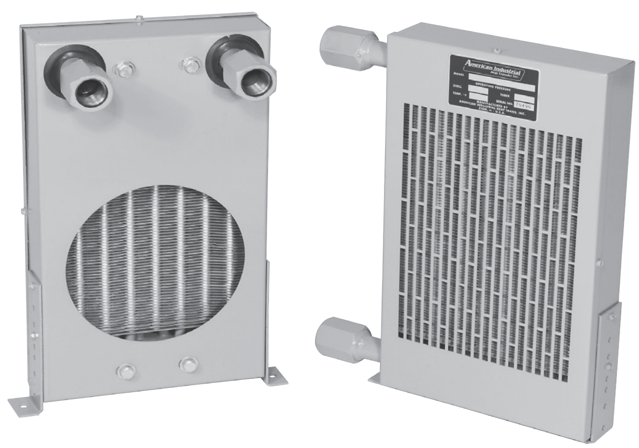
American Industrial
Heat Transfer Inc.

Manufacturer of Quality Heat Exchangers

BM SERIES

BM - 201 thru BM - 322
SERIES



BM - 101 & BM - 102
SERIES

AIR COOLED

LIQUID COOLERS

- Mounts directly to TEFC electric motor.
- Fits NEMA frame sizes 48 through 365.
- Standard NPT or SAE connections.
- Operating temperature of 300°F & pressure of 300PSI.
- Cools case drains, hydraulic presses, bearings gear boxes, hydraulic tools, etc…

MODELS TO ACCOMMODATE
ELECTRIC MOTOR NEMA FRAME SIZES

48 - 184	213 - 256	254 - 286	324 - 365
BM - 101	BM - 201	BM - 301	BM - 321
BM - 102	BM - 202	BM - 302	BM - 322

BM Series *selection*

SIZING
To properly size a BM TEFC Motor air-cooled oil cooler for industrial equipment, you should first determine some basic parameters associated with your system.

HEAT LOAD
In many instances the heat load must be determined by using a "total potential" method. This total potential or horse power method is the most common method, and is the simplest way to determine basic heat rejection requirements for hydraulic systems. The total potential is equal to the maximum operating flow and pressure that are generated by the system under full load. To determine the total potential (HP) use the following formula. Note: If the electric motor horsepower of the system prime mover is known, use it as your system potential.

HP = [System Pressure (PSI) x System flow (GPM)] / 1714

Examples:
(1) 7.5 HP 254T frame electric motor driving a pump = 7.50 HP potential
(1) HP = (1250 PSI x 10 GPM) / 1714 = 7.30 HP or the total input potential

To determine the system heat load in BTU / HR we must use a percentage (v) of the system potential HP. The factor (v) can be calculated by adding up the actual inefficencies of a system; however, for most applications a (v) value of 25% - 30% can be used.

Example: 7.50 HP x .30 = 2.25 HP heat

To convert the horsepower of heat into BTU/HR use the formula below:
HP x 2542 = BTU/HR

Example: 2.25 HP Heat x 2545 = 5,729 BTU/HR

Applying into a return line
For most open loop systems with vane or gear type fixed delivery pumps. To calculate the Fs value required when applying the air/oil cooler into a return line use the formula below:

$$Fs = \frac{BTU/HR \times Cv}{T - t_{ambient}} \qquad \text{Example} = \frac{5729 \times 1.08}{140 - 90} = 123.7 \text{ Fs}$$

T = Desired system oil temperature leaving the cooler °F

$t_{ambient}$ = Ambient air temperature entering the cooler °F

Cv = Correction factor for oil viscosity. Example: ISO32 oil @140°F = 1.08

(see chart)

APPLYING INTO A CASE LINE
In circumstances where the system is a closed loop, or when return line flow is not available, the case drain flow can be utilized to help cool the system. However, in many instances, the case drain flow alone will not be enough to reject all of the heat generated by the system. Case drain lines should not be treated as a normal return lines since the pressure drop allowable usually can vary from 2 - 10 PSI max. Check with your pump manufacturer for the appropriate pressure drop tolerance before applying any cooler. To size the system for case flow or case flow plus any additional flushing loops, please use the following method. Closed loop case drain operating temperatures are normally higher than open loop circuit return line temperatures.

Formula
Tc_{exit} = { T - [Q / (case flow gpm x 210)]}

Example
Tc_{exit} = { 155 - [5,729 / (3 x 210)]} = 145.9

Tc_{exit} = The corrected temperature of the oil exiting the cooler.

$$Fs = \frac{Q \times Cv}{Tc_{exit} - t_{ambient}} \qquad \frac{5{,}729 \times 1.08}{145.9 - 90} = 101.6$$

SELECTION
To select a model, locate the flow rate (GPM) at the bottom of the flow vs Fs graph. Proceed upward until the GPM intersects with the calculated Fs. The curve closest above the intersection point will meet these conditions.

Examples:

Return Line	Case Drain
Fs = 123.7	Fs = 101.6
GPM = 10 "return line flow"	GPM = 3.0
Motor size = 324 frame	Motor size = 254T frame
Model = BM - 321	Model = BM - 302

PRESSURE DROP
Determine the oil pressure drop from the curves as indicated. For viscosities other than 50 sus at operating, multiply the actual indicated pressure drop (psi) for your GPM by the value in the pressure differential chart for your viscosity.

Examples:	GPM = 10	GPM = 3
Indicated pressure drop	1.4 PSI	1 PSI
Cp correction factor for ISO 32 oil @ 140°F	1.23	1.23
Pressure drop correction	1.4x1.23 = 1.72 psi	1.0x1.23 = 1.23 psi

AIR FLOW CORRECTION CHART
In some instances our units are applied to motors or application where additional or less air flow is available than the flows used for our performance curves. In these instances you can use our air flow correction curves to determine if one of the existing models will work for your application.

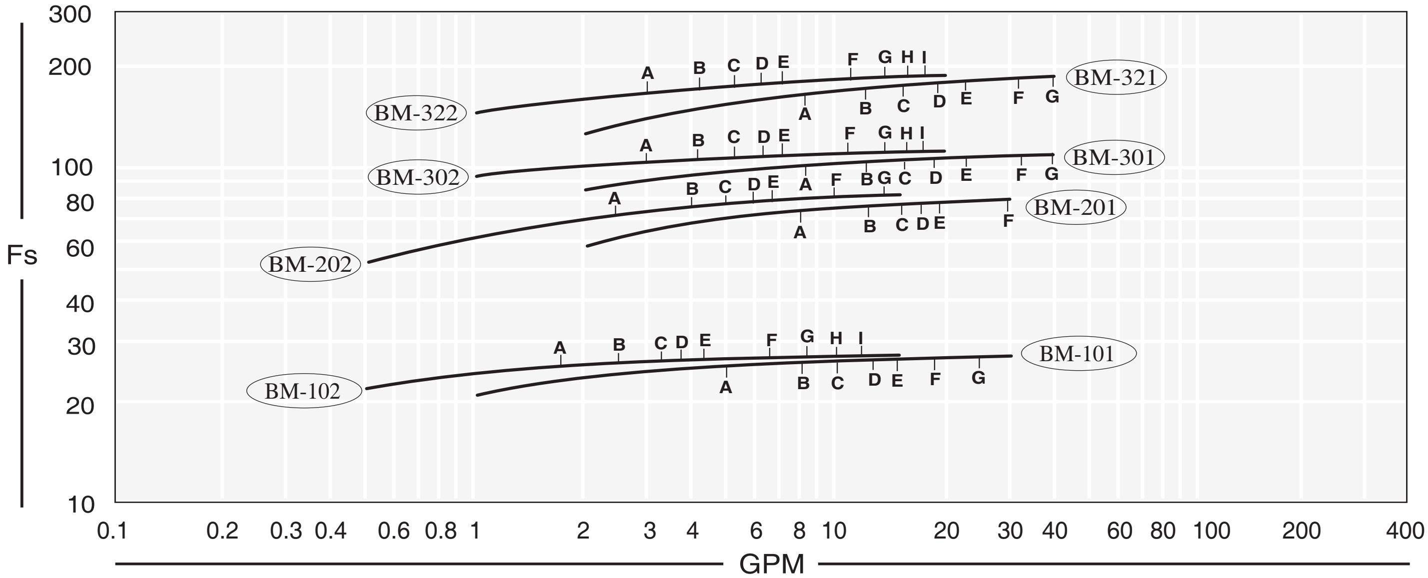
Example:
Follow the preceding examples to properly determine your required Fs. Use the following formula to correct for the difference in air-flow rate. If the calculated Fs = 123.7 and the electric motor were a 1800 rpm 326 frame motor with 250 cfm of air flow, correct as shown. Select the correction factor Cf only from the curve that matches to your electric motor frame size properly. Note: Using a unit that is to small may damage your electric motor due to lack adequate of air flow.

Formula	Example
Fs x Cf = CFs (corrected)	CFs = 123.7 x 1.50 (from curve) = 185.6 CFs

Average Liquid Temperature	Cv VISCOSITY CORRECTION FACTORS																
	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	POLY-GLYCOL	PHOS-PHATE ESTER	50% ETHY-LENE GLYCOL &WATER
100	1.11	1.15	1.25	1.38	1.45	1.08	1.14	1.18	1.26	1.37	1.43	1.56	1.84	1.19	0.92	0.83	0.85
110	1.09	1.12	1.20	1.32	1.40	1.06	1.13	1.16	1.25	1.31	1.39	1.48	1.67	1.14	0.89	0.80	0.84
120	1.06	1.10	1.17	1.27	1.35	1.04	1.11	1.14	1.20	1.27	1.35	1.40	1.53	1.09	0.88	0.79	0.84
130	1.04	1.08	1.13	1.24	1.29	1.03	1.09	1.13	1.17	1.24	1.30	1.34	1.44	1.05	0.85	0.77	0.83
140	1.03	1.05	1.11	1.19	1.25	1.02	1.08	1.10	1.16	1.20	1.26	1.30	1.39	1.03	0.84	0.76	0.82
150	1.01	1.04	1.09	1.16	1.22	1.02	1.06	1.09	1.13	1.17	1.22	1.27	1.33	1.01	0.83	0.74	0.82
200	0.98	0.99	1.01	1.04	1.07	0.98	0.99	1.00	1.01	1.02	1.08	1.09	1.14	0.98	0.79	0.71	0.80
250	0.95	0.96	0.97	0.98	0.99	0.95	0.96	0.96	0.96	0.97	0.99	1.01	1.02	0.97	0.76	0.69	0.79

Average Liquid Temperature	Cp PRESSURE DROP CORRECTION FACTORS																
	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	POLY-GLYCOL	PHOS-PHATE ESTER	50% ETHY-LENE GLYCOL &WATER
100	2.00	2.40	4.40	6.40	8.80	1.07	1.53	1.82	2.54	4.19	6.44	9.38	13.56	1.26	3.00	3.50	0.730
110	1.70	2.10	3.60	5.10	6.70	1.04	1.45	1.72	2.35	3.73	5.70	8.33	11.63	1.20	2.40	2.90	0.720
120	1.50	1.80	3.00	4.20	5.60	1.02	1.38	1.60	2.15	3.26	4.91	7.23	9.73	1.14	2.10	2.50	0.709
130	1.40	1.60	2.60	3.40	4.50	0.99	1.30	1.49	1.94	2.80	4.14	6.19	7.80	1.08	1.90	2.20	0.698
140	1.30	1.50	2.23	2.90	3.70	0.97	1.23	1.38	1.75	2.38	3.47	5.20	6.11	1.03	1.90	2.00	0.686
150	1.20	1.30	1.90	2.50	3.10	0.95	1.17	1.30	1.61	2.04	2.90	4.35	4.77	0.98	1.70	1.90	0.676
200	0.93	0.96	1.20	1.40	1.60	0.89	0.99	1.08	1.18	1.33	1.59	1.74	1.95	0.90	1.20	1.30	0.635
250	0.81	0.82	0.92	0.97	1.05	0.85	0.93	0.96	1.03	1.11	1.21	1.22	1.23	0.83	1.00	1.05	0.556

BM SERIES



PERFORMANCE CALCULATION
$F_s = \dfrac{\text{Horsepower to be removed (HP) x 2545 x Cv}}{\text{°F (Oil Leaving* - Ambient Air Entering)}} = \dfrac{\text{BTU}}{\text{hr °F}}$

*Represents desired fluid leaving the cooler.

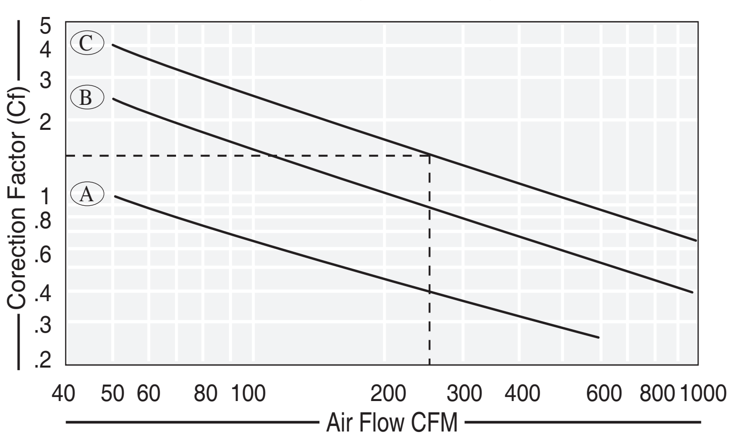
OIL PRESSURE DROP (PSI) CODE		
A = 1 PSI	D = 4 PSI	G = 15 PSI
B = 2 PSI	E = 5 PSI	H = 20 PSI
C = 3 PSI	F = 10 PSI	I = 25 PSI

Note:
Performance curves are based upon petroleum oil at 50 sus. For average oil viscosities other than 50 sus, use the correction factors Cv & Cp located on page 3. If the above models can not meet your cooling needs, please refer to our fan cooled models.

Standard Construction Materials			
Tubes	Copper	Manifold	Steel
Fins	Aluminum	Mount. bracket	Steel
Turbulators	Steel	Cabinet	Steel

Standard Unit Ratings	
Operating Pressure	300 psig
Operating Temp.	400 °F

Air Flow Correction Chart



ELECTRIC MOTOR NEMA FRAME SIZES

Curve A	Curve B		Curve C
48 - 184	213 - 256	254 - 286	324 - 365
BM - 101	BM - 201	BM - 301	BM - 321
BM - 102	BM - 202	BM - 302	BM - 322

EXAMPLE OF A MODEL

BM - 302 - S

Series

Model

Connections

N = NPT

S = SAE

Use the following formula to correct for airflow rates for the given curves A,B, or C (as it is shown in the above dotted line graph).

Formula

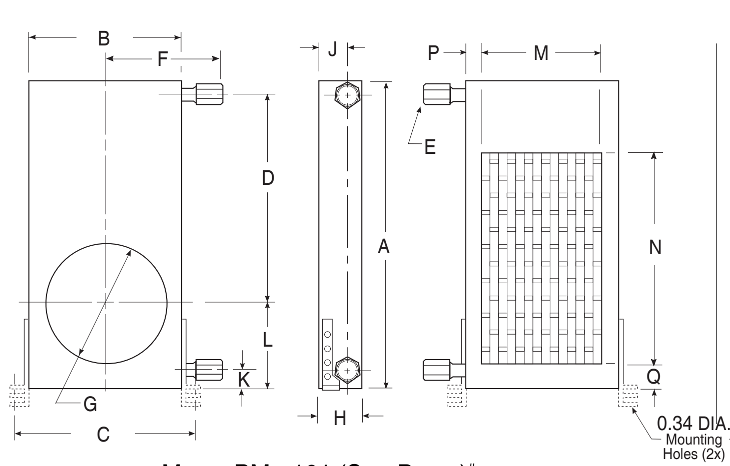
Fs x C*f* = CFs (corrected Fs)

Example

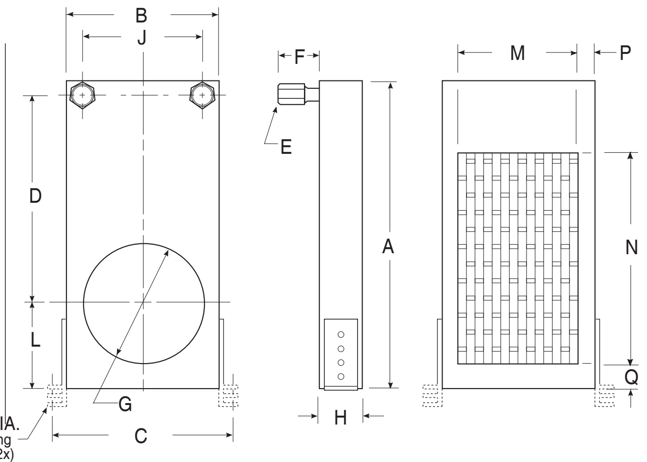
123.7 x 1.50 (from curve) = 185.6 CFs

BM Series *dimensions*

BM-101 or BM-102 can be used for electric motor NEMA frame size 48-184



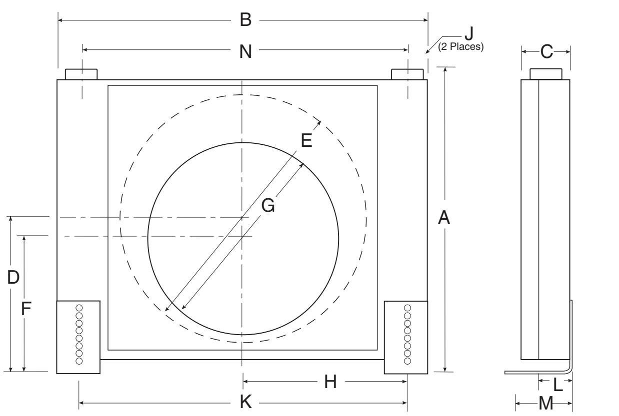
MODEL BM - 101 (SIDE PORTS)#



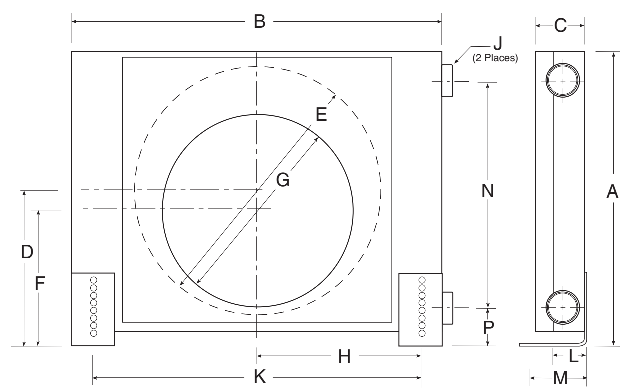
MODEL BM - 102 (REAR PORTS)#

STANDARD DIMENSIONS (inches)																	
Model	A	B	C	D	E NPT	E SAE	F	G Dia.	H	J	K	L	M	N	P	Q	Weight LBS
BM - 101	15.75	9.00	10.25	8.50	.75	#12	7.75	7.00	2.22	.94	1.13	5.88	7.50	10.50	0.75	2.31	14.50
BM - 102							2.69			6.00	–						14.50

BM-201 thru BM-322 can be used for electric motor NEMA frame size 213-365



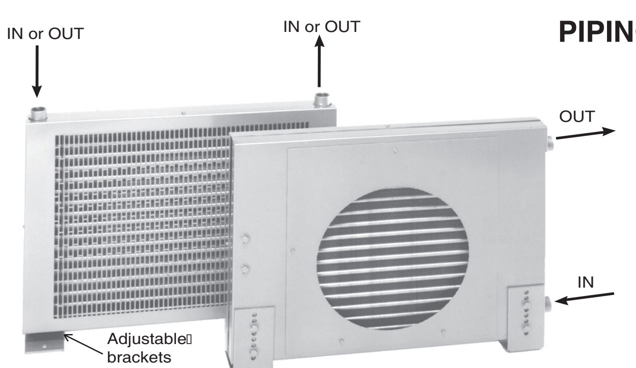
MODELS BM-201, 301, 321 (SINGLE PASS)



MODELS BM-202, 302, 322 (TWO PAS)

STANDARD DIMENSIONS (inches)															
Model	A	B	C	D	E Dia.	F	G Dia.	H	J NPT	J SAE	K	L	M	N	P	Weight LBS
BM - 201	14.90	16.50	2.75	7.33	12.62	5.13	8.00	7.38	.75	#12;1-1/16-12	14.75	.50	1.94	14.62	–	14
BM - 202	13.75	16.50	2.75	7.33	12.62	5.13	8.00	7.38	.75	#12;1-1/16-12	14.75	.50	1.94	8.00	3.19	14
BM - 301	19.50	24.80	2.75	9.75	14.62	8.19	12.00	10.72	.75	#12;1-1/16-12	21.44	.88	3.38	22.88	–	30
BM - 302	18.69	24.80	2.75	9.75	14.62	8.19	12.00	10.72	.75	#12;1-1/16-12	21.44	.88	3.38	14.00	2.62	30
BM - 321	19.50	24.80	2.75	9.75	17.00	9.75	14.62	10.72	.75	#12;1-1/16-12	21.44	.88	3.38	22.88	–	30
BM - 322	18.69	24.80	2.75	9.75	17.00	9.75	14.62	10.72	.75	#12;1-1/16-12	21.44	.88	3.38	14.00	2.62	30

PIPING HOOK-UP



(SINGLE PASS) (TWO PASS)

Note:

To obtain the best performance place the opening of the unit against the fan air intake of the motor. Use a gasket or calking compound around the joint to prevent air from leaking out from around the edges.