



HOTSTART®

**Oil and Coolant Circulating
Heating System**

Model - OCSM

Installation & Operation Manual

Identifying Your System

The HOTSTART heating system is designed to heat fluids for use in marine propulsion, diesel-powered generator sets, locomotives, gas compression, or any engine applications. The system is pre-wired, pre-plumbed, and assembled on a steel plate. Each heating system has an identification plate which includes the part number and date code.

Warranty information can be found at www.hotstart.com or by contacting our customer service department. Have your model and date code ready when contacting the warranty department.



NOTE: When ordering replacement parts, be sure to reference your heating system's Model and Date Code found on the identification plate and the label above.

HOTSTART. 	SPOKANE, WA U.S.A.	REF. SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS
MODEL _____		
VOLTS _____ HERTZ _____		
AMPS. _____ PHASE _____		
CONTROL CIRCUIT VOLTS _____		
CONTROL CIRCUIT AMPS. _____ MAX		
SERIAL NUMBER _____		U.S. PATENTS 4,245,593, 4,249,491 CAN. PATENTS 1,087,473, 1,082,541
CAUTION OPEN CIRCUITS BEFORE WORKING ON THIS EQUIPMENT OR REMOVING COVERS. KEEP COVERS TIGHTLY CLOSED WHILE CIRCUITS ARE ALIVE.		

Typical label – actual label may vary slightly from model to model, but the general layout is the same.

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Important Safety Information

⚠ WARNING



Hazardous Voltage: Before wiring, servicing or cleaning the system, turn off the power and install a lockout on the heater circuits at the service panel. Failure to do so could allow others to turn on power unexpectedly, resulting in fatal electrical shock.

All wiring shall be done by qualified personnel in accordance with national, state and local codes. Failure to properly ground the system may result in electric shock. Operation of the system during engine operation may cause damage to the heater.

⚠ CAUTION

Please read carefully: The safety of any system incorporating this heater is the responsibility of the assembler. The safe and proper use of this heater is dependent upon the installer following sound engineering practices. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. All applicable electrical safety standards defined by local jurisdictions must be followed. (reference EU directive 2006/95/EC in EU countries)

The heater must be connected to a suitable ground (protective earthing conductor).

The power supply must be protected by a suitable overcurrent limiting device.

The means of disconnection from the power supply is required. HOTSTART recommends a power switch or circuit breaker be located near the heater for the safety and ease of use.

Installers and operators of this equipment must be thoroughly familiar with the instructions in this manual before commencing work.

Use proper lifting equipment and rigging to move this equipment. Create a plan before attempting to move. Proper lifting locations are identified with labels on each system, please use these locations when lifting and mounting the system.

Hot surfaces: avoid contact with the system while it is in service – some surfaces may stay hot even if the system is not energized.

Rotating equipment: system can start automatically and without warning – avoid contact unless a lockout at the service panel has been installed.

NOTICE

EU Countries Only: Equipment rated for the conditions listed in EN 61010-1 1.4.1 Ingress protection rating IP44. (Special conditions for specific applications may apply)

Table of Contents

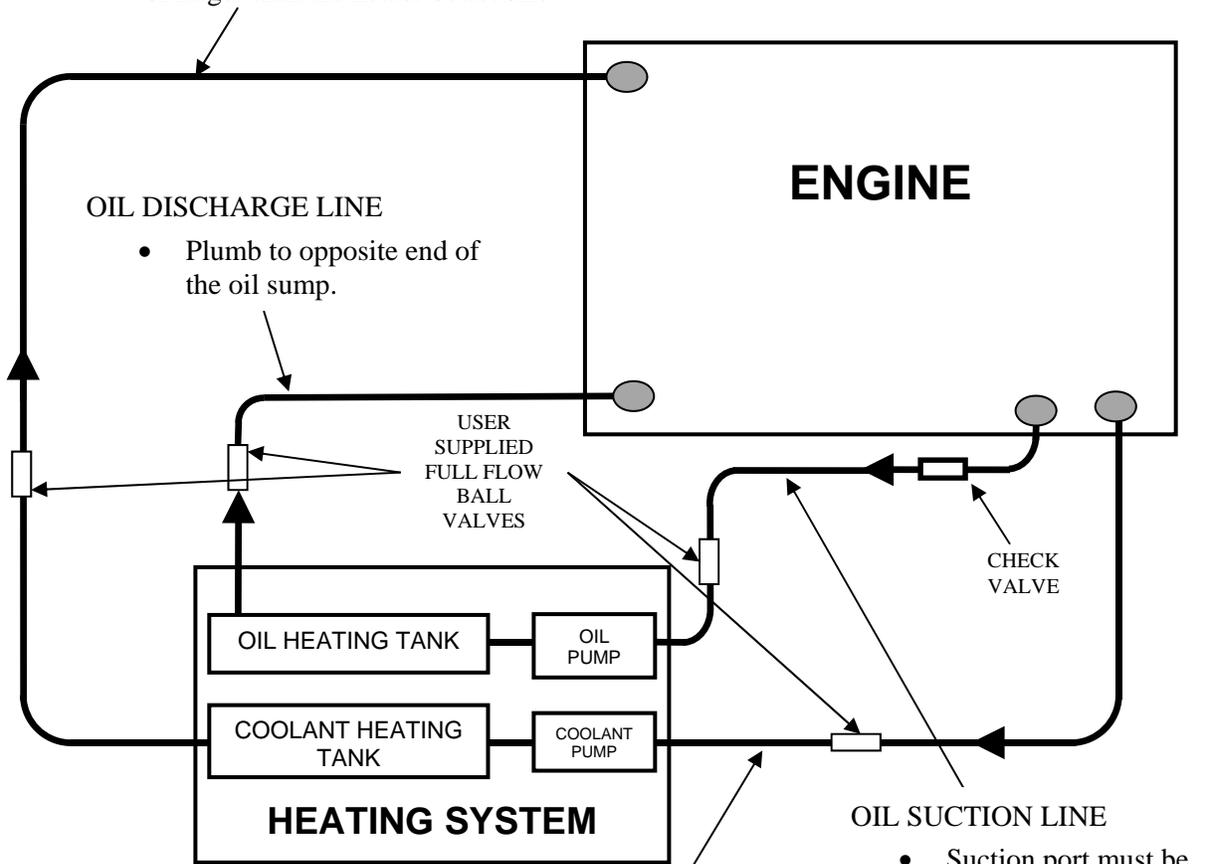
1	Installation.....	3
1.1	Oil/Coolant Plumbing Diagram	3
1.2	Mounting.....	4
1.3	Suction Line Requirements	4
1.4	Discharge Line	4
1.5	Main Power Supply.....	4
1.6	Customer Interface Connections	5
2	Heating System Start-Up.....	6
3	Overview of Operations	7
3.1	Coolant Overview	7
3.2	Oil Overview.....	7
4	Maintenance, Repair, and Troubleshooting	8
4.1	Periodic Maintenance.....	8
4.2	System Maintenance	8
4.2.1	Plumbing Connections	8
4.2.2	Magnetic Contactors	8
4.2.3	Pump Seal	9
4.2.4	Heating Element Replacement.....	9
4.3	Troubleshooting	10

1 Installation

1.1 Oil/Coolant Plumbing Diagram

COOLANT DISCHARGE LINE

- Plumb to the highest possible entrance of the water jacket at the opposite end of the engine.
- Outlet hose ID should be the same size or larger than the heater outlet size.



OIL DISCHARGE LINE

- Plumb to opposite end of the oil sump.

ENGINE

USER
SUPPLIED
FULL FLOW
BALL
VALVES

CHECK
VALVE

HEATING SYSTEM

OIL SUCTION LINE

- Suction port must be immersed at all times.
- Keep suction port off bottom of oil pan.
- Suction line ID should be the same size or larger than the pump inlet size.
- Avoid elbows whenever possible.
- Do not reduce the inlet line. Pump seal damage will occur.

COOLANT SUCTION LINE

- Plumb to the lowest possible water jacket port, preferably the main engine drains.
- Suction line ID should be the same size or larger than the pump inlet size.
- Avoid elbows whenever possible.
- Do not reduce the inlet line. Pump seal damage will occur.

1.2 Mounting

System should be as close to the suction port as possible. It is recommended to mount at or below the oil/coolant level to insure a flooded suction. The system should not be mounted directly to the engine, as vibration can cause failures. Isolate when vibration is present. Heating system should be mounted with the base plate in the vertical position such that the outlet of the heating chamber is pointing up. Clearance is required for heating element removal.

CAUTION

Lifting hazard: Proper rigging and safety equipment must be used to move this equipment.

1.3 Suction Line Requirements

Suction plumbing should be at least the size of the port entering the pump. If the connection to the equipment is smaller than this port size, immediately increase it size to reduce pressure losses in plumbing. A check valve should be used at the oil suction port on the equipment if it is mounted above the level of the oil in order to maintain prime in the pump.

NOTICE

Seal leaks will occur if suction plumbing is not adequately sized for the pump.

1.4 Discharge Line

Size the discharge line per the outlet of the heating system. The heated oil must be returned to the opposite end of the oil sump to ensure even heating. The heated coolant must be returned to the highest point possible in the engine water jacket.

NOTICE

Do not reduce the inlet line. Pump seal damage will occur.

Position the heating tank so that it is completely full of oil/coolant while in operation.

Fill the suction line with oil/coolant. Pump is **not** self-priming. Liquid must be present in the pump before start-up. Trapped air inside the pump will cause pump and seal damage.

After completing oil/coolant line installation, top-off the oil/coolant levels to compensate for the oil/coolant used to fill the lines and heating tank. The system should be configured with user supplied full port ball valves in the oil/coolant lines, allowing maintenance on the heating system without draining the engine oil/coolant.

CAUTION

Pressure and steam hazard: This product generates heat during operation. Operation of heating system with closed isolation valves could result in high pressure and serious injury. It is the responsibility of the installer and operator to ensure that no unsafe condition can result from the generation of pressure. In EU countries, PED (97/23/EC) compliant pressure relief may be required (125psi maximum)

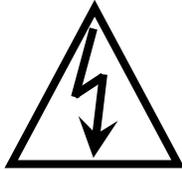
1.5 Main Power Supply

Connect the specified power from the customer supplied circuit breaker to the terminal blocks located in the main control box. For three phase applications, the terminal blocks are labeled L1, L2, and L3. For single phase applications, use the terminal blocks labeled L1 and L3 or L and N. The circuit breaker must be near the heating system and easily accessible.

The main power ground wire must be connected to the ground lug or ground block on the electrical panel located inside the electrical box.

The main power supply operates the heating elements and the circulating pumps. A transformer is used to operate the control circuit. The transformer and control circuits are overload protected with fuses and/or a circuit breaker.

WARNING



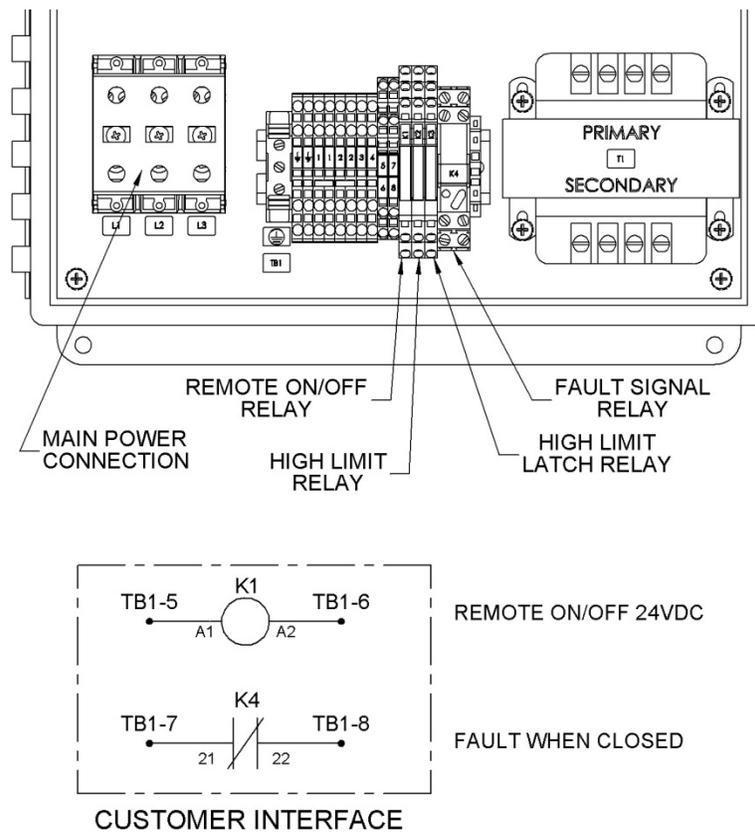
Hazardous Voltage: Before wiring, servicing or cleaning the system, turn off the power and install a lockout on the heater circuits at the service panel. Failure to do so could allow others to turn on power unexpectedly, resulting in fatal electrical shock.

All wiring shall be done by qualified personnel in accordance with national, state and local codes. Failure to properly ground the system may result in electric shock. Operation of the system during engine operation may cause damage to the heater.

1.6 Customer Interface Connections

Reference electrical schematic and control box drawing for proper wiring locations. Shown below are typical customer interface locations.

The Fault signal indicates a fault. The 24 VDC connections are for remote control of the heater is ON. Typical wiring on 24VDC remote control relay is N/C, to switch the remote control relay to N/O move the wire from K1:12 to K1:14.



Typical Customer Interface: see included drawings and wiring diagram for specific system locations.

2 Heating System Start-Up

Step 1 Check and tighten all electrical and plumbing connections.

Step 2 Ensure isolation valves are open before energizing the system.

Step 3 **Check for proper rotation of the motor** by pressing the prime button while watching the motor shaft or fan. Single phase systems are pre-wired to rotate in the correct direction. On a three phase system, if the pump is not rotating in the correct direction, switch any two electrical leads at the main power terminal block.

NOTICE

DO NOT RUN MOTOR/PUMP ASSEMBLY DRY FOR MORE THAN A FEW SECONDS.

Running a pump that is not completely filled with liquid will cause damage to the pump seal.

Step 4 Bleed all trapped air from the heating system by opening a plug or pipe fitting at or near the pump. Press and hold the prime button to evacuate any remaining air in the lines.

Step 5 Energize the heating system by switching the control switch to the ON position.

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Step 6 Verify that when the engine starts, that the heater ceases operation. This verifies the 24V DC remote operation of the system.

3 Overview of Operations

3.1 Coolant Overview

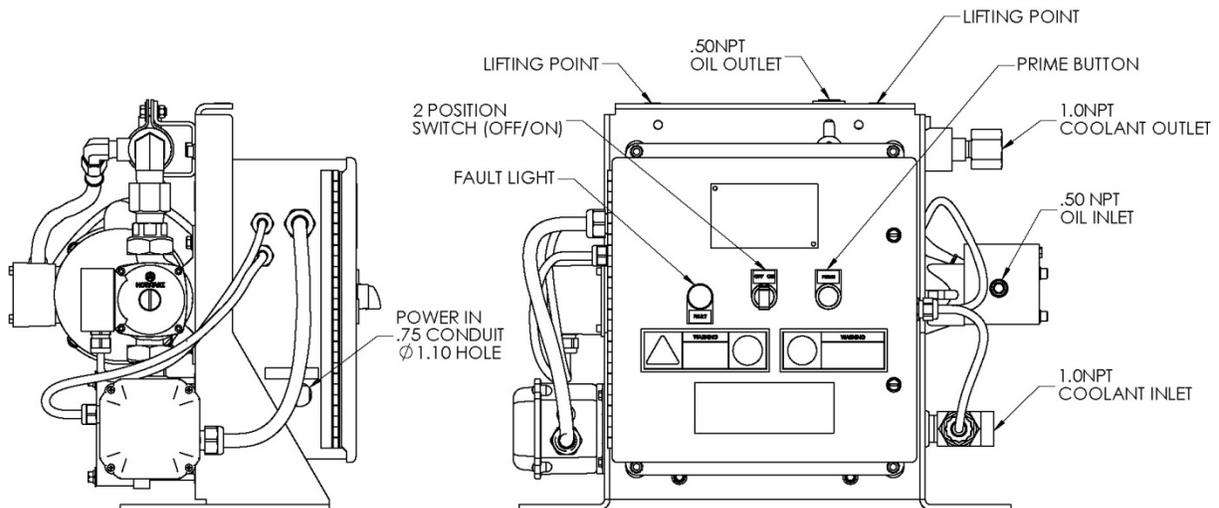
The heating system is designed to automatically start following engine shut-down if the switch is on. There is a 24 VDC relay in the system that receives a signal from the engine or equipment control to start and stop the heater. Upon heater start-up, the pump motor runs continuously and the heating element cycles on and off to maintain the set temperature of the heater. The heater acts as an after-cooler as it circulates coolant after an engine shutdown. When the engine has cooled to the set temperature minus the hysteresis, the heating element turns on and raises the temperature to the set temperature, and continues the cycle.

If there is a failure in the system that causes a high temperature to occur, the high temperature controller shuts down the entire heating system, including the pump motor. To restart the system, the power switch or the 24 VDC start/stop signal has to be cycled off and back on.

3.2 Oil Overview

When the system is energized, a positive displacement rotary gear pump takes oil from the engine sump and forces it through the heat exchanger and into the return line back to the sump.

A failure in the oil motor that causes the motor protective switch to trip only stops oil heating. The coolant heater will continue to heat the engine. In this circumstance, the user must press the motor protective switch start button to reset the fault.



4 Maintenance, Repair, and Troubleshooting

4.1 Periodic Maintenance

Yearly:

- Drain, clean, and flush heating system
- Check for cracked and/or weakened hoses and replace if necessary
- Tighten and check electrical wiring and connections for wear and excessive heat
- Check mounting bolts and tighten if necessary
- Remove element and clean element and tank

Every 3 years or 25,000 hours of operation:

- Replace control thermostat
- Replace heating element contactor



High Temperature: The thermostat and contactor used in this system are critical components to prevent excessive temperatures that could lead to an unsafe condition. Regular inspection and replacement of these components is required to ensure continued safe operation. This is the responsibility of the maintenance personnel.

4.2 System Maintenance

Instructions for the following maintenance procedures are provided to ensure trouble-free operation of your heating system. Replacement parts must meet or exceed original part requirements in order to maintain the compliance level of the original heater.

- Plumbing Connections
- Magnetic Contactors
- Pump Seal
- Heating Tanks/Elements

After maintenance is performed, refer to the start-up section of this manual.



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4.2.1 Plumbing Connections

Periodically check plumbing connections for leaks and, if necessary, tighten connections. A loose connection on the suction side will cause a loss of flow and cavitation in the pump. It can also pull air into the heating tank and cause an element failure.

4.2.2 Magnetic Contactors

Magnetic contactors are used as voltage switching controls for motors and heating elements in HOTSTART Heating Systems. The contactors use 120 or 240 V coils. To test for failure, check for continuity across the coil connections; an open or direct-short reading indicates a failed contactor coil.

The contactor contacts should be inspected periodically for welding, arc erosion, and mechanical wear. If any of these conditions exist, replace the contactor.

4.2.3 Pump Seal

Leakage can occur at any time throughout the life of the seal. Always replace the seal at the first sign of leakage. If the heating system is installed on an engine that is used for a critical application, replace the seal annually. Instructions to replace the seal are included with the new seal.

4.2.4 Heating Element Replacement

To replace the heating element or perform routine maintenance, observe the following procedure. The wattage and phase of the heating element are listed on the identification label.



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- Step 1** Turn the heating system OFF, close isolation valves, and lock out at the service panel.
- Step 2** Drain the fluid from the heating tank.
- Step 3** Remove the cap from the heating element service entrance enclosure.
- Step 4** Note the termination points for the wires before removing.
- Step 5** Remove wires from their terminations.
- Step 5** Remove the electrical wires from the heating element.
- Step 6** Remove the 4 screws securing the element in place and remove the assembly.
- Step 7** Replace the heating element or perform the necessary cleaning procedure. Ensure the o-ring is in place before reassembly.

4.3 Troubleshooting

Faults indicated by the system only occur from an overheating condition or a tripped motor protective switch.

Symptom	Possible Causes	Solution
Indicated System Fault	Pump not primed properly	Bleed all trapped air from lines, restart system
	Isolation valves may be closed	Open valves, restart system
	Hose kinked or crushed	Remove obstruction, restart system
	Leak in suction line	Repair leak, restart system
	Pump motor turning backwards	Reverse any two leads on power in (3 phase systems), restart system
	Control thermostat failed closed	Check and replace if needed, restart system
	Motor/pump failure	Check and replace if needed, restart system
	Motor contactor failure	Check contacts and coil replace if needed, restart system
	Motor protective switch tripped	Check and reset, if problem happens again check motor, restart system
Low Temperature	Motor/pump failure	Check and replace if needed
	Control thermostat failed open	Check and replace if needed
	Heater has been turned off, fluid is cold	Allow time for heater to heat fluid
	Heating element failed	Check elements for continuity and replace if needed
	System fuses failed or Breaker Tripped	Check all element fuses for continuity and replace as necessary or reset breaker
	Element contactor failed	Check contacts and coil replace if needed
	Motor contactor failed	Check contacts and coil replace if needed