# **Fluid Cooling** Shell & Tube CA-2000 Series



COPPER & STEEL CONSTRUCTION

## Performance Notes

- Super high flow
- Largest flow rates & heat transfer available
- Rugged steel construction
- Custom designs available
- Competitively priced
- 3/8" and 5/8" tubes available
- Maximum 10" diameter, 12' long
- 150# ANSI/ASME flanged shell connections (metric available)
- End bonnets removable for servicing
- Saddle brackets for incremental mounting
- Special ASME/TEMA C/CRN ratings available

**Options**
Optional construction on tubes, tubesheets and end bonnets

## Ratings

**Maximum Operating Pressure - Shell Side**
150 PSI

**Maximum Operating Pressure - Tube Side**
150 PSI

**Maximum Operating Temperature**
300°F

## Materials

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

**CA** = ANSI/ASME shell side flanges; NPT tubeside bottom connections (two & four pass); ANSI/ASME flanges on tube side (one pass).
**CAM** = ANSI/ASME shell side metric flanges; BSPP tubeside connections (two & four pass); ANSI/ASME metric flanges on tube side (one pass).

# Shell & Tube 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.

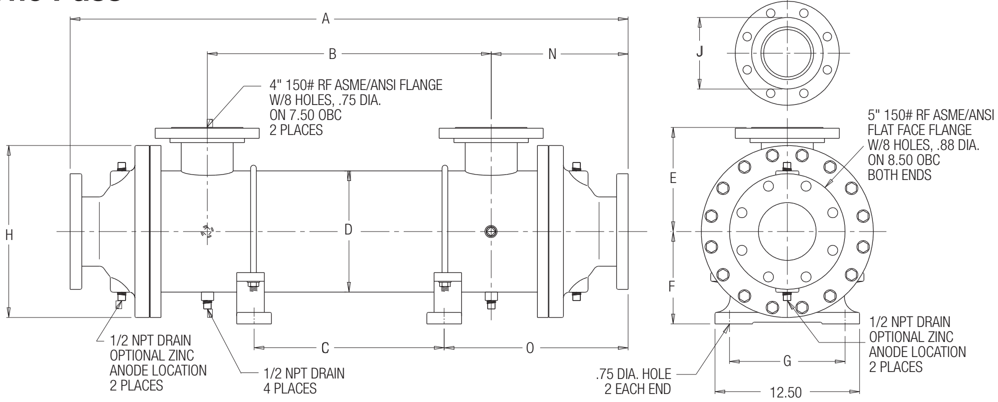
It may be necessary to clean the inside of the cooling tubes to remove any contamination and/or scale buildup. It is recommended that a fifty-fifty percent solution of inhibited muriatic acid and water may be used. For severe problems, the use of a brush through the tubes may be of some help. Be sure 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 HC/SSC/SSCA Series models only.*

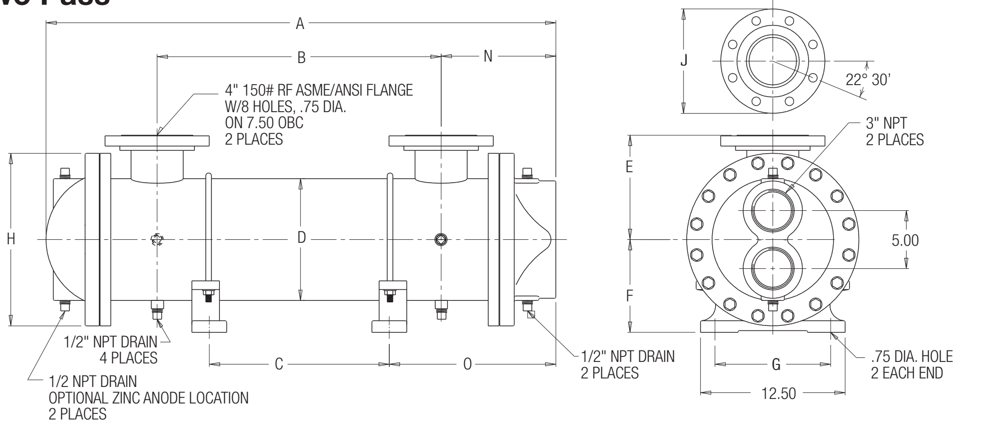
# Dimensions

## One Pass



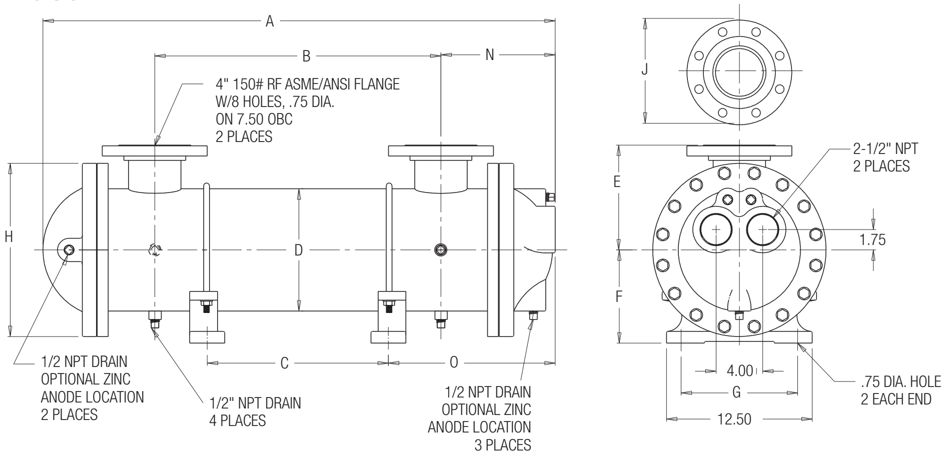

| Model | A | N | O |
|---|---|---|---|
| CA-2036 | 49.64 | 11.82 | 15.92 |
| CA-2048 | 61.64 | 11.82 | 15.92 |
| CA-2060 | 73.64 | 11.82 | 15.92 |
| CA-2072 | 85.64 | 11.82 | 15.92 |
| CA-2084 | 97.64 | 11.82 | 15.92 |
| CA-2096 | 109.64 | 11.82 | 15.92 |
| CA-20108 | 121.64 | 11.82 | 15.92 |
| CA-20120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

## Two Pass




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

## Four Pass



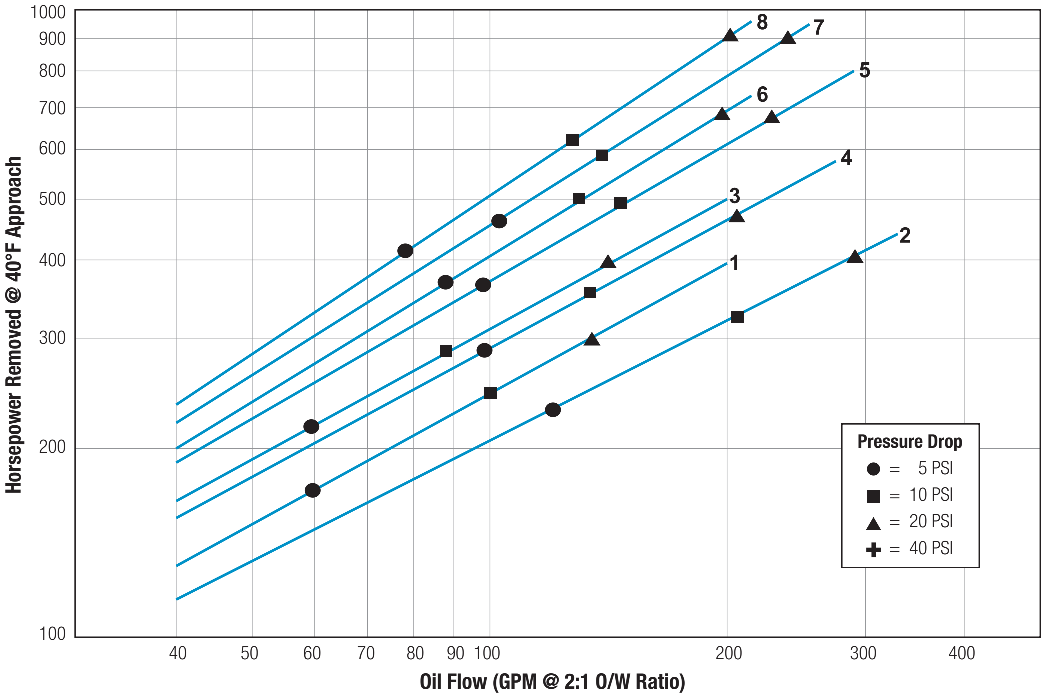

| Model | A | N | O |
|---|---|---|---|
| CA-2036 | 45.34 | 9.78 | 13.78 |
| CA-2048 | 57.34 | 9.78 | 13.78 |
| CA-2060 | 69.34 | 9.78 | 13.78 |
| CA-2072 | 81.34 | 9.78 | 13.78 |
| CA-2084 | 93.34 | 9.78 | 13.78 |
| CA-2096 | 105.34 | 9.78 | 13.78 |
| CA-20108 | 117.34 | 9.78 | 13.78 |
| CA-20120 |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

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

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

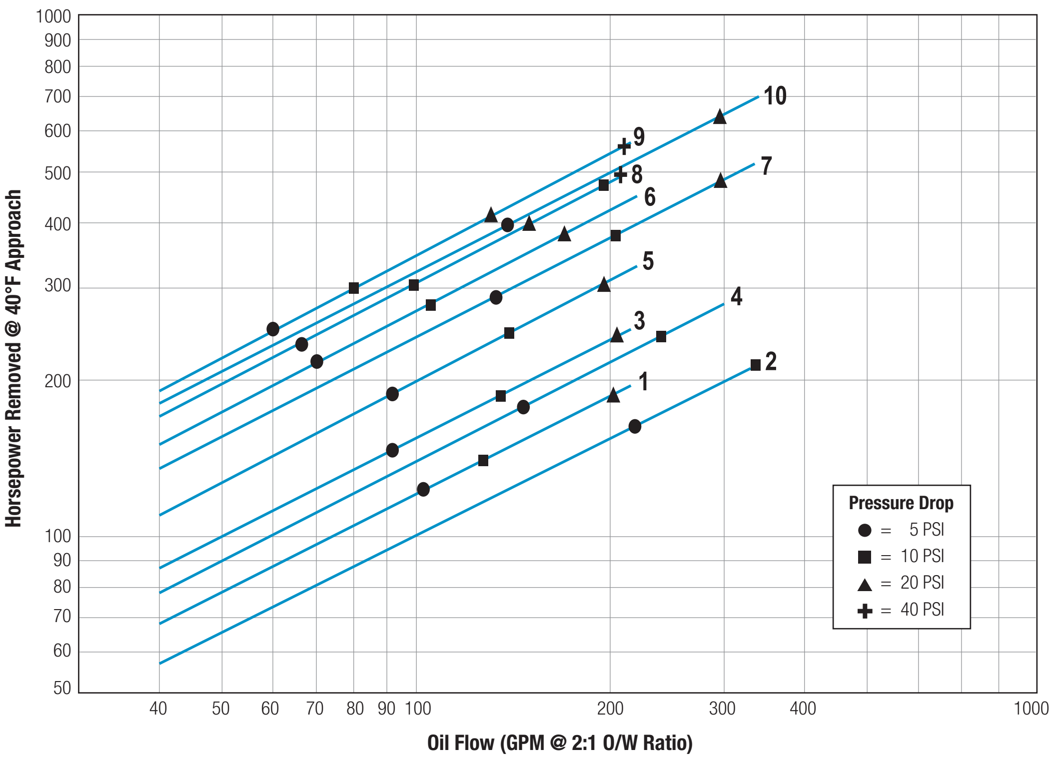
# Performance Curves

## 3/8" Tubes




| Curve Number | Model |
|---|---|
| 1 | CA-2036-6-6-F |
| 2 | CA-2036-9-6-F |
| 3 | CA-2048-6-6-F |
| 4 | CA-2048-9-6-F |
| 5 | CA-2072-9-6-F |
| 6 | CA-2084-9-6-F |
| 7 | CA-20108-9-6-F |
| 8 | CA-20132-9-6-F |

## 5/8" Tubes




| Curve Number | Model |
|---|---|
| 1 | CA-2036-6-10-F |
| 2 | CA-2036-9-10-F |
| 3 | CA-2048-6-10-F |
| 4 | CA-2048-9-10-F |
| 5 | CA-2060-6-10-F |
| 6 | CA-2084-6-10-F |
| 7 | CA-2084-9-10-F |
| 8 | CA-2096-6-10-F |
| 9 | CA-20120-6-10-F |
| 10 | CA-20132-9-10-F |

# 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:

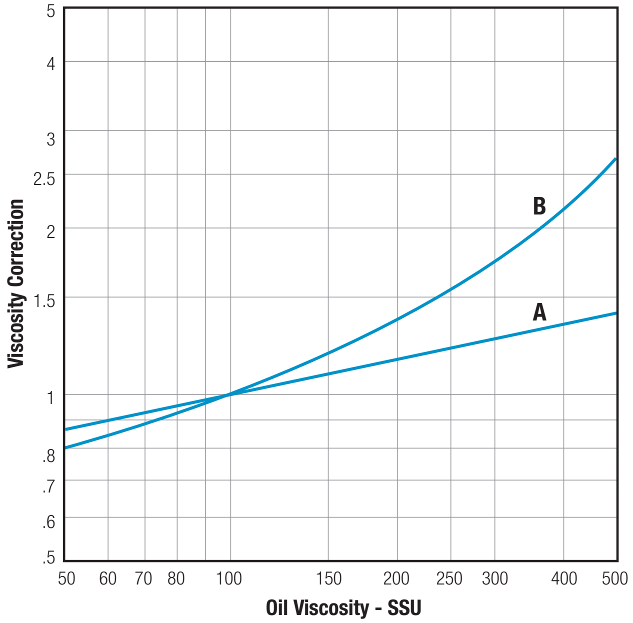
$$\text{HP heat load} \times \frac{40}{\text{Actual Approach}} \times \text{Viscosity Correction A} = \text{Curve Horsepower}$$

**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.** Multiply pressure drop from curve by correction factor B found on oil viscosity correction curve.

● = 5 PSI ■ = 10 PSI ▲ = 20 PSI ✚ = 40 PSI

## Viscosity Correction




## 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 $\triangle$T) with this formula:

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

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

Oil Leaving Temperature = Oil Entering Temperature - Oil $\triangle$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.