

B/SB Series – Bare Tube Bundle Shell & Tube Water to Oil Cooling

The B/SB Series is very versatile in its ability to accommodate multiple application requirements. 700, 1000, 1200 and 1600 sizes feature 3/8" tube option for less pressure drop. 1/4" tube offers greater surface area, and multiple baffle spacing options to optimize heat transfer.

The **B** series is a non-ferrous design, with Brass construction, which makes it ideal for water to water, including sea water cooling applications.

Competitively priced **SB** Series, Steel construction version is the same as the **B** series, and mainly used for standard hydraulic applications.



Options

90/10 copper nickel cooling tubes, bronze end bonnets for sea water service and zinc anodes

How to Order

Model Series

B Series - Brass Hub

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

SB Series - Steel Hub

- SB** - NPT Shell Side x NPT Tube Side
- SBF** - SAE Flange (with UNC threads) Shell Side connections x NPT Tube Side connections

Model Size Selected

401, 402, 701, 702, 703, 1002, 1003, 1004, 1202, 1204, 1203, 1205, 1206, 1207, 1208, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610

(See Performance Curve Chart on page 3 for sizes or **XSelector*** sizing program)

Baffle Spacing

- A** - 1.125 **C** - 4.5
- B** - 2.25 **D** - 9.0

(Baffle spacing is dependent on applicable sizes found in sizing charts on page 3 or can be determined by using **XSelector*** sizing program)

Tube Diameter Code

- 4** - 1/4"
- 6** - 3/8" (Not Available in 400 Sizes)

Tubeside

- O** - One Pass
- T** - Two Pass
- F** - Four Pass

Shell Material

- Blank** - Steel
- BR** - Brass

Cooling Tube Material

- Blank** - Copper
- CN** - Copper Nickel

End Bonnet Material

- Blank** - Cast Iron
- B** - Bronze (B Series Only)

Zinc Anodes

- Blank** - None
- Z** - Zinc

Features

Young Touchstone thermal interchange

Sea water applications (B Series only), end model code with BR-CN-B-Z

Water to Water applications (B Series only)

Cooling Tube Side Material Options

- Standard Steel
- Copper Nickel
- Bronze

Multiple Connection Options

- NPT x NPT
- SAE x NPT
- SAE Code 61 x NPT
- BSPP x BSP

End Bonnets Removable for Servicing

Mounting Feet Included (May be rotated in 90° increments)

Materials

Tubes Copper / Copper Nickel

Hubs - B – Brass, **SB** - Cast Iron

Shell - B – Brass, **SB** - Steel

Baffles Brass

End Bonnets Cast Iron / Bronze

Mounting Brackets Carbon Steel

Gaskets Nitrile Rubber / Cellulose Fiber

Nameplate Aluminum Foil

Ratings

Maximum Operating Pressure - Shell Side
250 PSI

Maximum Operating Pressure - Tube Side
150 PSI

Maximum Operating Temperature
350°F

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:

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

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:
 l = 5 PSI n = 10 PSI s = 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 ΔT) with this formula:

$$\text{Oil } \Delta T = (BTUs/HR) / (\text{GPM Oil Flow} \times 210).$$

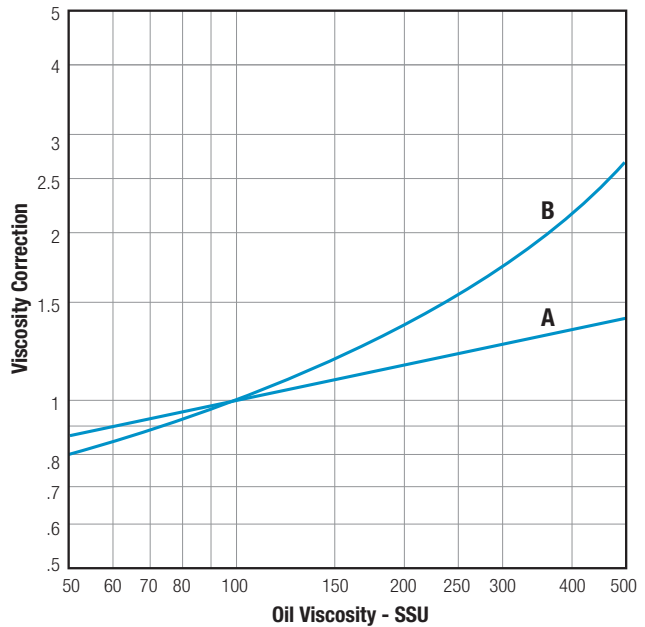
To calculate the oil leaving temperature from the cooler, use this formula:

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

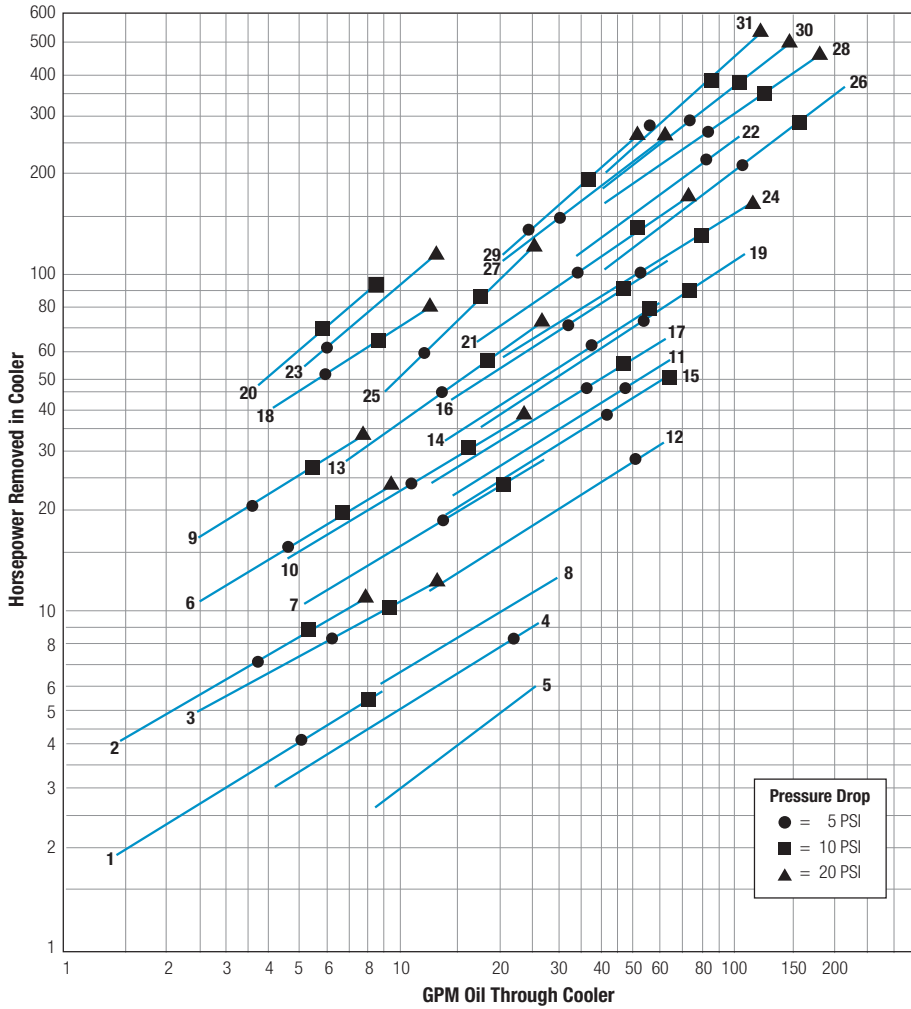
This formula may also be used in any application where the only temperature available is the entering oil temperature.

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.

Viscosity Correction



Performance Curves



| Curve Number | Model | Shipping Weight (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.

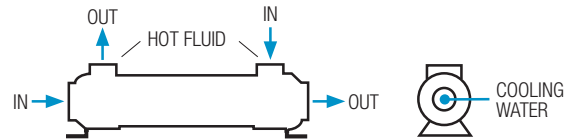
B - 1003 - C4 - F

| Unit Size | Shell Side (GPM) | | Baffle Spacing | | Tube Side (GPM) | | |
|-----------|------------------|----|----------------|-----|-----------------|-----|----|
| | A | B | C | D | 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 |

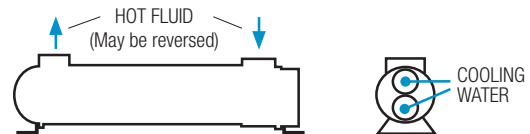
Caution: Incorrect installation can cause this product to fail prematurely, causing the shell side and tube side fluids to intermix.

Piping Diagram

One Pass



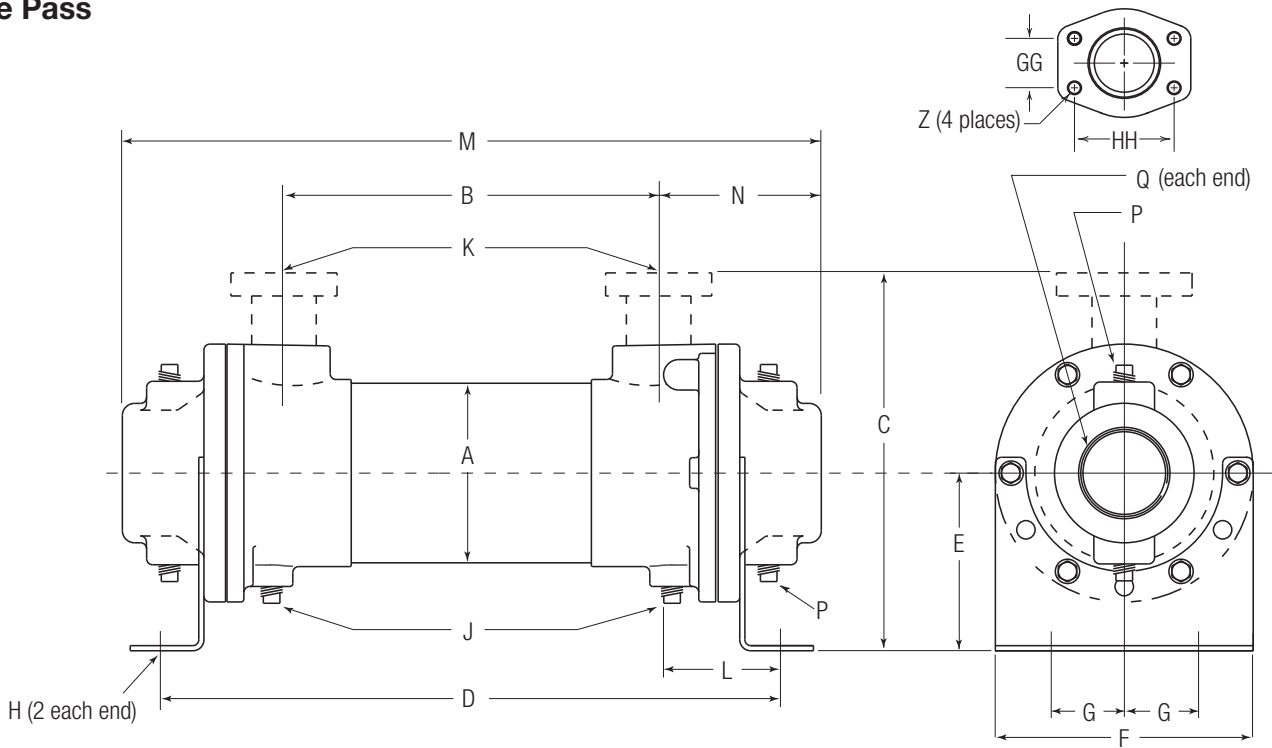
Two and Four Pass



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

Dimensions

One Pass



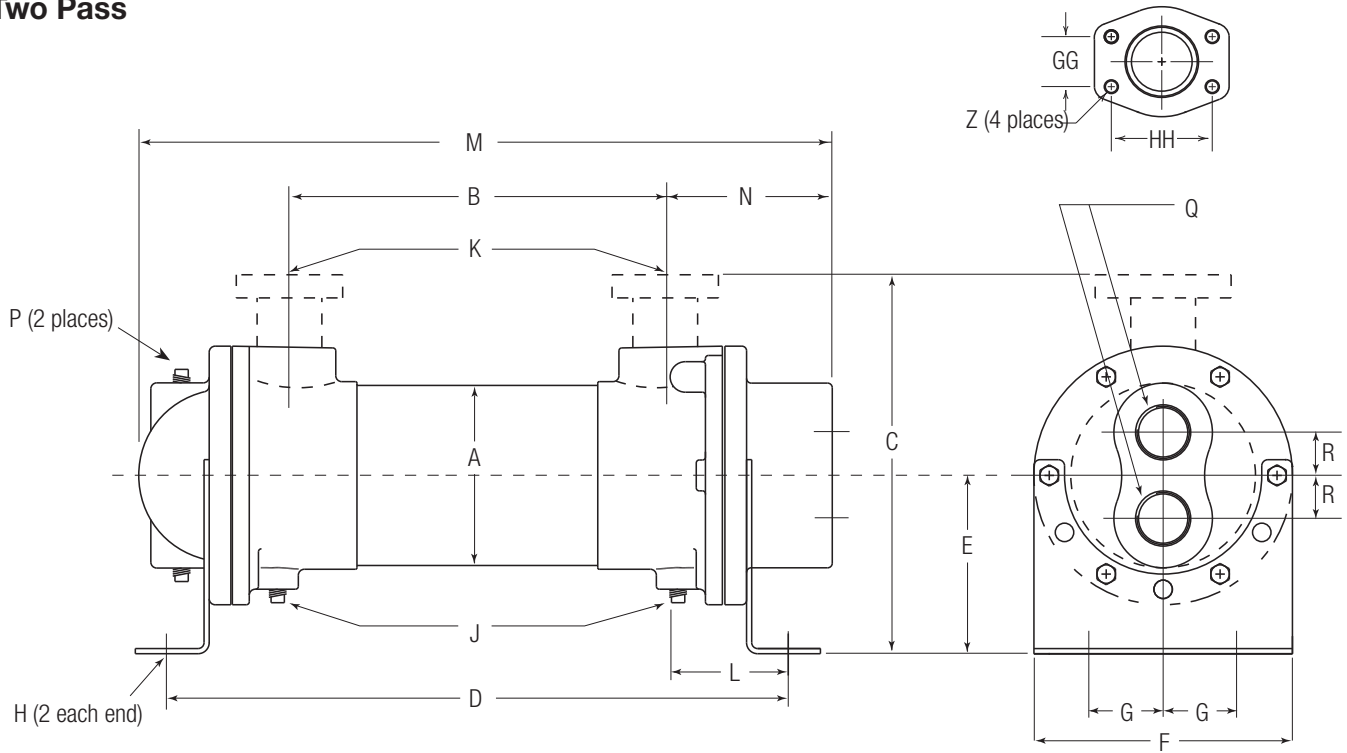
| Flange Size | GG | HH | Z - BF | Z - BFM |
|-------------|------|------|------------|---------|
| 1 | 1.03 | 2.06 | 3/8-16 UNC | M-10 |
| 1.50 | 1.41 | 2.75 | 1/2-13 UNC | M-12 |
| 2 | 1.69 | 3.06 | 1/2-13 UNC | M-12 |
| 3 | 2.44 | 4.19 | 5/8-11 UNC | M-16 |

| Model | A | B | C | | D | E | F | G | H | J NPT | K | | L | M | N | P NPT | Q NPT |
|--------|------|-------|------------------------|---------------|-------|------|------|------|------------|----------|--------------------|---------------|------|-------|------|----------|----------|
| | | | NPT/BSPP SAE O-Ring | SAE Flange | | | | | | | NPT/BSPP Flange | SAE O-Ring | | | | | |
| B-401 | 2.13 | 7.62 | 3.50 | — | 11.04 | 1.94 | 2.62 | .88 | .41 Dia. | — | * 1/2 | -8 | 1.72 | 11.24 | 1.81 | — | 1 |
| B-402 | 2.13 | 16.62 | 3.50 | — | 20.04 | 1.94 | 2.62 | .88 | .41 Dia. | — | * 1/2 | 3/4-16 | 1.72 | 20.24 | 1.81 | — | 1 |
| B-701 | 3.66 | 7.00 | 6.25 | 7.75 | 12.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | -16 | 2.69 | 13.62 | 3.31 | (4) 3/8 | 1 1/2 |
| B-702 | 3.66 | 16.00 | 6.25 | 7.75 | 21.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | 1 1/16-12 | 2.69 | 22.62 | 3.31 | (4) 3/8 | 1 1/2 |
| B-703 | 3.66 | 25.00 | 6.25 | 7.75 | 30.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | -24 | 2.69 | 31.62 | 3.31 | (4) 3/8 | 1 1/2 |
| B-1002 | 5.13 | 15.50 | 7.38 | 8.46 | 21.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | 1 1/8-12 | 3.06 | 23.75 | 4.12 | (4) 3/8 | 2 |
| B-1003 | 5.13 | 24.50 | 7.38 | 8.46 | 30.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | -24 | 3.06 | 32.75 | 4.12 | (4) 3/8 | 2 |
| B-1004 | 5.13 | 33.50 | 7.38 | 8.46 | 39.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | 1 1/8-12 | 3.06 | 41.75 | 4.12 | (4) 3/8 | 2 |
| B-1202 | 6.13 | 14.62 | 8.83 | 10.50 | 21.67 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | -32 | 3.52 | 24.53 | 4.95 | (4) 1/2 | 3 |
| B-1203 | 6.13 | 23.50 | 8.83 | 10.50 | 30.54 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | 2 1/2-12 | 3.52 | 33.40 | 4.95 | (4) 1/2 | 3 |
| B-1204 | 6.13 | 32.38 | 8.83 | 10.50 | 39.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | -32 | 3.52 | 42.28 | 4.95 | (4) 1/2 | 3 |
| B-1205 | 6.13 | 41.38 | 8.83 | 10.50 | 48.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | 2 1/2-12 | 3.52 | 51.28 | 4.95 | (4) 1/2 | 3 |
| B-1206 | 6.13 | 50.50 | 8.83 | 10.50 | 57.54 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | -32 | 3.52 | 60.41 | 4.95 | (4) 1/2 | 3 |
| B-1207 | 6.13 | 59.50 | 8.83 | 10.50 | 66.54 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | 2 1/2-12 | 3.52 | 69.41 | 4.95 | (4) 1/2 | 3 |
| B-1208 | 6.13 | 68.38 | 8.83 | 10.50 | 75.33 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | -32 | 3.52 | 78.19 | 4.95 | (4) 1/2 | 3 |
| B-1602 | 8.00 | 13.60 | 12.13 | 15.37 | 22.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 26.75 | 6.58 | (4) 1/2 | 4 |
| B-1603 | 8.00 | 22.60 | 12.13 | 15.37 | 31.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 35.75 | 6.58 | (4) 1/2 | 4 |
| B-1604 | 8.00 | 31.60 | 12.13 | 15.37 | 40.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 44.75 | 6.58 | (4) 1/2 | 4 |
| B-1605 | 8.00 | 40.60 | 12.13 | 15.37 | 49.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 53.75 | 6.58 | (4) 1/2 | 4 |
| B-1606 | 8.00 | 49.60 | 12.13 | 15.37 | 58.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 62.75 | 6.58 | (4) 1/2 | 4 |
| B-1607 | 8.00 | 58.60 | 12.13 | 15.37 | 67.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 71.75 | 6.58 | (4) 1/2 | 4 |
| B-1608 | 8.00 | 67.60 | 12.13 | 15.37 | 76.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 80.75 | 6.58 | (4) 1/2 | 4 |
| B-1609 | 8.00 | 76.60 | 12.13 | 15.37 | 85.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 89.75 | 6.58 | (4) 1/2 | 4 |
| B-1610 | 8.00 | 85.60 | 12.13 | 15.37 | 94.50 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.45 | 98.75 | 6.58 | (4) 1/2 | 4 |

*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



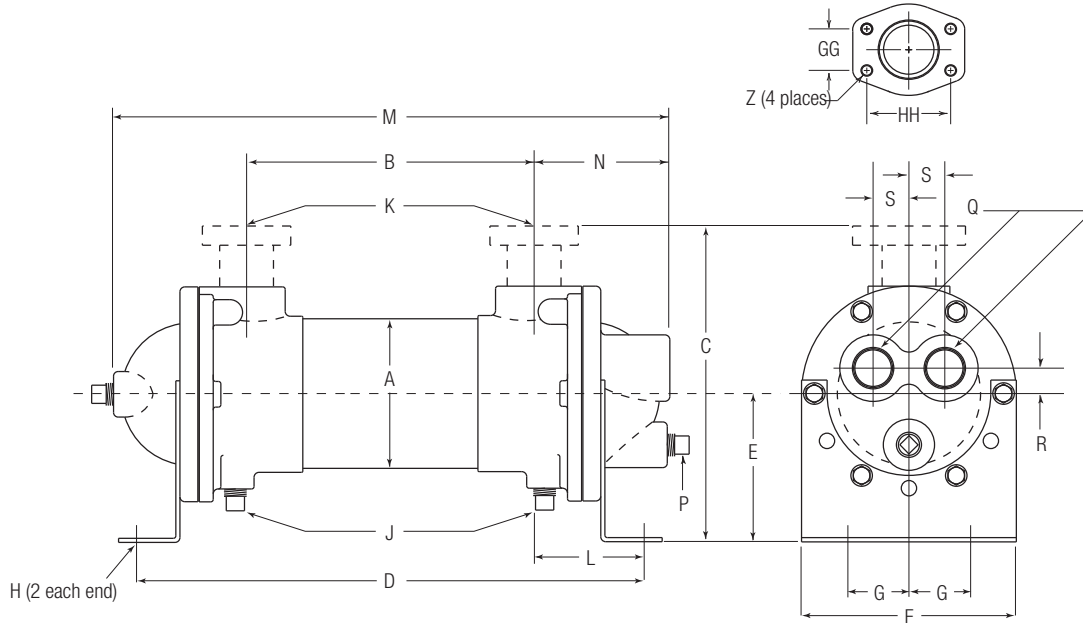
| Flange Size | GG | HH | Z - BF | Z - BFM |
|-------------|------|------|------------|---------|
| 1 | 1.03 | 2.06 | 3/8-16 UNC | M-10 |
| 1.50 | 1.41 | 2.75 | 1/2-13 UNC | M-12 |
| 2 | 1.69 | 3.06 | 1/2-13 UNC | M-12 |
| 3 | 2.44 | 4.19 | 5/8-11 UNC | M-16 |

| Model | A | B | C | | D | E | F | G | H | J NPT | K | | L | M | N | P NPT | Q NPT | R |
|--------|------|-------|------------------------|---------------|-------|------|------|------|------------|----------|--------------------|------------------|------|-------|-------|----------|----------|-------|
| | | | NPT/BSPP SAE O-Ring | SAE Flange | | | | | | | NPT/BSPP Flange | SAE O-Ring | | | | | | |
| B-701 | 3.66 | 7.00 | 6.25 | 7.75 | 12.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | -16 1 1/16-12 | 2.69 | 13.51 | 3.38 | (2) 3/8 | 1 | .88 |
| B-702 | 3.66 | 16.00 | 6.25 | 7.75 | 21.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | | 2.69 | 22.44 | 3.38 | (2) 3/8 | 1 | .88 |
| B-703 | 3.66 | 25.00 | 6.25 | 7.75 | 30.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | | 2.69 | 31.44 | 3.38 | (2) 3/8 | 1 | .88 |
| B-1002 | 5.13 | 15.50 | 7.38 | 8.46 | 21.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | -24 1 1/8-12 | 3.06 | 23.44 | 3.88 | (2) 3/8 | 1 1/2 | 1.19 |
| B-1003 | 5.13 | 24.50 | 7.38 | 8.46 | 30.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | | 3.06 | 32.44 | 3.88 | (2) 3/8 | 1 1/2 | 1.19 |
| B-1004 | 5.13 | 33.50 | 7.38 | 8.46 | 39.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | | 3.06 | 41.44 | 3.88 | (2) 3/8 | 1 1/2 | 1.19 |
| B-1202 | 6.13 | 14.62 | 8.83 | 10.50 | 21.67 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | -32 2 1/2-12 | 3.52 | 24.09 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1203 | 6.13 | 23.50 | 8.83 | 10.50 | 30.54 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 32.96 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1204 | 6.13 | 32.38 | 8.83 | 10.50 | 39.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 41.84 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1205 | 6.13 | 41.38 | 8.83 | 10.50 | 48.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 50.84 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1206 | 6.13 | 50.50 | 8.83 | 10.50 | 57.55 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 59.97 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1207 | 6.13 | 59.50 | 8.83 | 10.50 | 66.55 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 68.97 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1208 | 6.13 | 68.38 | 8.83 | 10.50 | 75.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 77.84 | 4.64 | (2) 1/2 | 2 | 1.44 |
| B-1602 | 8.00 | 13.60 | 12.13 | 15.37 | 22.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | | — | 4.39 | 25.23 | 6.14 | (2) 1/2 | 2 1/2 |
| B-1603 | 8.00 | 22.60 | 12.13 | 15.37 | 31.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 34.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1604 | 8.00 | 31.60 | 12.13 | 15.37 | 40.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 43.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1605 | 8.00 | 40.60 | 12.13 | 15.37 | 49.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 52.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1606 | 8.00 | 49.60 | 12.13 | 15.37 | 58.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 61.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1607 | 8.00 | 58.60 | 12.13 | 15.37 | 67.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 70.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1608 | 8.00 | 67.60 | 12.13 | 15.37 | 76.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 79.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1609 | 8.00 | 76.60 | 12.13 | 15.37 | 85.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 88.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |
| B-1610 | 8.00 | 85.60 | 12.13 | 15.37 | 94.38 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.39 | 97.23 | 6.14 | (2) 1/2 | 2 1/2 | 1.88 |

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 - BF | Z - BFM |
|-------------|------|------|------------|---------|
| 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 | 1/2-13 UNC | M-12 |
| 3 | 2.44 | 4.19 | 5/8-11 UNC | M-16 |

| Model | A | B | C | | D | E | F | G | H | J NPT | K | | L | M | N | P NPT | Q NPT | R | S |
|--------|------|-------|------------------------|---------------|-------|------|------|------|------------|----------|--------------------|------------------|-------|-------|-------------------------------|-------------------------------|----------|------|------|
| | | | NPT/BSPP SAE O-Ring | SAE Flange | | | | | | | NPT/BSPP Flange | SAE O-Ring | | | | | | | |
| B-701 | 3.66 | 7.00 | 6.25 | 7.75 | 12.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | -16 1 1/16-12 | 2.69 | 13.57 | 3.32 | (3) 3/8 | 3/4 | .62 | .88 |
| B-702 | 3.66 | 16.00 | 6.25 | 7.75 | 21.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | | 2.69 | 22.57 | 3.32 | (3) 3/8 | 3/4 | .62 | .88 |
| B-703 | 3.66 | 25.00 | 6.25 | 7.75 | 30.01 | 3.62 | 5.25 | 1.50 | .44 x 1.00 | (2) 3/8 | 1 | | 2.69 | 31.57 | 3.32 | (3) 3/8 | 3/4 | .62 | .88 |
| B-1002 | 5.13 | 15.50 | 7.38 | 8.46 | 21.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | -24 1 7/8-12 | 3.06 | 23.65 | 4.15 | (3) 3/8 | 1 | .75 | 1.34 |
| B-1003 | 5.13 | 24.50 | 7.38 | 8.46 | 30.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | | 3.06 | 32.65 | 4.15 | (3) 3/8 | 1 | .75 | 1.34 |
| B-1004 | 5.13 | 33.50 | 7.38 | 8.46 | 39.71 | 4.00 | 6.75 | 2.00 | .44 x 1.00 | (6) 3/8 | 1 1/2 | | 3.06 | 41.65 | 4.15 | (3) 3/8 | 1 | .75 | 1.34 |
| B-1202 | 6.13 | 14.62 | 8.83 | 10.50 | 21.67 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | -32 2 1/2-12 | 3.52 | 24.59 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 |
| B-1203 | 6.13 | 23.50 | 8.83 | 10.50 | 30.54 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 33.46 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 |
| B-1204 | 6.13 | 32.38 | 8.83 | 10.50 | 39.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 42.34 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 |
| B-1205 | 6.13 | 41.88 | 8.83 | 10.50 | 48.42 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 51.34 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 |
| B-1206 | 6.13 | 50.50 | 8.83 | 10.50 | 57.55 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 60.47 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 |
| B-1207 | 6.13 | 59.50 | 8.83 | 10.50 | 66.55 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | | 3.52 | 69.47 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 |
| B-1208 | 6.13 | 68.38 | 8.83 | 10.50 | 75.33 | 4.77 | 7.50 | 2.50 | .44 x .88 | (6) 3/8 | 2 | 3.52 | 78.25 | 4.98 | (1) 1/2 I/O (2) 3/8 Return | 1 1/2 | 1.06 | 1.41 | |
| B-1602 | 8.00 | 13.60 | 12.13 | 15.37 | 22.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 26.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1603 | 8.00 | 22.60 | 12.13 | 15.37 | 31.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 35.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1604 | 8.00 | 31.60 | 12.13 | 15.37 | 40.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 44.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1605 | 8.00 | 40.60 | 12.13 | 15.37 | 49.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 53.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1606 | 8.00 | 49.60 | 12.13 | 15.37 | 58.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 62.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1607 | 8.00 | 58.60 | 12.13 | 15.37 | 67.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 71.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1608 | 8.00 | 67.60 | 12.13 | 15.37 | 76.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 80.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1609 | 8.00 | 76.60 | 12.13 | 15.37 | 85.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 89.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |
| B-1610 | 8.00 | 85.60 | 12.13 | 15.37 | 94.56 | 6.50 | 8.63 | 3.50 | .44 x 1.00 | (6) 3/8 | 3 | — | 4.51 | 98.85 | 6.55 | (3) 1/2 | 2 | 1.88 | 1.88 |

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