

# Fluid Cooling P-Bar Series Industrial BOL

AIR COOLED BOL

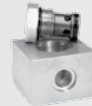
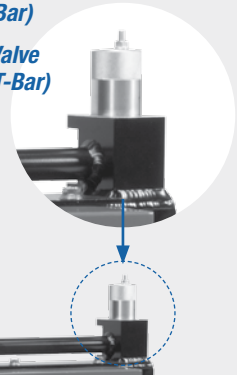
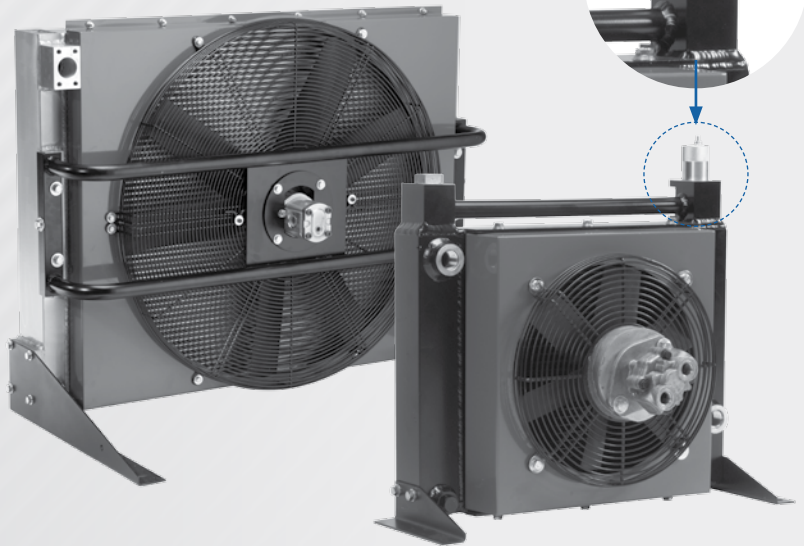
## BRAZED ALUMINUM CONSTRUCTION

### Features

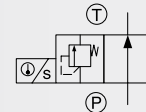
- Bar and Plate Brazed Aluminum Core
- Provides the best heat transfer per given envelope size while minimizing pressure drop
- Air-side fin design minimizes fouling and static pressure ensuring long-term, reliable performance
- Welded fittings/ports and manifolds ensure structural integrity
- Standard SAE ports – NPT & BSPP available
- Customized units are available to meet your OE 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
- Optional factory installed integrated bypass relief valve in the cooler tank inlet line (P-Bar). Core protection from system spikes.
- Optional bypass valve with a temperature controlled opening pressure – the hotter the oil, the higher the opening pressure (single-pass only, T-Bar). Key to protecting core and bringing system temperatures up quickly in cold ambients.



- Pressure Relief Bypass Valve (P-Bar)
- Temperature Controlled Bypass Valve with Integrated Pressure Relief (T-Bar)



Pressure Relief Bypass Valve Option



Temperature Controlled Bypass Valve with Integrated Pressure Relief Option

## Ratings

### Maximum Operating Pressure

250 psi (17 BAR)

### Maximum Operating Temperature

300° F (150° C)

## Fluid Compatibility

Petroleum/mineral oils

Oil/water emulsion

Water/ethylene glycol

## 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

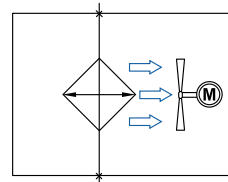
### Fanguard Steel

### Connectors Aluminum

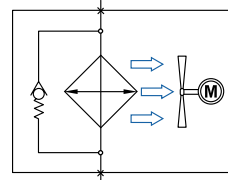
### Fan Aluminum Hub, Plastic Blades

### Shroud Steel

### Motor TEFC & IEC



Without Bypass



With Bypass

## How to Order

<b>Model Series</b> BOL (BOLR)	<b>Model Size Selected</b> 4 • 8 • 16* • 30 400* • 725* • 950 1200* • 1600* • 2000	<b>Connection Type*</b> 1 - NPT 2 - SAE 3 - BSPP	<b>Bypass</b> Blank - None 25 - 25 PSI 60 - 60 PSI	<b>Specify Motor Required</b> 2 - Single Phase 3 - Three Phase 6 - 575V Three Phase 9 - Hydraulic 18 - IEC Three Phase	<b>Core</b> Blank - Standard P-Bar TB - T-Bar Core**	<b>Noise Level</b> Blank - Standard Noise Level LN - Low Noise Level



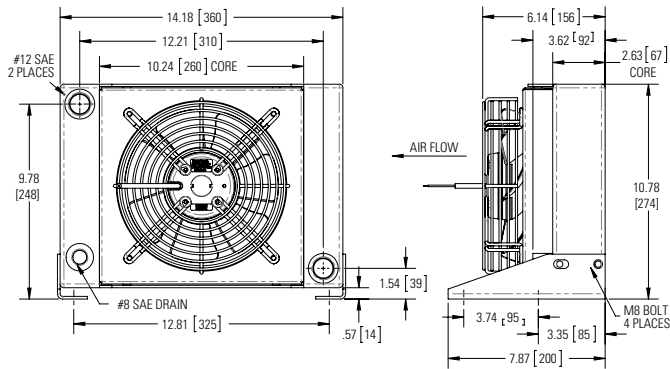
\*BOL Bypass (BOLR) for the P-Bar core is a pressure-relief valve. Bypass for the T-Bar is a thermal/pressure relief valve. Consult factory for further details.

\*\* T-Bar core option provides a T-Bar core in a BOL frame. Used for high fouling or high viscosity fluids. Performance is typically 15-25% less than the P-Bar Core. Consult Factory for details.

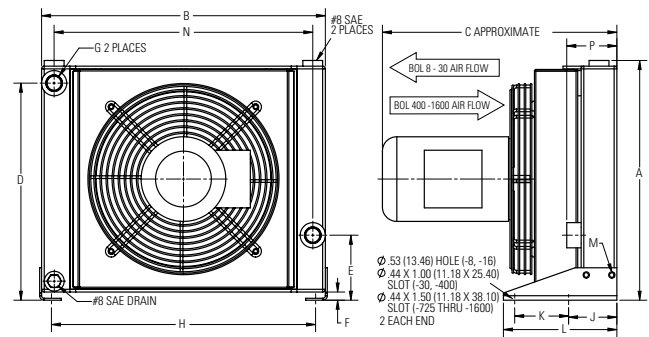
\*\*\* Available in models 8-2000 only, the low noise option is done by lowering the fan speed. As a result, the performance will be reduced by approximately one model size.

# Dimensions

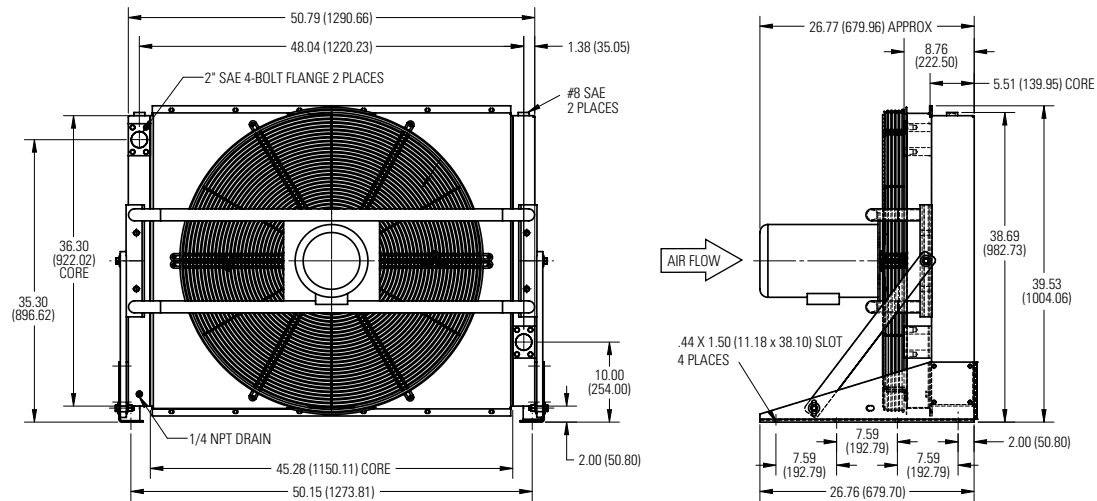
## BOL-4



## BOL-8 through BOL-1600



## BOL-2000

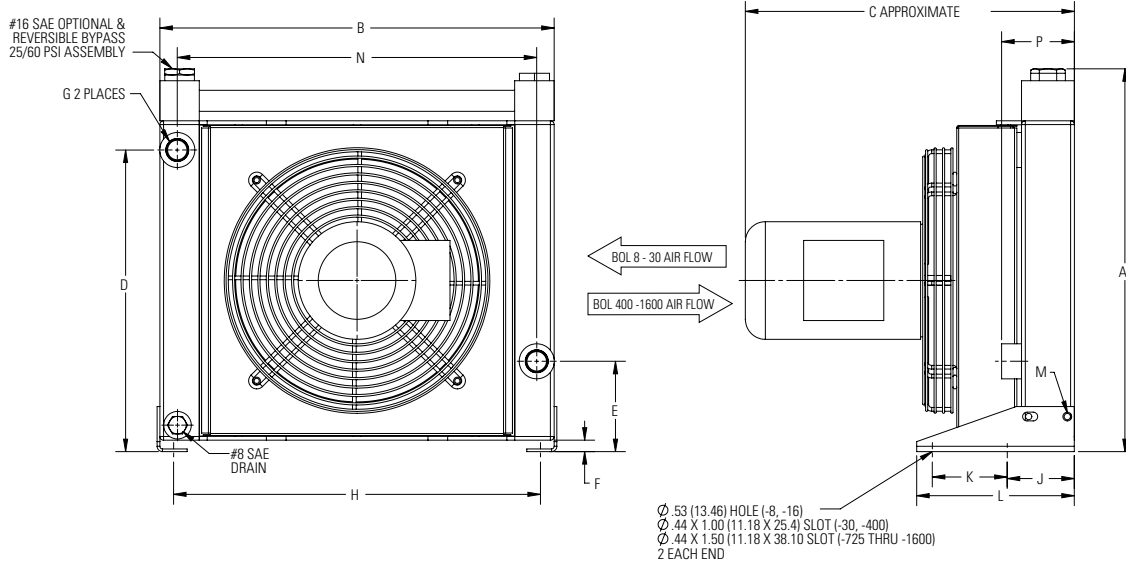


Model	A	B	C	D	E	F	G		H	J	K	L	M	N	P	Approx. Ship Wt. lbs (kg)
							SAE	NPT & BSPP								
BOL-4	See diagram above						#12 SAE	3/4"	See diagram above						18 (8.16)	
BOL-8	12.56 (319)	15.81 (402)	15.94 (405)	11.34 (288)	4.51 (115)	0.57 (14)	#12 SAE	3/4"	14.44 (361)	3.36 (85)	3.74 (95)	7.87 (200)	M8 BOLT (2PL)	13.99 (355)	3.63 (92)	45 (20.4)
BOL-16	16.33 (415)	19.69 (500)	16.43 (417)	15.06 (383)	4.57 (116)	0.57 (14)	#12 SAE	3/4"	18.31 (465)	3.35 (85)	3.74 (95)	7.87 (200)	M8 BOLT (2PL)	17.95 (456)	3.63 (92)	55 (24.94)
BOL-30	20.13 (511)	26.38 (670)	17.88 (454)	19.49 (495)	5.26 (134)	1.32 (340)	#20 SAE	1 1/4"	24.74 (628)	4.15 (105)	5.00 (127)	9.9 (251)	M8 BOLT (4PL)	24.34 (618)	5.00 (127)	125 (56.70)
BOL-400	18.90 (480)	22.38 (568)	18.6 (472)	17.31 (440)	6.50 (165)	2.00 (51)	#20 SAE	1 1/4"	22.31 (567)	4.15 (105)	5.00 (127)	9.9 (251)	M8 BOLT (4PL)	20.07 (510)	5.00 (127)	148 (67.13)
BOL-725	23.40 (594)	30.25 (768)	17.56 (446)	21.62 (549)	6.50 (165)	2.00 (51)	#20 SAE	1 1/4"	30.11 (765)	4.15 (105)	5.00 (127)	9.9 (251)	M10 BOLT (4PL)	27.95 (710)	5.00 (127)	170 (77.11)
BOL-950	27.70 (705)	37.01 (940)	22.68 (576)	24.55 (624)	9.50 (241)	2.00 (51)	2" SAE 4 BOLT FLANGE	2"	35.87 (911)	6.05 (154)	9.20 (234)	16 (406)	M10 BOLT (4PL)	34.26 (9870)	7.00 (178)	300 (136.08)
BOL-1200	28.38 (721)	40.98 (1041)	24.05 (611)	24.55 (624)	5.50 (140)	2.00 (51)		2"	40.29 (1023)	6.05 (154)	9.20 (234)	16 (406)	M10 BOLT (4PL)	38.18 (970)	8.75 (222)	430 (195.04)
BOL-1600	36.50 (927)	40.98 (1041)	25.43 (646)	32.80 (833)	9.50 (241)	2.00 (51)		2"	40.29 (1023)	6.05 (154)	9.20 (234)	16 (406)	M10 BOLT (4PL)	38.18 (970)	8.75 (222)	515 (233.60)
BOL-2000	See diagram above								2"	See diagram above						582 (264.00)

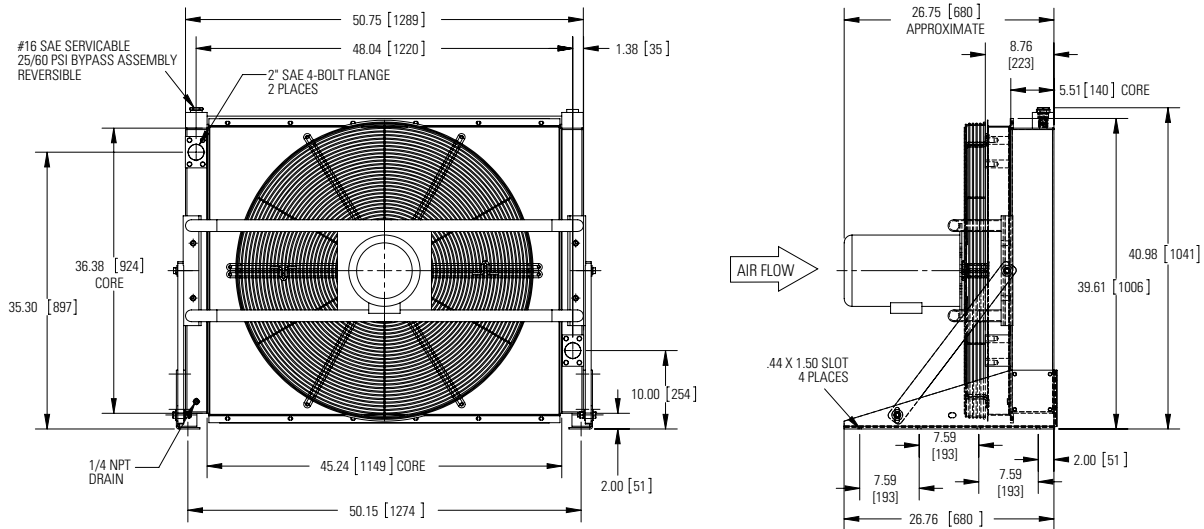
Note: We reserve the right to make reasonable design changes without notice. All dimensions are in inches (millimeters) unless noted otherwise.

# Dimensions with Bypass

## BOL-8 – BOL-1600



## BOL-2000



Model	A	B	C	D	E	F	G		H	J	K	L	M	N	P	Approx. Ship Wt. lbs (kg)
							SAE	NPT & BSPP								
BOL-8	15.34 (390)	15.81 (402)	15.94 (405)	11.34 (288)	4.51 (115)	0.57 (14)	#12 SAE	3/4"	14.44 (361)	3.36 (85)	3.74 (95)	7.87 (200)	M8 Bolt (2PL)	13.99 (355)	3.63 (92)	60 (27.22)
BOL-16	19.11 (485)	19.69 (500)	16.43 (417)	15.06 (383)	4.57 (116)	0.57 (14)	#12 SAE	3/4"	18.31 (465)	3.35 (85)	3.74 (95)	7.87 (200)	M8 Bolt (2PL)	17.95 (456)	3.63 (92)	70 (31.75)
BOL-30	23.66 (601)	26.38 (670)	17.88 (454)	19.49 (495)	5.26 (134)	1.32 (340)	#20 SAE	1 1/4"	24.74 (628)	4.15 (105)	5.00 (127)	9.9 (251)	M8 Bolt (4PL)	24.34 (618)	5.00 (127)	140 (63.50)
BOL-400	21.49 (546)	22.38 (568)	18.6 (472)	17.31 (440)	6.50 (165)	2.00 (51)	#20 SAE	1 1/4"	22.31 (567)	4.15 (105)	5.00 (127)	9.9 (251)	M8 Bolt (4PL)	20.07 (510)	5.00 (127)	162 (73.48)
BOL-725	25.82 (656)	30.25 (768)	17.56 (446)	21.62 (549)	6.50 (165)	2.00 (51)	#20 SAE	1 1/4"	30.11 (765)	4.15 (105)	5.00 (127)	9.9 (251)	M10 Bolt (4PL)	27.95 (710)	5.00 (127)	185 (83.92)
BOL-950	30.15 (766)	37.01 (940)	22.68 (576)	24.55 (624)	9.50 (241)	2.00 (51)	2" SAE 4 BOLT FLANGE	2"	35.87 (911)	6.05 (154)	9.20 (234)	16 (406)	M10 Bolt (4PL)	34.26 (9870)	7.00 (178)	315 (142.88)
BOL-1200	30.15 (766)	40.98 (1041)	24.05 (611)	24.55 (624)	5.50 (140)	2.00 (51)		2"	40.29 (1023)	6.05 (154)	9.20 (234)	16 (406)	M10 Bolt (4PL)	38.18 (970)	8.75 (222)	445 (201.85)
BOL-1600	38.26 (972)	40.98 (1041)	25.43 (646)	32.80 (833)	9.50 (241)	2.00 (51)		2"	40.29 (1023)	6.05 (154)	9.20 (234)	16 (406)	M10 Bolt (4PL)	38.18 (970)	8.75 (222)	530 (240.40)
BOL-2000	See diagram above						2"	See diagram above								597 (270.79)

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

# 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	12.5	440	0.12	230	1	0.37	60 Hz	2710	N/A	Yes	61
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	396.44	14000	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	11.5	405	0.07	230	1	50 Hz	2485	N/A	58
BOL-8	18.9	667	.25	230/400/415	3	50 Hz	3000	63	71
BOL-16	33.7	1188	.37	230/400/415	3	50 Hz	3000	71	77
BOL-30	52.4	1850	.37	230/400/415	3	50 Hz	1500	71	73
BOL-400	52.4	1850	.75	230/400/415	3	50 Hz	3000	80	81
BOL-725	85.0	3000	1.10	230/400/415	3	50 Hz	3000	80	80
BOL-950	108.2	3821	1.50	230/400/415	3	50 Hz	1500	90	78
BOL-1200	165.1	5834	2.20	230/400/415	3	50 Hz	1500	100	83
BOL-1600	186.4	6584	3.00	230/400/415	3	50 Hz	1500	100	85
BOL-2000	331.3	11700	4.00	230/400/415	3	50 Hz	1500	112	88

All IEC frame motors have CE mark.  
IEC motor voltages have +/- 5% tolerance.

## Hydraulic Motor Information

Model	Oil Flow Required GPM (LPM)	Min. Pressure Required PSI (BAR)	Motor IN <sup>3</sup> /REV (CM <sup>3</sup> /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 <sup>3</sup> /REV (CM <sup>3</sup> /REV) Displacement	Sound dB(A) at 3 ft.
BOL-725	3.3 (12.49)	675 (46.50)	0.22 (3.6)	100
BOL-950	10.1 (38.23)	300 (20.70)	1.4 (22.9)	92
BOL-1200	10.1 (38.23)	725 (50.00)	1.4 (22.9)	94
BOL-1600	10.1 (38.23)	1100 (75.80)	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.

$$HP = \text{BTU/HR} \div 2545$$

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

$$\text{BTU/HR} = HP \times 2545$$

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

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

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**

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

(BTU/HR) to use with selection chart

**METRIC Version**

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

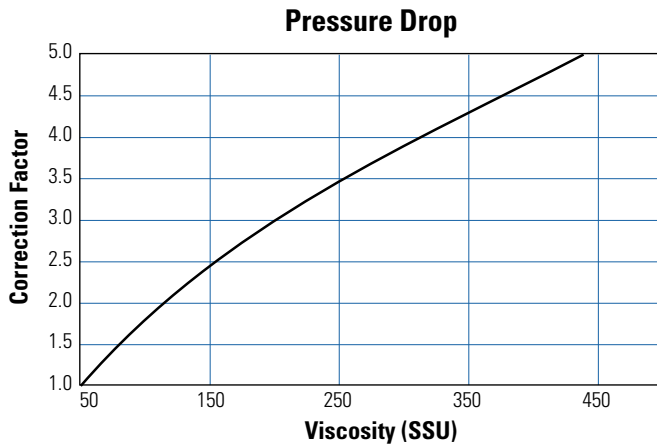
**Step 4 Select Model From Curves** Enter the Performance Curves at the bottom with the GPM oil flow and proceed upward to the adjusted Heat Rejection from Step 3. Any Model or Curve on or above this point will meet these conditions.

**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.*



## 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 ΔT) with this formula:

$$\text{Oil } \Delta T = (\text{BTU's/Hr.}) / (\text{GPM Oil Flow} \times 210).$$

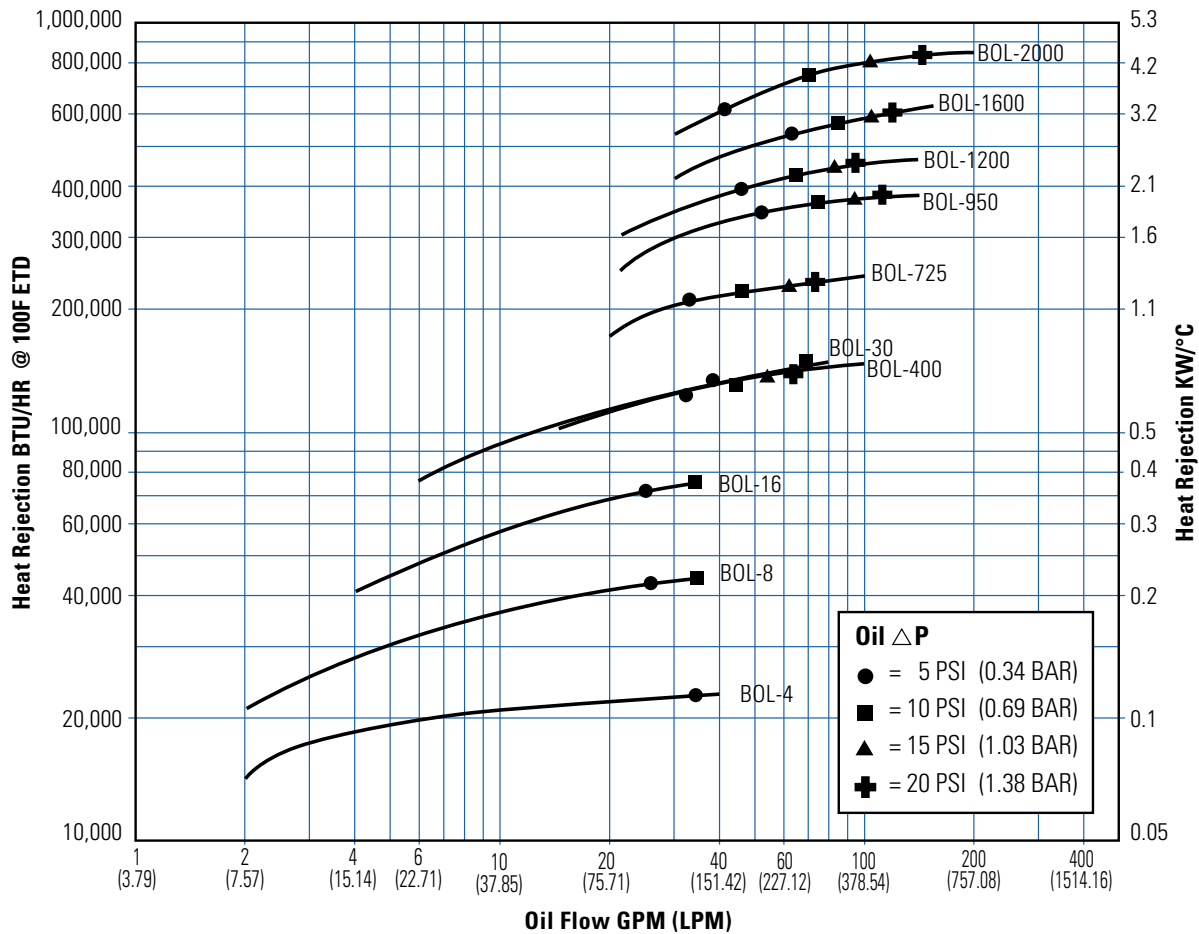
To calculate the oil entering temperature to the cooler, use this formula:

$$\text{Oil Entering Temp.} = \text{Oil Leaving Temp} + \text{Oil } \Delta T.$$

**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 Standard P-BAR Core



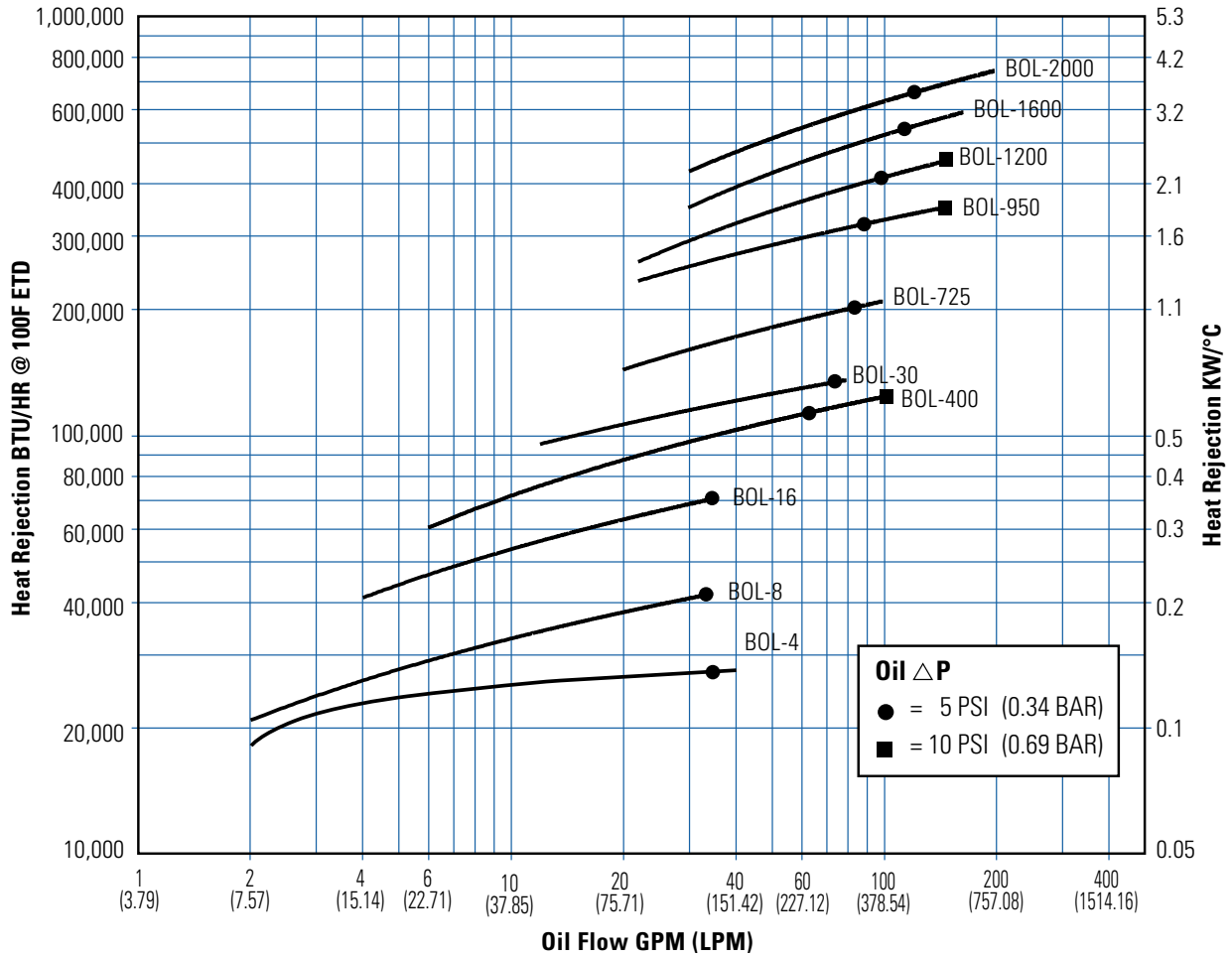
Note: Derate heat rejection values 15% if using 50Hz motors.



# Performance Curves

## BOL Models with Optional T-BAR Core

AIR COOLED BOL



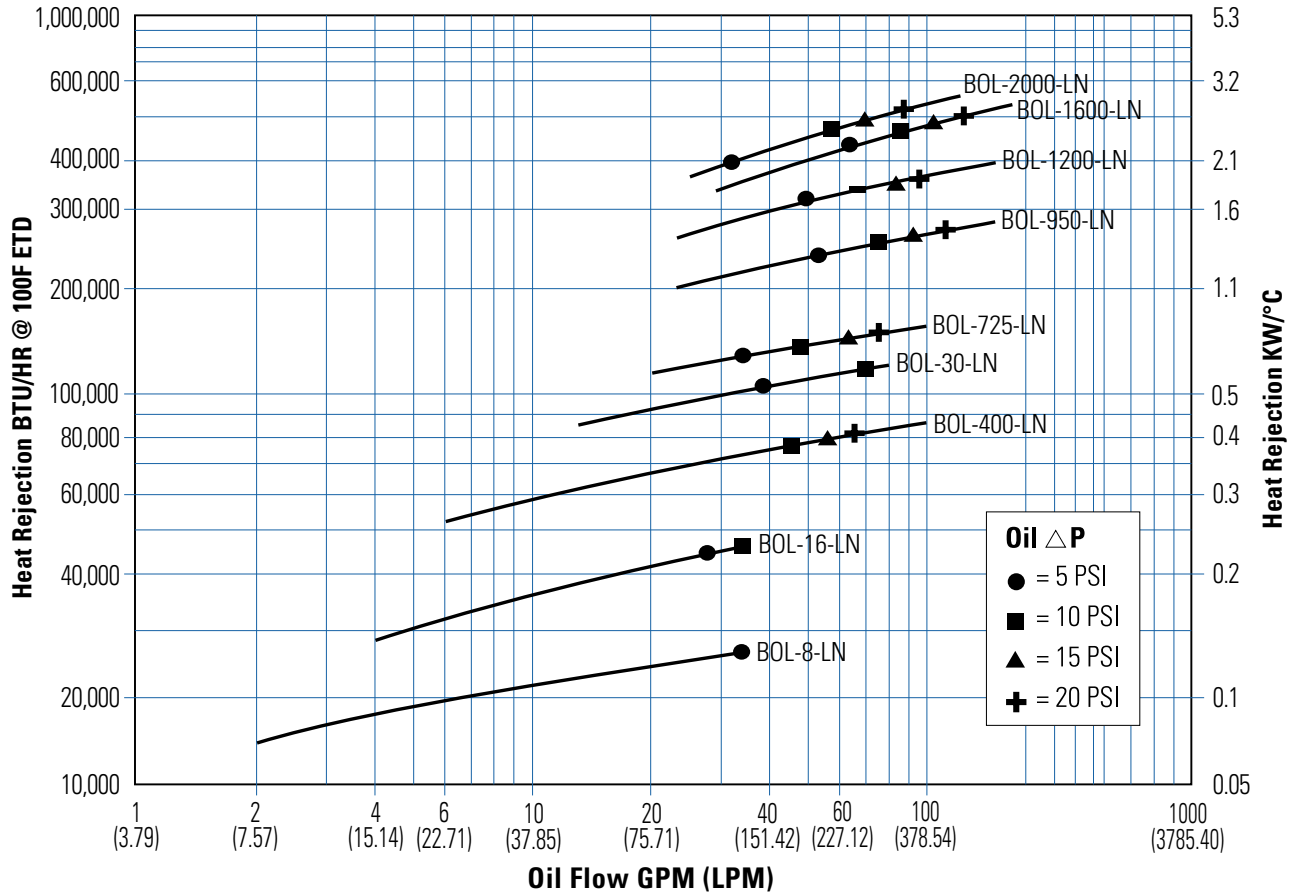
Note: Derate heat rejection values 15% if using 50Hz motors.



# 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

Low noise ratings are lab tested in a 1/4 spherical pattern. Additional nearby objects can increase the sound level.