

# INSTALLATION INSTRUCTIONS

## THERMOSIPHON HEATER CB/CL, SB/SL, WL & EE SERIES

### BEFORE YOU INSTALL

Your industrial tank heater uses thermosiphon action – *the natural expansion and rising action of a heated fluid* – to circulate heated coolant throughout an engine’s water jacket. With no moving parts, thermosiphon heaters require little maintenance. However, initial installation of the heating system is critical; even seemingly minor adjustments to port location, hose routing or heater positioning may help ensure your thermosiphon heater preheats your engine effectively.

#### **CAUTION**

**Hazardous voltage:** Before wiring, servicing or cleaning the heating system, turn off the power and follow your organization’s lockout and tagout procedure. Failure to do so could allow others to turn on the power unexpectedly, resulting in harmful or fatal electrical shock.

**Electrical hazard:** Power source must be properly grounded and in accordance with national and local electrical codes. Do not connect heater prior to installation.

**Personal injury:** If equipped with isolation valves, ensure valves are open before energizing heater. Obstructed flow may result in an unexpected release of heated coolant, potentially causing serious injury.

#### **NOTICE**

**Read instructions carefully:** The HOTSTART warranty does not cover any damage that a heating system may sustain from improper installation, improper operation, improper specification or corrosion. Before installing your heater, be sure you have the right heating system for your application. Carefully read all instructions before installing and energizing your heater.

**Safety devices:** The high-limit thermostat (enclosed in the element assembly) is intended only to prevent hazardous temperatures. A bi-directional ball valve (installed at the tank inlet) allows a minimal amount of coolant to reverse flow when the engine is running, protecting the element from overheating. Do not alter or misuse safety devices.

**Proper operation:** The HOTSTART heating system is intended to be activated only while the engine is not in operation. Preheating while the engine is running may reduce heater longevity. For automatic-start engines, a control box with automatic shut-off device is recommended.

Figure 1. Typical industrial tank heater model configurations. Your model may vary.

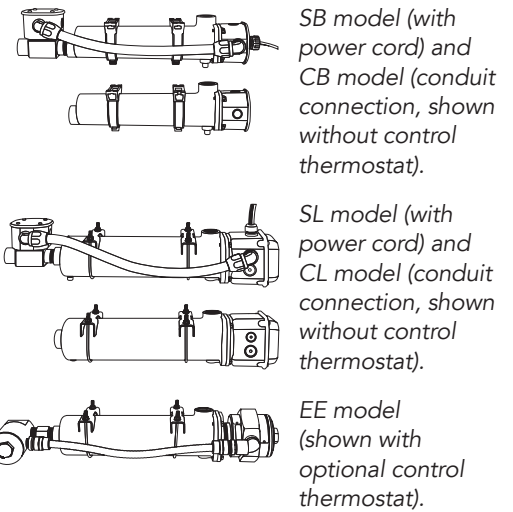
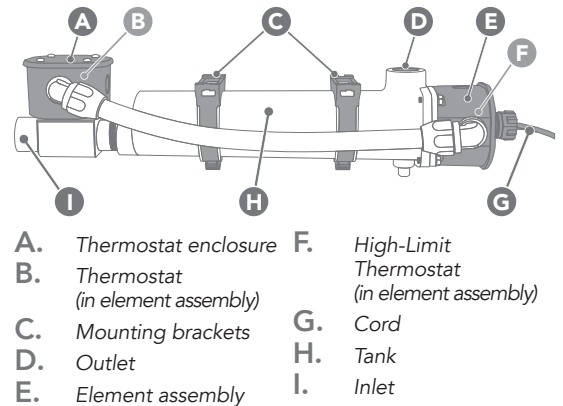


Figure 2. Typical SB model thermosiphon heater. Style and configuration may vary.



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# INSTALLING THE HEATER

## PREPARE COOLANT SYSTEM

1. Drain and flush cooling system to remove any debris present in the engine's cooling system.

## SELECT PORTS

2. Select return port. The return port will allow heated coolant to return to the engine. See Fig 3 on following page. The return port should be located:
  - away from the engine thermostat
  - toward the rear (flywheel) of the engine
  - high on the engine's water jacket
  - away from the supply port
3. Select supply port. The supply port will allow coolant to flow from the engine to the heater. See Fig 3 on opposite page. The supply port should be located:
  - toward the front (radiator) of the engine
  - at the lowest point of the engine's water jacket
  - away from the return port.

## SELECT HOSE, FITTINGS & VALVES

4. Select fittings. Use the following table to determine the proper engine port fitting size for your heater:

CB/CL/SB/SL	500–3000 watts	1/2 inch NPT
CB/CL/SB/SL	3750–5000 watts	3/4 inch NPT
WL/EE	1500–5000 watts	3/4 inch NPT

5. Select hoses. Use the following table to determine the minimum hose inner diameter for your heater:

CB/CL/SB/SL	500–3000 watts	3/4 inch
CB/CL/SB/SL	3750–5000 watts	1 inch
WL/EE	1500–5000 watts	1 inch

**NOTE:** Select hoses rated for 250 °F (121 °C) and 100 psi (690 kPa) minimum.

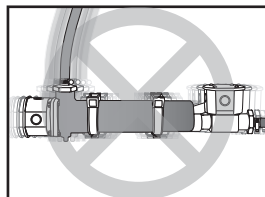
6. Select optional, user-supplied isolation valves.

**NOTE:** HOTSTART recommends installing valves to isolate the heating system in case of service. To minimize flow restriction, select full-flow ball isolation valves.

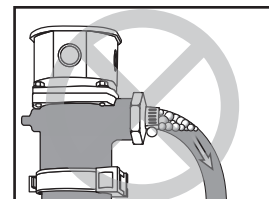
## MOUNT HEATER

### NOTICE

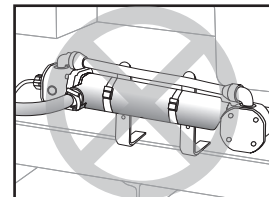
**Vibration damage:** Do not mount heater directly to engine. Engine vibration will damage heater. If the heater is installed with rigid pipe, connect flexible hose to inlet and outlet to isolate from vibration.



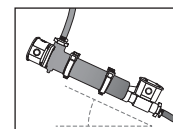
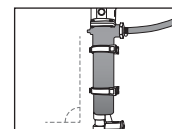
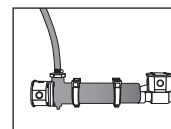
**Vertical orientation:** If mounted vertically, all dips and horizontal hose routing **must** be eliminated. An incorrectly oriented heater may cause heater failure.



**Outlet orientation:** If mounting heater horizontally or at an angle, outlet must face upward. If mounting heater vertically, ensure outlet is at top of heater. Do not attempt to reverse flow through heater. An incorrectly oriented outlet may cause heater failure.



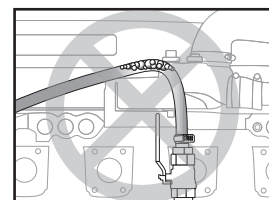
7. Select a heater mounting position directly below the return port and at least 6 inches (15 cm) below the lowest point of the engine's water jacket.
8. Mount heater using the supplied mounting brackets and fasteners. The heater may be mounted:
  - straight horizontally (HOTSTART recommended)
  - straight vertically
  - horizontally at an angle (see **TROUBLESHOOTING**)



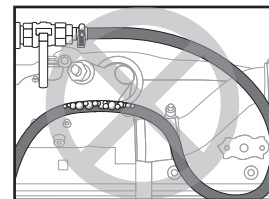
## PLUMB HEATER

### NOTICE

**High points:** Do not allow high points along heater plumbing. High points will create hot spots, restricting coolant flow and damaging heater.



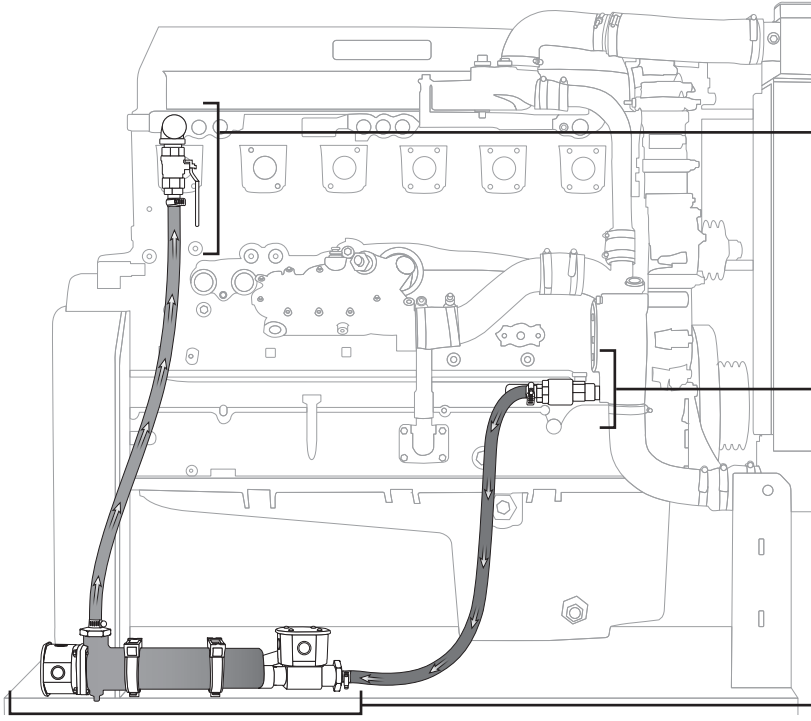
**Dips and bends:** Do not allow dips or bends along heater plumbing. Dips or bends will allow air pockets to form, restricting coolant flow and damaging heater.



9. Install isolation valves to port fittings.
10. Route and install return hose. The return hose should continuously rise from the heater to the return port.
11. Route and install supply hose. The supply hose should continuously descend from the supply port to the heater.

**NOTE:** For V-type engines, it is acceptable to select a supply port on the opposite side of the engine as long as the supply hose is routed properly.

Figure 3. Example heater installation. The return hose continuously rises to the engine and supply hose continuously descends to the heater; the hoses have no dips, bends or high points. The heater is mounted in the correct orientation and is isolated from engine vibration.



## RETURN PORT

- Select a **return** port away from the engine thermostat.
  - Select a **return** port high on the engine.
  - Select a **return** port toward the rear of the engine.
  - Select a **return** port away from the remote thermostat.
- NOTE:** If an optional remote thermostat is installed
- Select a **return** port away from the **supply** port.

## SUPPLY PORT

- Select a **supply** port low on the engine.
- Select a **supply** port toward the front of the engine.
- Select a **supply** port away from the **return** port.

## HEATER MOUNTING

- Mount the heater in the proper orientation. Ensure heater outlet faces upward.
- Mount the heater to a vibration-isolated surface.
- Mount the heater directly below the **return** port.
- Mount the heater at least 6 inches (15 cm) below the lowest point of the water jacket.

## REFILL COOLANT

### NOTICE

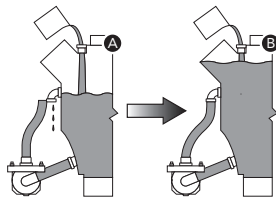
**Heater damage:** When mixing coolant, only use deionized or distilled water and low-silicate antifreeze. Refer to your engine's manufacturer recommendations. Do not exceed 60% antifreeze to 40% water ratio. **Never** add unmixed water and antifreeze to an engine. Do not add anti-leak or other coolant additives.

- Mix coolant according to your engine manufacturer's recommendations. Refill cooling system with coolant. To prevent air pockets, refill coolant with return hose removed. See Fig 4.

**NOTE:** HOTSTART recommends using a 50% deionized or distilled water to 50% low-silicate antifreeze mixture.

- Start engine. Allow engine to run until engine thermostat opens, purging air from cooling system. **NOTICE!** Engine must be run to eliminate air from heating system before energizing heater.

Figure 4. When refilling engine with coolant, remove heater return hose (A). Once filled to level of return port, reconnect return hose to ensure no air remains in heating system (B).



- When engine has reached operating temperature, shut engine off and check for coolant leaks.
- Allow engine to cool. Check coolant level and top off as needed. Secure heater power cord to avoid contact with all hot or moving parts.

## WIRE HEATER

- Connect heater to an appropriately rated power source. Ensure power source is grounded and in accordance with local and national electrical codes. If necessary, install control box:
  - If your heater is **single-phase** and **rated up to 480 volts**, your heater may be powered directly without the use of a control relay or contactor. See Fig. 5.

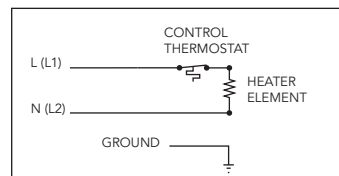


Figure 5 (left). Wiring schematic for single-phase heaters rated for up to 480 volts.

- If your heater is **three-phase** or is **single-phase and rated for over 480 volts**, the heater thermostats must be used in a control circuit with a contactor for switching the main power to the heating elements. See Fig. 6 and 7 on following page.

## MAINTENANCE & PARTS

### CAUTION

**Electrical hazard:** Before wiring, servicing or cleaning the heating system, turn off the power and follow your organization's lockout and tagout procedure. Failure to do so could allow others to turn on the power unexpectedly, resulting in harmful or fatal electrical shock.

**Personal injury:** If equipped with isolation valves, ensure valves are open before energizing heater. Obstructed flow may result in an unexpected release of heated coolant, potentially causing serious injury.

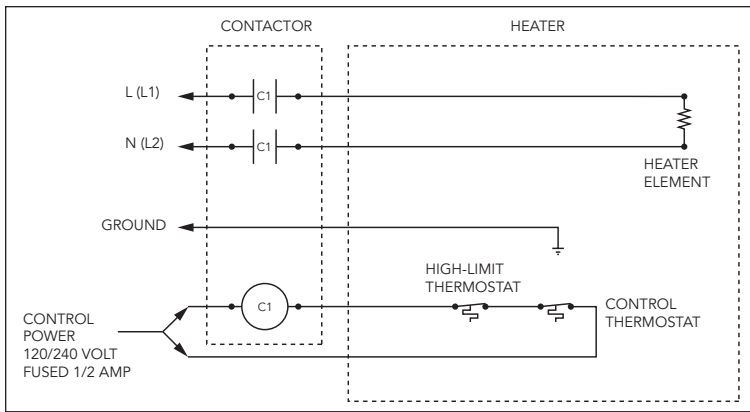
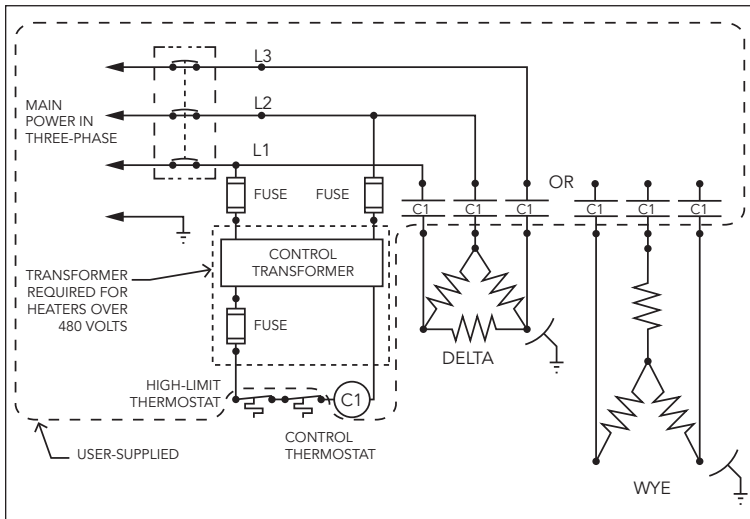


Figure 6 (above) and Figure 7 (below). Wiring schematics for three-phase heaters or single-phase heaters rated for over 480 volts. Note the contactor schematic (above) and the recommended wiring schematic (below).



## TROUBLESHOOTING

To ensure coolant is flowing, check the outlet temperature. If the coolant temperature along the return hose exceeds 180 °F (82 °C) or the heater cycles more than four times per hour, it may indicate:

- Air pockets are restricting flow. Air may collect due to loops in hose, routing hose over the top of the engine, excessive hose lengths, or kinks. Reroute hoses or change port locations.
- Heater is mounted too high. Lower heater position.
- Heater is not mounted in the proper orientation. If heater is horizontal, ensure the outlet is pointed directly upward. If vertical, ensure the outlet is at the top of the tank.
- Contaminants in the coolant are restricting flow. Flush coolant system and refill.
- Flow is restricted. To improve flow, horizontally installed heaters may be installed at an angle to raise the heater outlet above the heater inlet. **NOTICE!** All angled installations must raise the heater outlet above the inlet and position the heater outlet facing upward.

## PREVENTATIVE MAINTENANCE

Annually:

- Check and replace cracked or weakened hoses.
- Check electrical wiring for wear and excessive heat
- Remove element and clean element and tank

Every three years or 25,000 hours of operation:

- Replace control thermostat sensing unit.

## THERMOSTAT REPLACEMENT

To replace the control or high-limit thermostat: (See Fig. 8.)

1. Disconnect heater from power source. Allow heating system to cool.
2. Remove thermostat enclosure cover. For control thermostat, remove thermostat enclosure cover. For high-limit thermostat, remove element assembly cover. **NOTE:** For EE heaters, unscrew thermostat enclosure or element assembly cap.
3. Disconnect terminals from control thermostat sensing unit spade connectors.
4. Remove sensing unit (and flange assembly, if equipped). To remove high-limit thermostat, loosen or remove mounting clip. **NOTE:** For EE heaters, remove high-limit thermostat from plug.
5. Place new sensing unit and flange assembly in recessed space. For high-limit thermostats, place and tighten thermostat mounting clip to secure.
6. Reconnect electrical connections. Reattach enclosure cover.
7. Reconnect heater to power source.

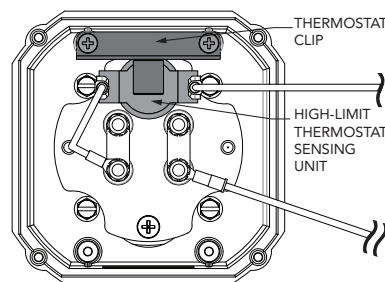
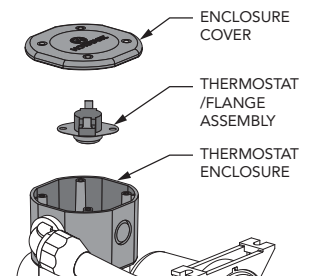


Figure 8. Replacing control (above) and high-limit (left) thermostats. For EE models, unscrew enclosure cap and remove high-limit from plug. (EE model not pictured).