Hotstart
THERMAL MANAGEMENT

Thermosiphon Heating Systems

CB · CL · WL

CB heater with thermostat shown

CL heater without thermostat shown

Hotstart's CB, CL and WL Thermosiphon heating systems are coolant preheaters developed to maintain optimal temperatures for diesel and gas engines in stationary land power, marine, construction equipment, and truck applications.

HEAVY DUTY HEATING

OEMs expect dependable heating for their engines. Hotstart's Thermosiphon Tank Heaters are the industry standard for consistent, reliable coolant heating for stationary power, equipment, marine and truck applications.

SAFE AND EASY OPERATION

Pressure die-cast aluminum tank construction means Hotstart heaters are built to last. Each unit includes a hi-limit safety thermostat rated for 205 °F (95 °C) ensuring safe operation day to day, year after year.

PRECISE HEATING CONTROL

Keeping critical fluids heated is key to easy engine starts regardless of ambient temperature. The CB, CL and WL heaters come with or without flow-through thermostats for precise heat control. The heaters can be configured with fixed or adjustable thermostats to best meet your heating needs.

EQUIPMENT MANUFACTURERS SOLUTION

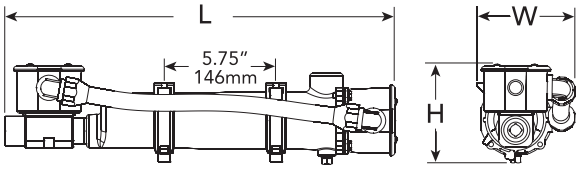
The CB, CL and WL heaters are ideal for OEM specifications requiring a wide range of heat power and phase options that can be hard wired into existing power systems.

Hotstart
THERMAL MANAGEMENT

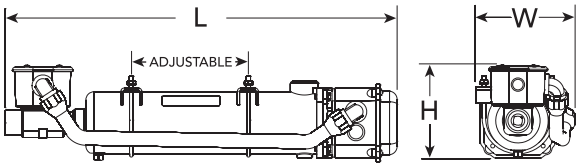
Thermosiphon Heating System

CB • CL • WL

CB Heater with thermostat shown



CL / WL Heater with thermostat shown



CB Model			
Length (L)	Width (W)	Height (H)	Weight
20.1"	5.1"	5.2"	6.9 lbs
510 mm	129 mm	132 mm	3 kg

CL / WL Models			
Length (L)	Width (B)	Height (H)	Weight
23.5"	6.2"	5.8	10 lbs
597 mm	158 mm	147 mm	4.5 kg

CB / CL System	
Phase	single-phase (1 Ø)
Voltage	120 V | 208 V | 240 V | 277 V | 380 V | 480 V
Ingress	NEMA 4
Min./Max. Ambient Temp.	-4–104 °F (-20–40 °C)
Certification	UL/C-US listed, CE-compliant

WL System	
Phase	three-phase (3 Ø)
Voltage	208 V | 240 V | 400 V | 480 V | 575 V
Ingress	NEMA 4
Min./Max. Ambient Temp.	-4–104 °F (-20–40 °C)
Certification	CE-compliant

CB / CL Coolant			
Fluid Type	Water | Coolant mix (50% water/50% glycol)		
CB Heat Power	1.5 kW	2 kW	2.5 kW
CL Heat Power	3 kW	4 kW	5 kW
Temp. Control	Fixed, 100–120 °F (38–49 °C)		
Temp. High-limit	205 °F (96 °C)		
Max. Pressure	125 psi (860 kPa)		
Inlet/Outlet	1" NPT		

WL Coolant		
Fluid Type	Water | Coolant mix (50% water/50% glycol)	
WL Heat Power	2.5 kW	4 kW | 5 kW
Temp. Control	Fixed, 100–120 °F (38–49 °C)	
Temp. High-limit	205 °F (96 °C)	
Max. Pressure	125 psi (860 kPa)	
Inlet/Outlet	1" NPT	

Temperature Range	
ON	OFF
80 °F (27 °C)	100 °F (38 °C)
100 °F (38 °C)	120 °F (49 °C)
120 °F (49 °C)	140 °F (60 °C)
Adjustable 90–130 °F (32–54 °C)	

Temperature Range	
ON	OFF
80 °F (27 °C)	100 °F (38 °C)
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Adjustable 90–130 °F (32–54 °C)	

Options shown represent typical tested or certified configurations. Additional options or configurations may be available. For assistance with your heating system application, contact Hotstart at 509.536.8660 or sales@hotstart.com.

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Thermosiphon Engine Heaters

CB Model Weathertight Single Phase

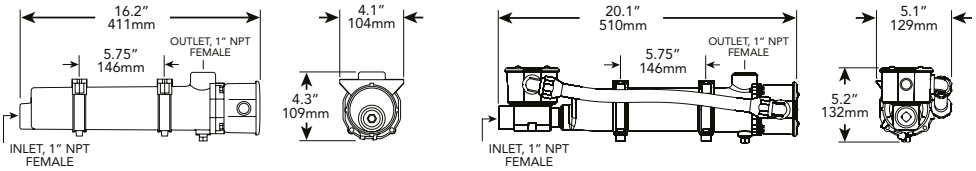
1500–2500 Watts

CB Model without thermostat

CB Model with thermostat

Engine Displacement	Model Number without Thermostat	Model Number with Thermostat see chart 1	Volts	Watts	Phase	Amps
350 – 500 CID **5.7 – 8.2 L**	CB115100-000 CB115800-000 CB115200-000 CB115400-000	CB1151XX-200 CB1158XX-200 CB1152XX-200 CB1154XX-200	120 208 240 480	1500 1500 1500 1500	1 1 1 1	12.5 7.2 6.3 3.1
500 – 600 CID **8.2 – 9.8 L**	CB120100-000 CB120800-000 CB120200-000 CB120400-000	CB1201XX-200 CB1208XX-200 CB1202XX-200 CB1204XX-200	120 208 240 480	2000 2000 2000 2000	1 1 1 1	16.7 9.6 8.3 4.2
600 – 800 CID **9.8 – 13.1 L**	CB125100-000 CB125800-000 CB125200-000 CB125700-000 CB125300-000 CB125400-000	CB1251XX-200 CB1258XX-200 CB1252XX-200 CB1257XX-200 CB1253XX-200 CB1254XX-200	120 208 240 277 380 480	2500 2500 2500 2500 2500 2500	1 1 1 1 1 1	20.8 12.0 10.4 9.0 6.6 5.2

CB Model



CL Model Weathertight Single Phase

3000–5000 Watts

CL Model without thermostat

CL Model with thermostat

Engine Displacement	Model Number without Thermostat	Model Number with Thermostat see chart 1	Volts	Watts	Phase	Amps
800 – 1000 CID **13.1 – 16.4 L**	CL130100-100 CL130800-100 CL130200-100 CL130700-100 CL130400-100	CL1301XX-200 CL1308XX-200 CL1302XX-200 CL1307XX-200 CL1304XX-200	120 208 240 277 480	3000 3000 3000 3000 3000	1 1 1 1 1	25.0 14.4 12.5 10.8 6.3
1000 – 1350 CID **16.4 – 22.1 L**	CL140800-100 CL140200-100 CL140700-100 CL140300-100 CL140400-100	CL1408XX-200 CL1402XX-200 CL1407XX-200 CL1403XX-200 CL1404XX-200	208 240 277 380 480	4000 4000 4000 4000 4000	1 1 1 1 1	19.2 16.7 14.4 10.5 8.3
1350 – 1650 CID **22.1 – 27.0 L**	CL150800-100 CL150200-100 CL150700-100 CL150300-100 CL150400-100	CL1508XX-200 CL1502XX-200 CL1507XX-200 CL1503XX-200 CL1504XX-200	208 240 277 380 480	5000 5000 5000 5000 5000	1 1 1 1 1	24.0 20.8 18.1 13.2 10.4

CL Model

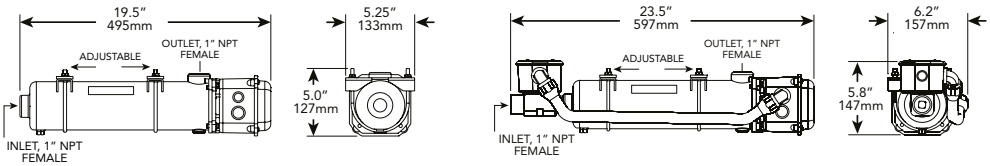


CHART 1

Heaters with Thermostats

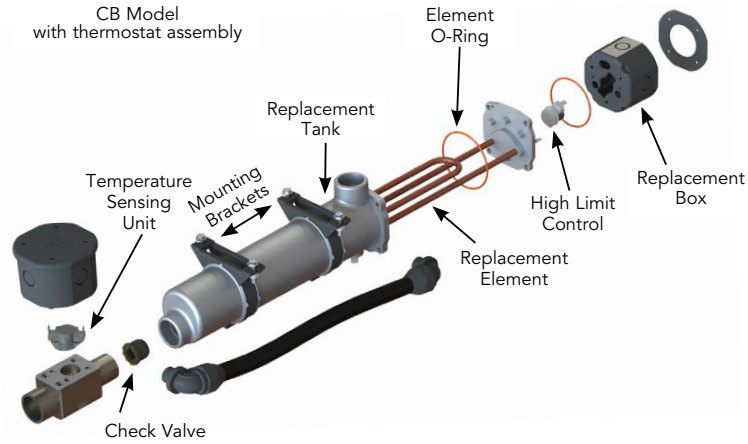
To specify temperature range of thermostat, insert numerical code from chart in place of the **XX** in model number.

Example:
Desired Temp. Range: 100° – 120°F
Model Number: CB1151**XX**-200
Order as: CB1151**10**-200

Temperature Range ON	Temperature Range OFF	Numerical Code
80°F (27°C)	100°F (38°C)	08
100°F (38°C)	120°F (49°C)	10
120°F (49°C)	140°F (60°C)	12

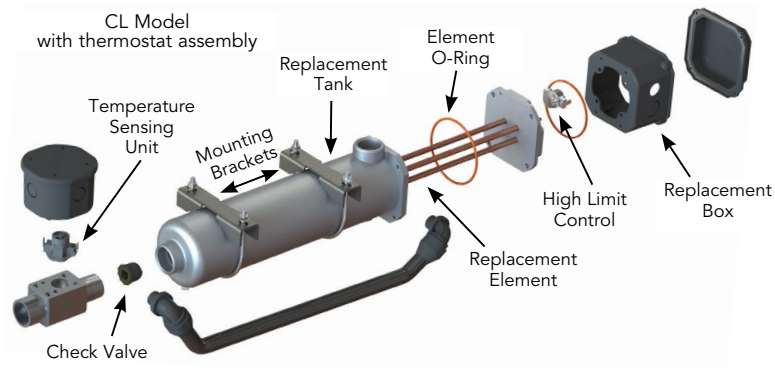
Model Number without Thermostat	Model Number with Thermostat see chart 2	Element Replacement
CB115100-000 CB115800-000 CB115200-000 CB115400-000	CB1151XX-200 CB1158XX-200 CB1152XX-200 CB1154XX-200	RECB1151 RECB1158 RECB1152 RECB1154
CB120100-000 CB120800-000 CB120200-000 CB120400-000	CB1201XX-200 CB1208XX-200 CB1202XX-200 CB1204XX-200	RECB1201 RECB1208 RECB1202 RECB1204
CB125100-000 CB125800-000 CB125200-000 CB125700-000 CB125300-000 CB125400-000	CB1251XX-200 CB1258XX-200 CB1252XX-200 CB1257XX-200 CB1253XX-200 CB1254XX-200	RECB1251 RECB1258 RECB1252 RECB1257 RECB1253 RECB1254

Common Replacement Parts available for all listed heaters	
High Limit Control	HLC-165
Check Valve	RV-M
Element O-ring	TMM-OR
Tank	RTB
Box	RTBCB
Mounting Brackets	RTMMB



Model Number without Thermostat	Model Number with Thermostat see chart 2	Element Replacement
CL130100-100 CL130800-100 CL130200-100 CL130700-100 CL130400-100	CL1301XX-200 CL1308XX-200 CL1302XX-200 CL1307XX-200 CL1304XX-200	RECL1301-100 RECL1308-100 RECL1302-100 RECL1307-100 RECL1304-100
CL140800-100 CL140200-100 CL140700-100 CL140300-100 CL140400-100	CL1408XX-200 CL1402XX-200 CL1407XX-200 CL1403XX-200 CL1404XX-200	RECL1408-100 RECL1402-100 RECL1407-100 RECL1403-100 RECL1404-100
CL150800-100 CL150200-100 CL150700-100 CL150300-100 CL150400-100	CL1508XX-200 CL1502XX-200 CL1507XX-200 CL1503XX-200 CL1504XX-200	RECL1508-100 RECL1502-100 RECL1507-100 RECL1503-100 RECL1504-100

Common Replacement Parts available for all listed heaters	
High Limit Control	HLC-165
Check Valve	RV-M
Element O-ring	TML-OR
Tank	RTL
Box	RTBCL-100
Mounting Brackets	FK7



Replacement Parts

For thermosiphon engine heaters CB/CL Models

CHART 2

Heaters with Thermostats

Temperature Range ON	Temperature Range OFF	Sensing Unit
80°F (27°C)	100°F (38°C)	FSU8
100°F (38°C)	120°F (49°C)	FSU10
120°F (49°C)	140°F (60°C)	FSU12

Example:

Model Number: CB1151**10**-200
T-Stat Replacement: FSU10

ADAPTER FITTINGS

For the use of 0.75" or 1" ID heater hose, hose barb adapters are available. See below.

HB-1	1" NPT to 1" hose barb adapter. Installs in 1" NPT female inlet or outlet of the heater.
HB-3/4	1" NPT to 0.75" hose barb adapter. Installs in 1" NPT female inlet or outlet of the heater.

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Read carefully for proper installation and operation.

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.

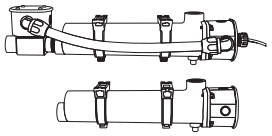
NOTICE

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.

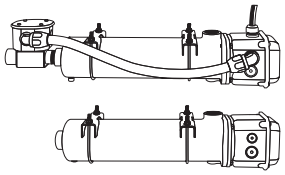
Safety devices: The high-limit thermostat (enclosed in the element assembly) is intended only to prevent hazardous temperatures. A bi-directional ball valve (installed at the tank inlet) allows a minimal amount of coolant to reverse flow when the engine is running, protecting the element from overheating. 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.

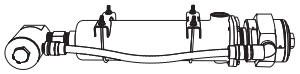
Figure 1. Typical industrial tank heater model configurations. Your model may vary.



SB model (with power cord) and CB model (conduit connection, shown without control thermostat).

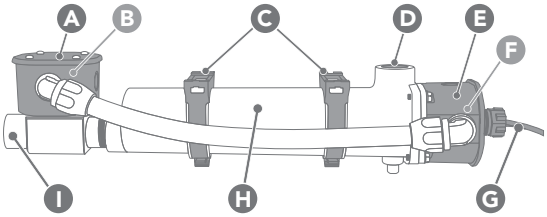


SL model (with power cord) and CL model (conduit connection, shown without control thermostat).



EE model (shown with optional control thermostat).

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



- **A.** *Thermostat enclosure*
- **B.** *Thermostat (in element assembly)*
- **C.** *Mounting brackets*
- **D.** *Outlet*
- **E.** *Element assembly*
- **F.** *High-Limit Thermostat (in element assembly)*
- **G.** *Cord*
- **H.** *Tank*
- **I.** *Inlet*

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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.

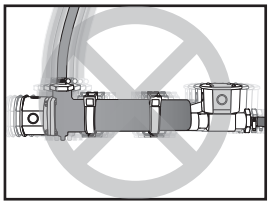
6. Select optional, user-supplied isolation valves.

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

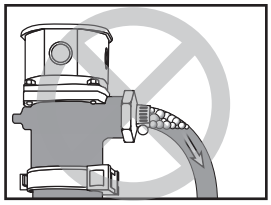
MOUNT HEATER

NOTICE

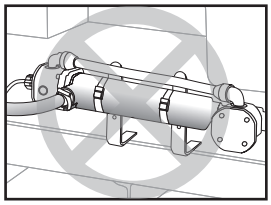
Vibration damage: Do not mount heater directly to engine. Engine vibration will damage heater. If the heater is installed with rigid pipe, connect flexible hose to inlet and outlet to isolate from vibration.



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

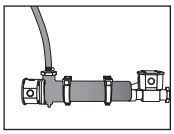


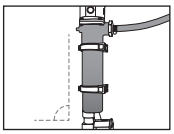
Outlet orientation: If mounting heater horizontally or at an angle, outlet must face upward. If mounting heater vertically, ensure outlet is at top of heater. Do not attempt to reverse flow through heater. An incorrectly oriented outlet may cause heater failure.

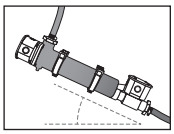


7. Select a heater mounting position directly below the return port and at least 6 inches (15 cm) below the lowest point of the engine's water jacket.

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***)*



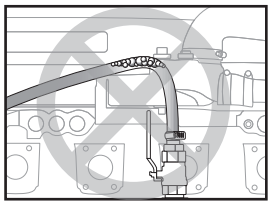




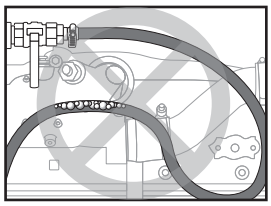
PLUMB HEATER

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.



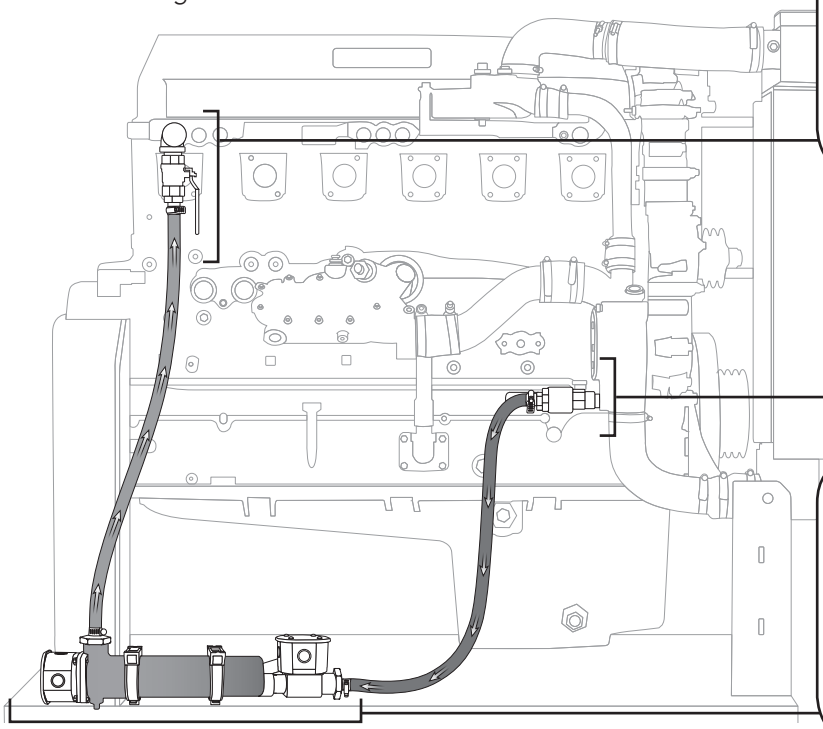
9. Install isolation valves to port fittings.

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

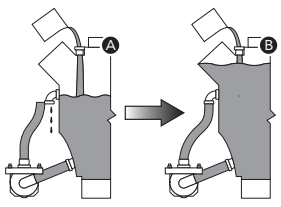
Heater damage: When mixing coolant, only use deionized or distilled water and low-silicate antifreeze. Refer to your engine's manufacturer recommendations. Do not exceed 60% antifreeze to 40% water ratio. **Never** add unmixed water and antifreeze to an engine. Do not add anti-leak or other coolant additives.

12. 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.

13. 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)**.



14. When engine has reached operating temperature, shut engine off and check for coolant leaks.

15. 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

16. 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.*

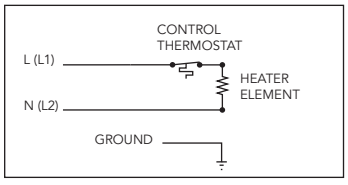


Figure 5 (left). Wiring schematic for single-phase heaters rated for up to 480 volts.

➤ 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.*

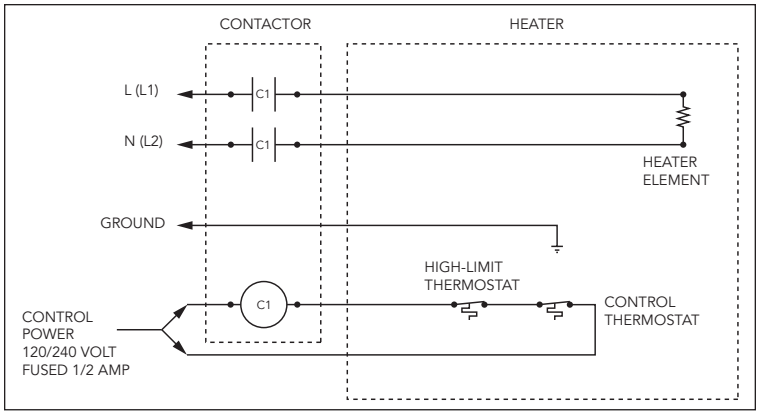
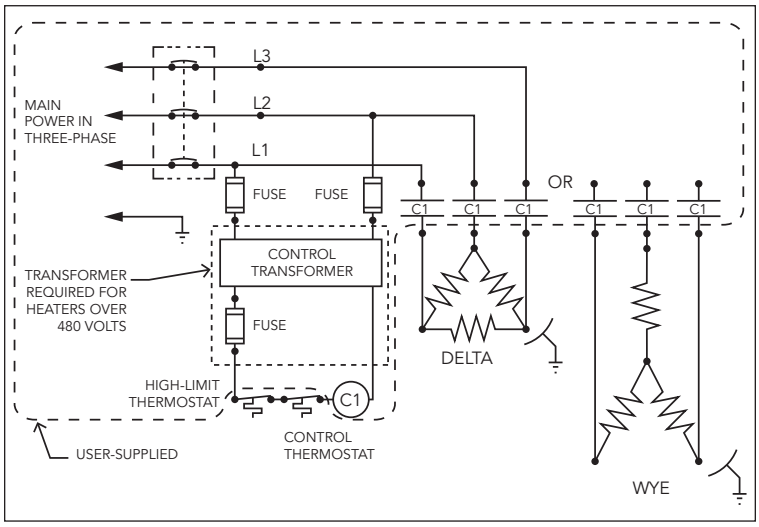


Figure 6 (above) and Figure 7 (below). Wiring schematics for three-phase heaters or single-phase heaters rated for over 480 volts. Note the contactor schematic (above) and the recommended wiring schematic (below).



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.

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.

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

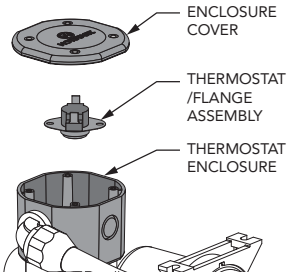
Every three years or 25,000 hours of operation:

- 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.



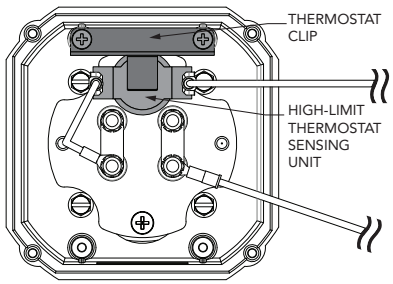


Figure 8. Replacing control (above) and high-limit (left) thermostats. For EE models, unscrew enclosure cap and remove high-limit from plug. (EE model not pictured).

HOTSTART®

INSTALLATION CHECKLIST & RECOMMENDATIONS

FOR THERMOSIPHON HEATERS

INSTALLING THE HEATING SYSTEM

BEFORE YOU INSTALL

- [ ] ⚠ Before installing the heater, is the power supply disconnected?

  Never install, service or perform maintenance on the heating system with the power supply connected.

- [ ] ⚠ Has the coolant been drained and flushed?

  After the heater is installed, you will need to refill the engine with coolant. Never operate the heater without the presence of coolant.

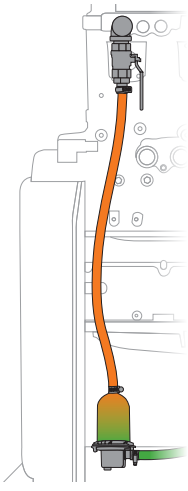
- [ ] ⚠ If isolation valves are installed, are they in the closed position?

  To make service easier, HOTSTART recommends installing full-flow ball valves to isolate the heating system. After the heater is installed, remember to open *the isolation valves. Operating the heater without the presence of coolant will cause overheating and damage the heater.*

SELECTING THE RETURN AND SUPPLY PORTS

- [ ] Is the heater **return** port toward the rear of the engine?

  A return port located toward the rear of the engine near the flywheel will ensure that heated coolant will spread evenly throughout the engine's water jacket, improving heating effectiveness.



- [ ] Is the heater **return** port as high as possible on the coolant system?

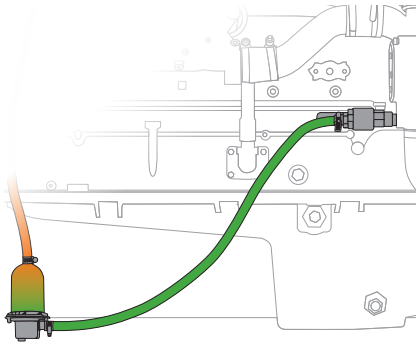
  A return port located at the highest possible point on the engine will ensure efficient engine heating.

- [ ] Is the heater **return** port away from the engine thermostat?

  If the heater return port is located close to the engine thermostat, the engine thermostat may open. Heated coolant will then be routed to the radiator, reducing heating effectiveness.

- [ ] Is the heater **supply** port toward the front of the engine?

  A heater supply port located toward the front of the engine, near the radiator, will ensure that heated coolant will spread evenly throughout the engine's water jacket.



☑ Is the heater **supply** port as low as possible on the coolant system?

A heater supply port located at the lowest possible point will ensure there is adequate coolant supplied to the heater.

☑ Are the heater **return** and **supply** ports located away from each other?

Supply and return ports that are too close together will allow heated coolant to flow through only a small portion of the engine, preventing the entire engine from being heated effectively.

SELECTING HOSE AND FITTING SIZES

☑ Do you have properly sized fittings?

The following table shows the minimum recommended port size fittings:

TPS	500–2000 watts	3/8 inch NPT
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

.

☑ Do you have the largest inside diameter hoses for your installation?

The following table shows the minimum recommended inner diameter hoses:

TPS	500–2000 watts	5/8 inch
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

☑ Do you have adequately rated hoses?

HOTSTART recommends hoses rated for a minimum of 250 °F (121 °C) and 100 psi (690 kPa).

SELECTING THE HEATER MOUNTING POSITION

☑ Is the heater mounted directly below the heater **return** port?

Positioning the heater directly below the heater return port will ensure efficient coolant flow and prevent unnecessary strain on the thermosiphon heater.

☑ Is the heater mounted at least 6 inches (15 cm) below the lowest point of the water jacket?

Positioning the heater below the lowest point of the engine's water jacket will ensure adequate coolant supply to the heater and reduce flow restriction along the return hose.

☑ Is the heater isolated from vibration?

Engine vibration will damage the heater. Ensure the heater is mounted to a vibration-isolated surface. Never mount a heater directly to the engine.

☑ Will the heater mounting location allow for shortest possible **return** and **supply** hoses?

Before mounting the heater, plan your hose routing. Unnecessarily long hoses may restrict coolant flow.

ROUTING THE HOSES

- [ ] Does the **return** hose continuously rise to the engine?

  Ensure that no point of the return hose is routed higher than the highest coolant level of the engine. Any high points along the return port hose may restrict the flow of coolant, placing unnecessary strain on the thermosiphon heater.

- [ ] Does the **supply** hose continuously descend to the heater?

  Coolant must be able to easily flow downward from the engine to the heater. To promote good flow, eliminate high or low points along the supply hose routing. Any high or low points may restrict the flow of coolant, placing unnecessary strain on the thermosiphon heater.

- [ ] Are the **return** and **supply** hoses free of dips and bends?

  Dips and bends along the hose routing may reduce the efficiency of coolant flow. To eliminate dips and bends, make your hose routing as direct as possible by using the shortest hoses necessary.

- [ ] Are the **return** and **supply** hoses free of kinks or damage?

  Kinked or damaged hoses can restrict or block the flow of coolant, reducing the efficiency of the heating system. Before refilling the system with coolant, inspect the hoses. Replace any damaged or kinked hoses.

- [ ] ⚠ If you are using isolation valves, have they been opened?

  After the heater and hoses are installed, remember to open *the isolation valves. Operating the heater without the presence of coolant can cause overheating and damage the heater.*

ADDING COOLANT TO THE ENGINE AND HEATER

- [ ] Has the coolant been prepared according to the engine manufacturer's recommendations?

  Carefully review your engine manufacturer's recommendations before adding coolant to the system. HOTSTART recommends using a 50% deionized or distilled water to 50% low-silicate antifreeze. Note that the antifreeze/water ratio should never exceed 60% antifreeze to 40% water.

- [ ] Has the coolant been mixed before adding to the engine?

  Never add unmixed antifreeze and water separately to an engine. Unmixed antifreeze will damage the heater.

- [ ] Has the coolant been mixed using deionized or distilled water?

  Never mix ordinary tap water with antifreeze. Tap water contains a high amount of impurities and will damage the heater.

- [ ] ⚠ Have you checked to ensure coolant is present before operating the heater?

  Operating the heater without coolant can cause overheating and damage the heater. If isolation valves are installed, ensure they are opened.

☑ Has the engine been run to eliminate air from the system?

After the heater is installed and coolant has been added, running the engine long enough to reach its normal operating temperature will eliminate any air remaining in the coolant system.

☑ After running the engine, have you checked the heating system for leaks?

Swipe each hose connection with a dry towel to find any leaks. If coolant leaks from the hoses or fittings, they may need to be tightened or replaced.

☑ After shutting the engine off, has the coolant level been topped off as necessary?

Shut the engine off once it has reached its normal operating temperature. After the engine has cooled, check the engine's coolant level. Additional coolant may need to be added.

COMPLETING AND EVALUATING THE INSTALLATION

☑  Have you wired the heater to a power source in accordance with local electrical codes?

Before energizing the heater, ensure that the heater is connected to a power source in accordance with national and local electrical codes. Never energize the heater while the engine is running.

☑  Have you connected the heater's power source?

It is safe to connect and energize the heater only after coolant has been run through the engine and heating system, air has been eliminated, coolant has been topped off and all potential leaks have been checked.

☑ While operating, is the **return** hose warm to the touch?

Ensure heated coolant is flowing by placing your hand on the return hose. It should be warm to the touch. If monitoring the temperature, note that the temperature of the coolant returning to the engine should not exceed 180 °F (82 °C).

☑ Does the heater's thermostat cycle on and off four or fewer times in one hour?

A heater's thermostat that cycles more than four times in one hour may indicate a problem with the heater installation or coolant flow. Review this installation checklist or your heater's installation instructions.

FOR MORE INFORMATION

For additional assistance, view the HOTSTART Engine Heater Installation and Troubleshooting videos at www.hotstart.com/home/resources/videos.

Hotstart
THERMAL MANAGEMENT

INSTALLATION BEST PRACTICES
for Thermosiphon Heaters

Return Port

- ☑ 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 engine thermostat.
- ☑ Select a return port away from the remote thermostat.

  If an optional remote thermostat is installed.

- ☑ Select a return port away from the supply port.

Hoses & Ports

☑ Select proper port fittings:

TPS	500 – 2000 W	3/8 inch NPT
CB/CL/SB/SL	500 – 3000 W	1/2 inch NPT
CB/CL/SB/SL	3750 – 5000 W	3/4 inch NPT
WL/EE	1500 – 5000 W	3/4 inch NPT

☑ Select proper hose inner diameter sizes:

TPS	500 – 2000 W	5/8 inch
CB/CL/SB/SL	500 – 3000 W	3/4 inch
CB/CL/SB/SL	3750 – 5000 W	1 inch
WL/EE	1500 – 5000 W	1 inch

Heater Mounting

- ☑ Mount the heater in the proper orientation.
- ☑ 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.

Supply Port

- ☑ Select a supply port low on the engine.
- ☑ Select a supply port toward the front of the engine.

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

- ☑ Select a supply port away from the return port.

For additional assistance, view the HOTSTART Engine Heater Installation and Troubleshooting videos at www.hotstart.com/resources-and-tools/support/videos.

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Hotstart
THERMAL MANAGEMENT

INSTALLATION PROBLEMS & HAZARDS
for Thermosiphon Heaters

Return Port

- ☒ **Return port is installed toward the front of the engine.**
  A return port too close to the front of the engine will reduce heating effectiveness.
- ☒ **Return port is too close to the engine thermostat.**
  A return port installed too close to the engine thermostat can cause heated coolant to flow to the radiator, reducing heating effectiveness.
- ☒ **Return port is too close to the supply port.**
  A return port too close to the supply port will cause heated coolant to only flow through a small portion of the engine.

Heater Mounting

- ☒ **Heater is mounted sideways.**
  An incorrectly oriented heater will reduce coolant flow and heating effectiveness.
- ☒ **Heater is mounted directly to the engine.**
  Engine vibration will damage the heater.
- ☒ **Heater is not mounted directly below the return port.**
  An incorrectly positioned heater will not allow the return hose to continuously rise to the engine.
- ☒ **Heater is not mounted at least 6 inches (15 cm) below the water jacket.**
  A heater mounted too high will restrict coolant flow and reduce heating effectiveness.

Hoses & Ports

- ☒ **Return hose is kinked or damaged.**
  Kinked or damaged hoses will reduce coolant flow.
- ☒ **Return hose does not continually rise to the port.**
  A return hose that does not continuously rise may create high points, restricting coolant flow.
- ☒ **Supply hose is unnecessarily long.**
  Unnecessarily long hoses may create dips and bends, collecting bubbles and restricting coolant flow.

Supply Port

- ☒ **Supply port is too high on the engine.**
  A supply port mounted too high will reduce heating efficiency.
- ☒ **Supply port is installed toward the rear of the engine.**
  A supply port mounted too close to the rear of the engine will reduce heating effectiveness.
- ☒ **Supply port isolation valve is closed.**
  Operating the heater without the presence of coolant will cause overheating and damage the heater.

For additional assistance, view the HOTSTART Engine Heater Installation and Troubleshooting videos at www.hotstart.com/resources-and-tools/support/videos.