THERMAL CARE

Installation, Operation and Maintenance Manual

RO Series

Oil Temperature Control Units
1½ amd 2 hp

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Foreword

The intent of this manual is to serve as a guide for placing our oil mold temperature control unit in service and operating and maintaining it properly. Improper installation can lead to poor equipment performance or severe equipment damage. Failure to follow the instructions may reesult in damage not covered by your warranty. It is extremely important that a qualified technician perform the installation. Please supply these instructions to your installer. This manual is for our standard product line with supplements as required to accommodate any special items provided for a specific application. Unit specific drawings are included with the equipment for troubleshooting and servicing of the unit. Additional copies of drawings are available upon request. We strive to maintain an accurate record of all equipment during the course of its useful life.

Due to the ever-changing nature of applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment we do not reference them in this manual. There is no substitute for common sense and good operating practices when placing any mechanical equipment into operation. We encourage all personnel to familiarize themselves with this manual's contents. Failure to do so may unnecessarily prolong equipment down time.

Follow good piping practices and the information in this manual to ensure successful installation and operation of this equipment. We are not responsible for liabilities created by substandard piping methods and installation practices external to the chiller.

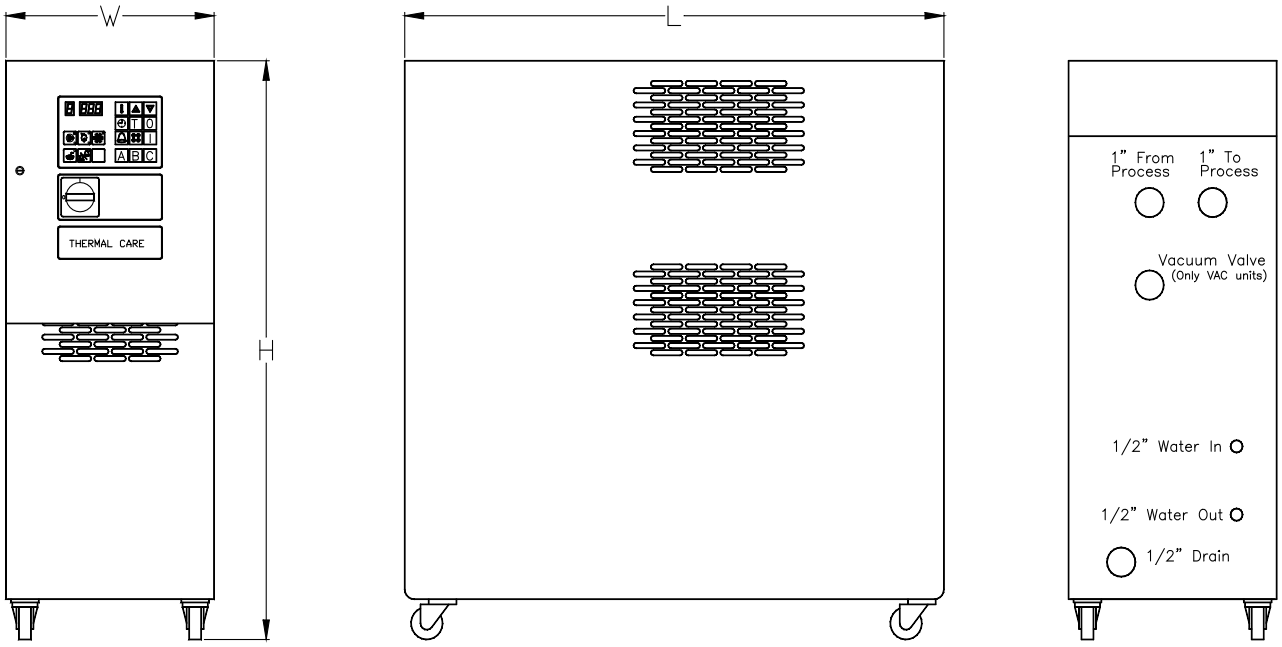
We trust your equipment will have a long and useful life. If you should have any questions, please contact our Customer Service Department specifying the serial number and model number of the unit as indicated on the nameplate.

General Data

Table 1 – RO Series Genral Data (60 Hz)

Model	Pump (HP)	Heater (KW)	Pump		Max Vacuum (PSI)	Oil Reservoir Size		FLA Amps 460V/3/60	Dimensions L x W x H (Inches)	Ship Weight (Lbs.)
			gpm	psi		Holding (Gal)	Expansion (Gal)			
RO0615	1½	6	14	32	Na	3.5	4	10	34 x 13 x 31	275
RO0615V	1½	6	14	32	-13	3.5	4	10	34 x 13 x 31	275
RO1220	2	12	14	44	Na	7	4	19	34 x 13 x 35	290
RO1220V	2	12	14	44	-13	7	4	19	34 x 13 x 35	290
RO1820	2	18	14	44	Na	13	6	26	34 x 20 x 36	300
RO1820V	2	18	14	44	-13	13	6	26	34 x 20 x 36	300
RO2420	2	24	14	44	Na	13	6	34	34 x 20 x 36	305
RO2420V	2	24	14	44	-13	13	6	34	34 x 20 x 36	305
RO3620	2	36	14	44	Na	13	6	49	34 x 20 x 39	325
RO3620V	2	36	14	44	-13	13	6	49	34 x 20 x 39	325

Figure 1 – Unit Drawing



Safety Guidelines

Observe all safety precautions during installation, start-up, and service of this equipment due to the presence of high voltage and refrigerant charge. Only qualified personnel should install, start-up, and service this equipment.

When working on this equipment, observe precautions in literature, and on tags, stickers, and labels located on the equipment. Wear work gloves and safety glasses.

WARNING: This equipment contains hazardous voltages that can cause severe injury or death. Disconnect and lock out incoming power before installing or servicing the equipment.

Pre-Installation

Receiving Inspection

When the unit arrives, verify it is the correct unit by comparing the information that appears on the unit nameplate with that which appears on the order acknowledgement and shipping papers. Inspect the equipment condition for any visible damage and verify all items shown on the bill of lading are present. If damage is evident, properly document it on the delivery receipt and clearly mark any item with damage as “unit damage” and notify the carrier. In addition, make note of the specific damage and notify our Customer Service Department and they will provide assistance in preparation and filing of your claims, including arranging for an estimate and quotation on repairs; however, filing the claim is the responsibility of the receiving party. Do not install damaged equipment without getting the equipment repaired.

Shipping damage is the responsibility of the carrier. To protect against possible loss due to damage incurred during shipping and to expedite payment for damages, it is important to follow proper procedures and keep records. Photographs of damaged equipment are excellent documentation for your records.

Start unpacking the unit, inspect for concealed damages, and take photos of any damages found. Once received, equipment owners have the responsibility to provide reasonable evidence that the damage did not occur after delivery. Photographs of the equipment damage while the equipment is still partially packed will help in this regard. Check for broken lines, damaged controls, or any other major component torn loose from its mounting point.

Record any signs of concealed damage and file a shipping damage claim immediately with the shipping company. Most carriers require concealed damages be reported within 15 days of receipt of the equipment. In addition to notifying the carrier, notify our Customer Service Department and they will provide assistance in preparation and filing of your claims, including arranging for an estimate and quotation on repairs; however, filing the claim is the responsibility of the receiving party.

Unit Storage
If the unit is stored prior to installation, it is important to protect it from damage. Blow out any water from the heat exchanger to protect the unit from damage from freezing. Cover the equipment to keep dirt and debris from accumulating on it. Units should not be stored in areas warmer than 145°F.

Installation

Unit Location
Locate the unit in an area where the temperature is between 40°F and 120°F. In all cases install the equipment on a rigid surface suitable to support the full operating weight of the unit. Level all equipment to ensure proper operation.

Serviceability was an important factor in the design of our equipment. Do not compromise this feature by locating the unit in an inaccessible area. When locating the unit it is important to consider accessibility to the components to allow for proper maintenance and servicing of the unit. In general, whenever possible allow a minimum of 36 inches of clearance around all sides and above the unit. Avoid locating piping or conduit over the unit. This ensures easy access with an overhead crane or lift to lift out heavier components when they are replaced or serviced.

Proper ventilation is another important consideration when locating the unit. Locate the unit in an area that will not rise above 120°F.

Rigging
The unit has a base frame on casters that has been designed to allow the unit to facilitate easy movement and positioning. Follow proper rigging methods to prevent damage to components. Avoid impact loading caused by sudden jerking when lifting or lowering the unit. Use pads where abrasive surface contact is anticipated.

Cooling Water and Oil Line Connection
Most cooling water sources will operate with a supply temperature above the dew point of the air in which the unit will operation. If cooler water is used, such as 50°F chilled water, proper insulation of chilled water piping is crucial to prevent condensation. The formation of condensation on chiller water piping, the state change of the water from gas to liquid, adds a substantial heat load to the system and becomes an additional burden for the chiller.

The oil circuit has the potential to operate up to 575°F with oil pressures of 80 psi. May sure all oil lines are designed to safely operate at these temperatures.

Note: Do not use brass, bronze, or copper (yellow) metals for oil line plumbing as they tend to promote oxidation of the oil which will cause a signification reduction of the oil

The importance of properly sized piping to and from the unit cannot be overemphasized. See the ASHRAE Handbook or other suitable design guide for proper pipe sizing. In general, run full size piping to and from the unit then reduce the pipe size to match the connections on the process equipment and cooling source as needed. One of the most common causes of unsatisfactory performance is poor piping

system design. Avoid long lengths of hoses, quick disconnect fittings, and manifolds wherever possible as they offer high resistance to fluid flow. When manifolds are required, install them as close to the use point as possible. If the unit is cooling multiple molds, provide flow-balancing valves at each machine to assure adequate oil distribution in the entire system.

Figure 2 – RO Series Pump Curves

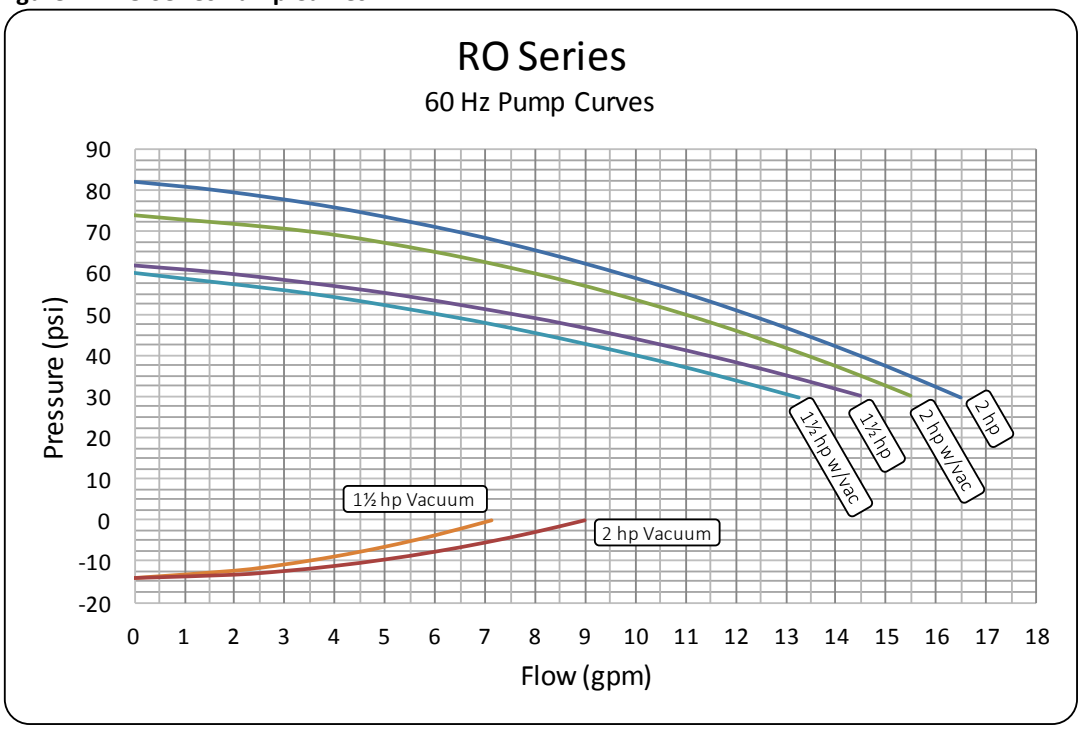
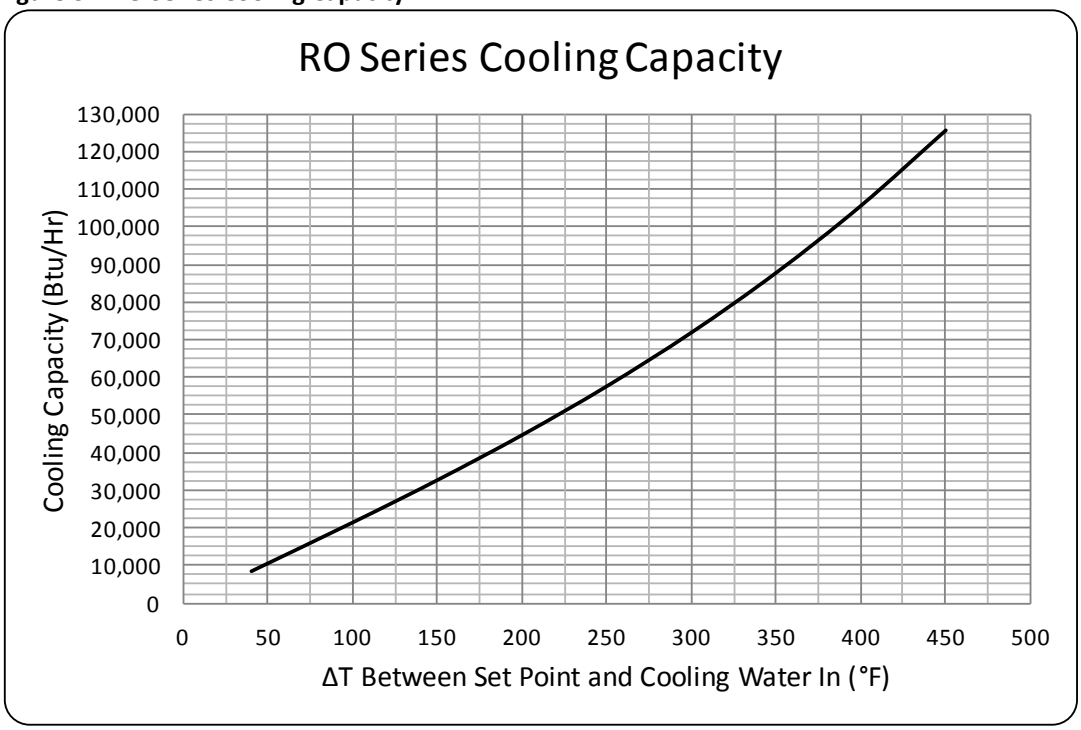


Figure 3 – RO Series Cooling Capacity



Installation - Electrical

All wiring must comply with local codes and the National Electric Code. Minimum Circuit Ampacity (MCA) and other unit electrical data are on the unit nameplate. A unit specific electrical schematic ships with the unit. Measure each leg of the main power supply voltage at the main power source. Voltage must be within the voltage utilization range given on the drawings included with the unit. If the measured voltage on any leg is not within the specified range, notify the supplier and correct before operating the unit. Voltage imbalance must not exceed two percent. Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. Voltage imbalance is determined using the following calculations:

%Imbalance = (Vavg – Vx) x 100 / Vavg
Vavg = (V1 + V2 + V3) / 3
Vx = phase with greatest difference from Vavg

For example, if the three measured voltages were 442, 460, and 454 volts, the average would be:
(442 + 460 + 454) / 3 = 452

The percentage of imbalance is then:
(452 – 442) x 100 / 452 = 2.2 %

This exceeds the maximum allowable of 2%.

There is a disconnect for main power connection to the main power source. There is a separate lug in the main control panel for grounding the unit. Check the electrical phase sequence at installation and prior to start-up. Check the phasing with a phase sequence meter prior to applying power. The proper sequence should read “ABC” on the meter. If the meter reads “CBA”, open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). Do not interchange any load leads that are from the unit contactors or the motor terminals.

Table 2 - Voltage Utilization Range

Rated Voltage	Utilization Range
230	208 to 254
460	414 to 506
575	516 to 633

WARNING: To prevent equipment damage due to reverse rotation, connect L1-L2-L3 in the A-B-C phase sequence.

WARNING: Connecting an appropriate power source to the main terminal block energizes the entire electric circuitry of the chiller. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance. Ground the unit properly in compliance with local and national codes.

Controller Operation

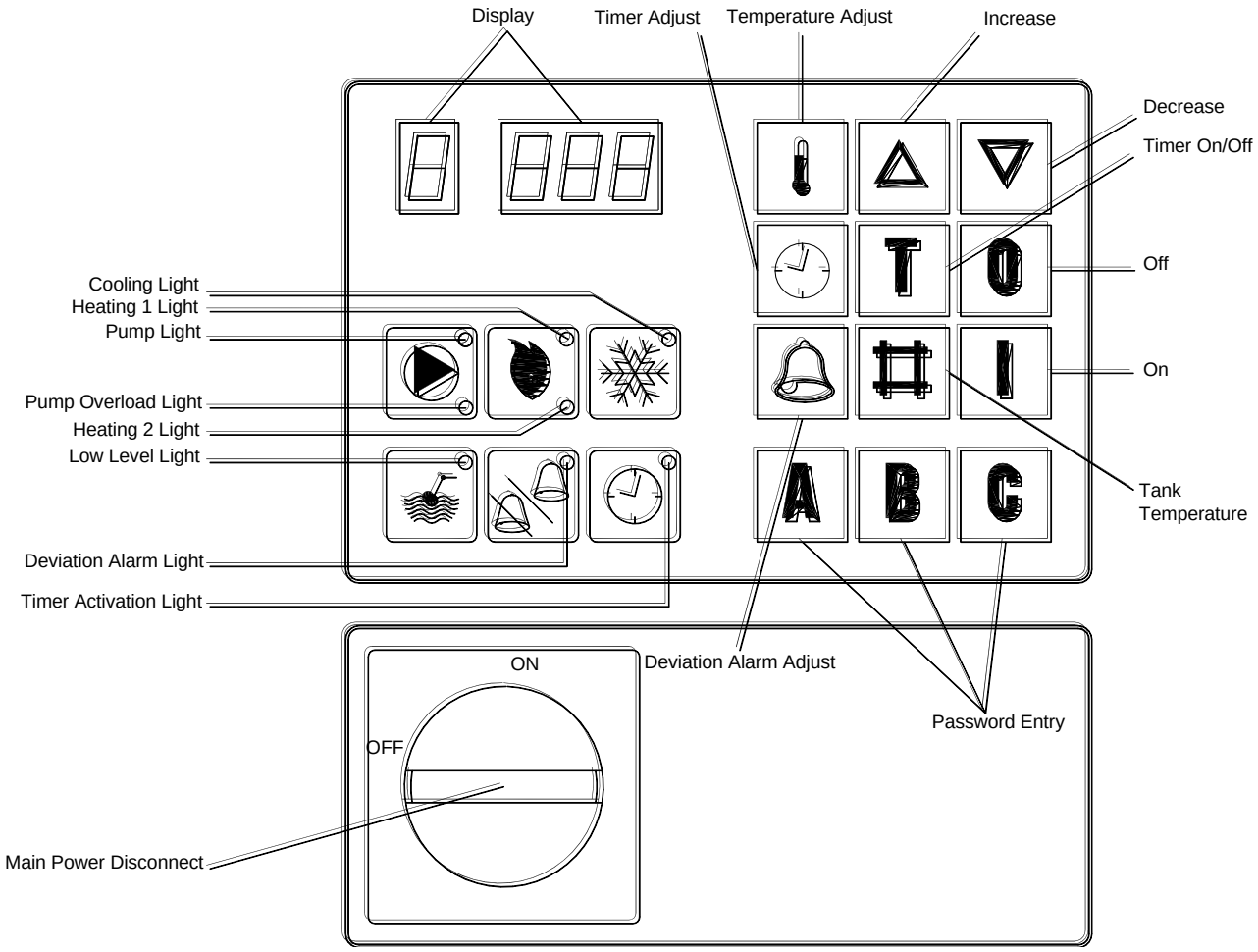


Table 3 – Controller Fault Indication

Fault	Alarm Indicating LED	Digital Display Indicator
Tank Low Level	Yes	F I L L
Internal Temperature Sensor Disconnected	No	A 2 .
Sensor Short Circuited (internal or external)	No	A 1 .
Actual Temperature Deviation Beyond Deviation Alarm Set Point	Yes	A X X
Pump Motor Overload	Yes	

On Button

Depressing the On button will enable the control circuit. If the oil level in the reservoir is below the level required to satisfy the Low Level sensor, the controller will display FILL and the Low Level light will turn on. The Low Level light will remain on until the oil level is above the level required to satisfy the Low Level sensor at which point the Low Level light will turn off.

If the oil temperature in the tank is below 70°F, the controller will turn the heaters on and the pump will not run. When the oil temperature is between 70°F and 85°F, the controller will continue to heat using the heaters and will turn the pump on but the display will only show "A", indicating that it is in an alarm mode and not in a running mode. Above 85°F, the unit enters a normal operation mode. The display will show a "1" as the first digit followed by the tank temperature. The heaters and pump remain on until the pump bearing reaches 250°F, at which time the controller will turn off the heaters and continue to run the pump.

Off Button

Depressing the Off button will stop the pump and disable the control circuit.

CAUTION: Stopping the unit without cooling the oil in the reservoir can lead to potential user injury during servicing of the unit. In order to allow the oil in the reservoir to be cooled automatically during shut down, depress the Temperature Adjust button and the Password 'C' button to initiate an automatic cool down cycle. The controller will open the cooling valve and keep it open until the temperature of the oil in the reservoir is below 120°F (49°C). The automatic cool down cycle can be stopped at any time by depressing the Off button.

Temperature Adjustment Button

Depressing the Temperature Adjust button will show the current set point temperature in the display. After depressing the Temperature Adjust button, it is possible to change the set point temperature by using the Increase or Decrease buttons. Once the desired set point temperature displays, release all buttons. After five seconds, the display will return to the actual temperature and the new set point is active.

Increase Button

Depressing the Increase button will adjust the set point, deviation alarm, and timer settings when those adjustment features are active.

Decrease Button

Depressing the Decrease button decreases the value of the set point, deviation alarm, and timer settings when those adjustment features are active.

Timer Adjustment Button

Depressing the Timer Adjust button will activate the various timer adjustments.

Setting Clock

Depressing the Timer Adjust button once will show the current time value in the display. If the power to the unit is disconnected, the clock resets to 0000 hours (based on a 24-hour clock) and will begin keeping time from that point forward until reset. To adjust the time, use the Increase and Decrease buttons to set the current time. Releasing all buttons sets the time to the time shown in the display. After five seconds, the display will return to the actual temperature and the new time is set.

Setting Day

Depressing the Timer Adjust button twice will show the current time value in the display. If the power to the unit is disconnected, the day resets to Monday (based on a 24-hour clock) and will begin keeping dates from that point forward until reset. To adjust the day, use the Increase and Decrease buttons to set the current day as follows.

Table 3 – Calendar Day Values

Day	Display Value
Monday	1000
Tuesday	2000
Wednesday	3000
Thursday	4000
Friday	5000
Saturday	6000
Sunday	7000

Releasing all buttons sets the day to the one shown in the display. After five seconds, the display will return to the actual temperature and the new day is set.

Setting Start Time

Depressing the Timer Adjust button and then immediately depressing the Timer On/Off button once will reset the display to 0000. To adjust the start time, use the Increase and Decrease buttons to set the desired start time (based on a 24-hour clock). Releasing all buttons sets the start time to the time shown in the display. After five seconds, the display will return to the actual temperature and the new start time is set.

Setting Stop Time

Depressing the Timer Adjust button and then immediately depressing the Timer On/Off button twice will reset the display to 0000. To adjust the stop time, use the Increase and Decrease buttons to set the desired stop time (based on a 24-hour clock). Releasing all buttons sets the stop time to the time shown in the display. After five seconds, the display will return to the actual temperature and the new stop time is set.

Setting Days for Automatic Start/Stop

Depressing the Timer Adjust button twice and then immediately depressing the Timer On/Off button once will reset the display to show the settings for Monday. When reviewing the settings for each day of the week, the first digit on the left of the display indicates the day of the week as follows.

Table 4 – Timer Day Values

Day	Display Value
Monday	1
Tuesday	2
Wednesday	3
Thursday	4
Friday	5
Saturday	6
Sunday	7

The remaining three digits of the display indicate the activation status of that day. If there is a decimal in the first and third digits for the day, automatic start/stop is scheduled. If there is there is a decimal in the second and third digits for the day, automatic start/stop is not scheduled.

Example	*Displays*
If the automatic start/stop is active for Monday	1. .
If the automatic start/stop is not active for Monday	1 . .

To toggle the schedule status, press the On button once. The display will indicate the change. When all changes for that day are complete, depress the Increase button to display the next day. Set all days to the settings selected, release all buttons. After five seconds, the display will return to the actual temperature and the days for automatic start/stop are set.

Timer On/Off Button

Depressing the Timer On/Off button will activate or deactivate the automatic start/stop timer. If the far right hand display shows a decimal after the number displayed, then the automatic start/stop timer is active. If no decimal is displayed the automatic start/stop timer is deactivated.

Deviation Alarm Button

Depressing the Deviation Alarm Adjust button will show the current deviation alarm set point in the display. The deviation alarm set point is the number of degrees the actual tank temperature must rise above the set point temperature before the alarm horn will activate. After depressing the Deviation Alarm, adjust the deviation alarm set point temperature by using the Increase or Decrease buttons. Releasing all buttons sets the deviation alarm to the temperature shown in the display. After five seconds, the display will return to the actual temperature and the new deviation alarm is set.

To activate the deviation alarm, press the deviation alarm button and release and immediately press the on button. To deactivate the deviation alarm, press the deviation alarm button and release and immediately press the off button. When the deviation alarm is active, the deviation alarm LED will be on and green.

Note: There is a time delay after initial start-up before the temperature deviation alarm is active. The unit must be on with the pump running for 45 minutes before the alarm function is active. This time delay feature minimizes the potential for unwanted alarms during initial start-up as the unit brings the system up to operating temperature.

Tank Temperature Button

Depressing the Tank Temperature button will show the current tank temperature in the display.

Password Entry Buttons

Depressing any of the Password Entry buttons will allow for secured access to the control program and will prevent unauthorized personnel from making changes. The correct four-letter password will be required to adjustment temperatures or timer functions. The password remains in memory even if the power is disconnected.

Entering or Changing Password

Depress the Off button and then immediately depress and hold the ‘C’ Password Entry button for three seconds. The display will now show a ‘C’ in the second display. Immediately enter a password consisting of any combination of four letters. The controller counts the number of letters entered and the display will show a ‘4’ in the last display when all four of the password letters are entered. Once the ‘4’ appears, release all buttons and press the ‘Off’ button to store the password. Press the ‘On’ button to restart the unit. The display will return to the actual temperature and the controls will be password protected.

Deleting Password

Depress the 'C' and hold until the second display show 'C' then press the 'Off' button to delete the password. When there is no password the first and last displays will show "• •". To resume operation press the 'On' button and the unit will resume normal operation without password protection.

Pump Operation LED

There are two indicating lights in the Pump icon. When the pump is on the upper LED will be green. When the pump overloads the lower LED will be yellow.

Heating LED

There are two indicating lights in the Heating icon. When Heat 1 is on the upper LED will be green. When Heater 2 is on the lower LED will be green.

Cooling LED

When the cooling valve is open, the LED in the Cooling icon will be green.

Reservoir Low Level Alarm LED

The LED in the Low Level icon will be yellow when the oil level in the reservoir is too low.

Deviation Alarm LED

The LED in the Deviation Alarm icon will be green when the Deviation Alarm is active. The LED will not be on if the Deviation Alarm has been turned off.

Timer LED

The LED in the Timer icon will be green when the Automatic Start/Stop Timer is active. The LED will not be on if the Automatic Start/Stop Timer is not active.

Unit Operation

The temperature control unit circulates oil through a process while precisely, automatically, and reliably maintaining the oil temperature at the selected set point temperature. The operating range of the unit is from 85°F to 575°F. The unit is well suited or use with city water, water from chillers, cooling towers, or wells to provide the cooling water supply.

The unit is a compact corrosion-proof unit with an integral stainless steel tank, stainless steel heating elements, cooling heat exchanger and an immersed stainless steel centrifugal pump without rotating seals. The pump sends oil to the process through the discharge line and returns to the tank through the return line. The unit is an open system. The microprocessor controls the temperature in the tank. The tank (process) temperature is displayed on the control panel LED's.

During the heating cycle, the heating elements turn on as required. During the cooling cycle, the solenoid valve opens and the cooling water goes through the heat exchanger as needed to maintain the proper temperature.

When the unit is on, an LED connected to a level probe inside the tank indicates if the oil level is to the correct level. When the unit is operating and there is too little oil in the tank, the Low Level light turns on, the pump stops and heating ceases. As soon as the oil level is high enough to satisfy the Low Oil Level switch the unit will start automatically.

The microprocessor controls the temperature and monitors the oil level in the unit. The microprocessor includes alarms for low tank level and temperature deviation as well as a timer making automatic start/stop of the temperature controller possible.

Vacuum Mold Drain Option

We offer an option for a vacuum mold drain. If the unit is equipped with this option, it has a special venture valve in the oil circuit that used the positive pressure of the pump to create a vacuum on the return line. The unit will also include a program sequence to automatically cool to 120°F before draining the mold.

To initiate a mold drain sequence depress the Temperature Adjust button and then immediately depress the ‘On’ button. The display will show ‘E’ followed by the actual temperature in the tank. The cooling solenoid valve opens and will remain energized until the tank temperature drops to 120°F. When the tank temperature reaches 120°F, the alarm horn will sound to signal the mold is ready for draining.

Once the unit has cooled to 120°F, close the vacuum adjusting valve and remove the hose on the valve. The vacuum created will automatically pull the oil through the hoses and the mold back to the unit. When the unit is finished draining, turn the unit off by depressing the Off button and remove the hoses.

Start-Up

Every unit is factory set to perform in accordance with the standard operating specifications for that particular temperature control unit. Due to variables involved with different applications and different installations, minor adjustments may be required during the initial start-up to ensure proper operation. The following start-up procedure should be followed in sequence. If trouble is encountered during start-up, the fault can usually be traced to one of the control or safety devices. This outline can be used as a checklist for the initial start-up and for subsequent start-ups if the unit is taken out of service for a prolonged period of time.

1. Assure the main power source is connected properly, that it matches the voltage shown on the nameplate of the unit, and that it is within the voltage utilization range given in Table 1. Electrical phase sequence must be checked at installation and prior to start-up. Operation of the temperature control unit with incorrect electrical phase sequencing will result in improper performance and could lead to mechanical damage. The phasing must be checked with a phase sequence meter prior to applying power. The proper sequence should read "ABC" on the meter. If the meter reads "CBA", open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). All components requiring electric power are wired in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals. Once proper power connection and grounding have been confirmed, turn the main power on.

WARNING: It is imperative that L1-L2-L3 are connected in the A-B-C phase sequence to prevent equipment damage due to reverse rotation.

2. The temperature control unit is provided with an inlet cooling water filter (shipped separately in crate). Install this in the inlet chilled water line before the line is connected to the unit.

3. Check to make sure that all process water and oil piping connections are secure.

WARNING: Only use hoses and connectors that are properly rated for operation with this unit. The unit can develop up to 100 PSI of pump pressure at 600°F. Do not use hose couplings or old or damaged hose when connection the unit to the process equipment. Always ensure the unit is fully cooled and the power is off before connecting or disconneting hoses or fittings.

4. Check to make sure all cooling water piping connections are secure. Make sure sufficient cooling water flow and pressure are available and that all shut-off valves are open.

5. Turn on the control power by pressing the On button. The panel displays should now be illuminated.

6. If the display shows a decimal point in the first and last LED displays the unit is full of oil and ready to operate. If the temperature control unit has never been filled or if the oil level in the reservoir is insufficient, the digital displays with read FILL and the Low Level light will turn on. If this occurs, remove the plug fron the fill connection located on the top of the unit and fill the unit with oil until the display shows the tank temperature and the Low Level light turns off. The 6 kW and 12 kW models hold about 8 gallons of oil and the 18 kW and 24 kW units hold about 15 gallons of oil.

WARNING: The use of improper oils can lead to built-up of sludge and scorching of oil in the unit. Use high-quality synthetic oil such as Paratherm NF® Heat Transfer Fluid. Do not use mineral oils and do not mix oils.

7. After the reservoir is sufficiently full of oil and the pump is operating, press the Temperature Adjustment button to display the current set point temperature. If the oil temperature in the tank is below 70°F, the unit will heat in pulses and the pump will not run. Between 70°F and 85°F, the unit will heat and the pump runs, but the display will only show "A", indicating that it is in an alarm mode and not in a running mode. Above 85°F, the unit works according to design. Once the pump bearing reaches 250°F, the heaters will turn off, but the pump will continue to run. Check to make sure the fan in the electrical cabinet is operating.

8. Set the desired temperature using the Increase and Decrease buttons. When finished release all buttons. After five seconds the tank temperature is displayed and the new set point is stored. The unit will now activate the heaters and/or cooling solenoid valve to maintain set point temperature.

9. (Vacuum Units Only) Adjust the positive/negative flow through the mold by using the vacuum adjusting valve on top of the back panel. Start by fully closing this valve so that the injector makes a vacuum in the return line from process. The vacuum creative will allow air to enter the circuit through any leaks that are present. Opening the adjusting valve slowly allows oil to flow to the mold and pressurize the supply line. The leak will reappear as the pressure increases. Slowly closing the adjusting valve now eliminates the leak.

10. Operate the unit for approximately 30 minutes. Check the unit for signs of leaks. Once proper flow and temperature are achieved, press the Off button.

The unit is now ready to be placed into service.

Preventive Maintenance

Once your oil temperature control unit is in service, please adhere to the following maintenance procedures. The importance of a properly established preventive maintenance program cannot be overemphasized. Taking the time to follow these simple procedures will result in substantially reduced downtime, reduced repair costs, and an extended useful lifetime for the unit.

Once a Week

1. Check all water and oil line connections for signs of leaks. Replace or repair water and/or oil lines and/or fittings as necessary.
2. Check to make sure the To Process temperature is maintained reasonably close to the Set Point temperature. If the temperature varies more than 5°F from the set point temperature, there may be a problem with the unit. If this occurs, refer to the Troubleshooting Chart or contact our Customer Service Department.
3. Check the pump discharge pressure of the unit. If the discharge pressure starts to stray from the normal operating pressure this could be an indication that the leak in the mold has worsened or that there may be a problem with the unit. If this occurs, refer to the Troubleshooting Chart or contact our Customer Service Department.

Once a Month

Repeat items 1 through 3 as listed above and continue with the following.

4. With the main disconnect shut off and locked out, check the condition of electrical connections at all contactors, starters and controls. Check for loose or frayed wires.
5. Check the incoming voltage to make sure it is within 10% of the design voltage for the unit.
6. Check the amp draws to each leg of the pump and heaters to confirm that they are drawing the proper current.
7. Check the heat exchanger inlet strainer and clean debris out as necessary.
8. Check the condition of the oil and replace as necessary as instructed by the oil manufacturer.

Once a Year

Repeat items 1 through 8 as listed above and continue with the following.

9. Carefully inspect the heat exchanger for signs of scale build-up and carefully clean and remove scale as necessary.

CAUTION: The amount of scale build-up is dependent upon the amount of cooling required for each process along with the quality of the cooling water supply. We have supplied the unit with a stainless steel heat exchanger to allow the use of strong lime-scale removal chemicals (acids). We recommend you clean the heat exchanger thoroughly on a periodic basis, or after each job, to allow for the longest life and highest heat removal potential of the unit. If the heat exchanger becomes completely blocked, lime scale removal will be impossible.

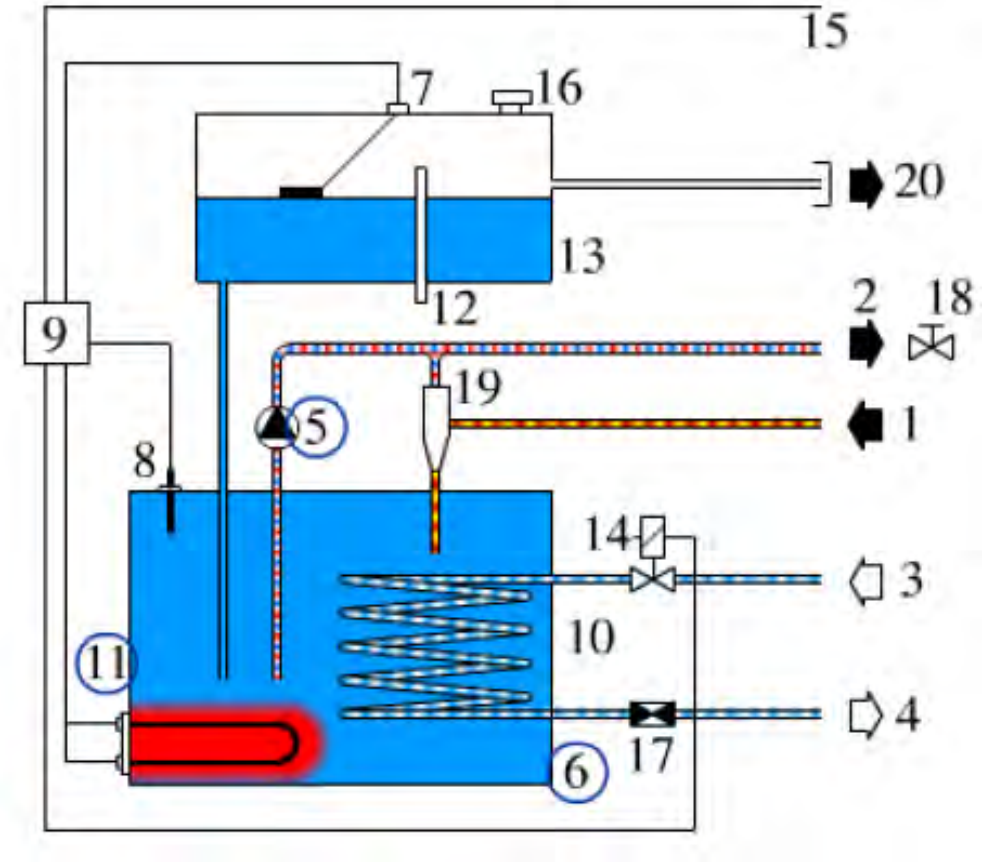
Troubleshooting

Table 5 – Troubleshooting Chart

Problem	Possible Cause	Remedy
The unit does not start after connection, tank filling, and pressing the On button	Main fuses blown	Replace blown fuses
	Motor defective	Contact factory
	Reset tripped	Reset
	Control circuit breaker tripped	Reset
Motor buzzes after pressing the On button and overload trips	Voltage on two of the phases only	Check incoming power supply, check and replace blown fuse
	Motor defective	Contact factory
No oil circulation, even though the pump is rotating	Pump is rotating in the wrong direction	Change two of the incoming power leads
	Process oil lines clogged	Clean lines
The unit does not heat	Contactor defective	Replace contactor
	Thermostat defective	Replace thermostat
	Heating element defective	Replace heating element
	Safety fuse defective	Replace safety fuse
The unit does not cool	Solenoid valve at “Cooling Water In” defective	Replace solenoid valve
	Cooling heat exchanger clogged	Clean coil
	Thermostat defective	Replace thermostat
The unit cooling all the time	Dirt in the cooling solenoid valve	Take apart the valve, clean out, replace if required
	Thermostat defective	Replace thermostat
Oil comes out the overflow pipe	Tank overfilled	Drain some oil
	Water in the system	Drain tank and refill with new oil

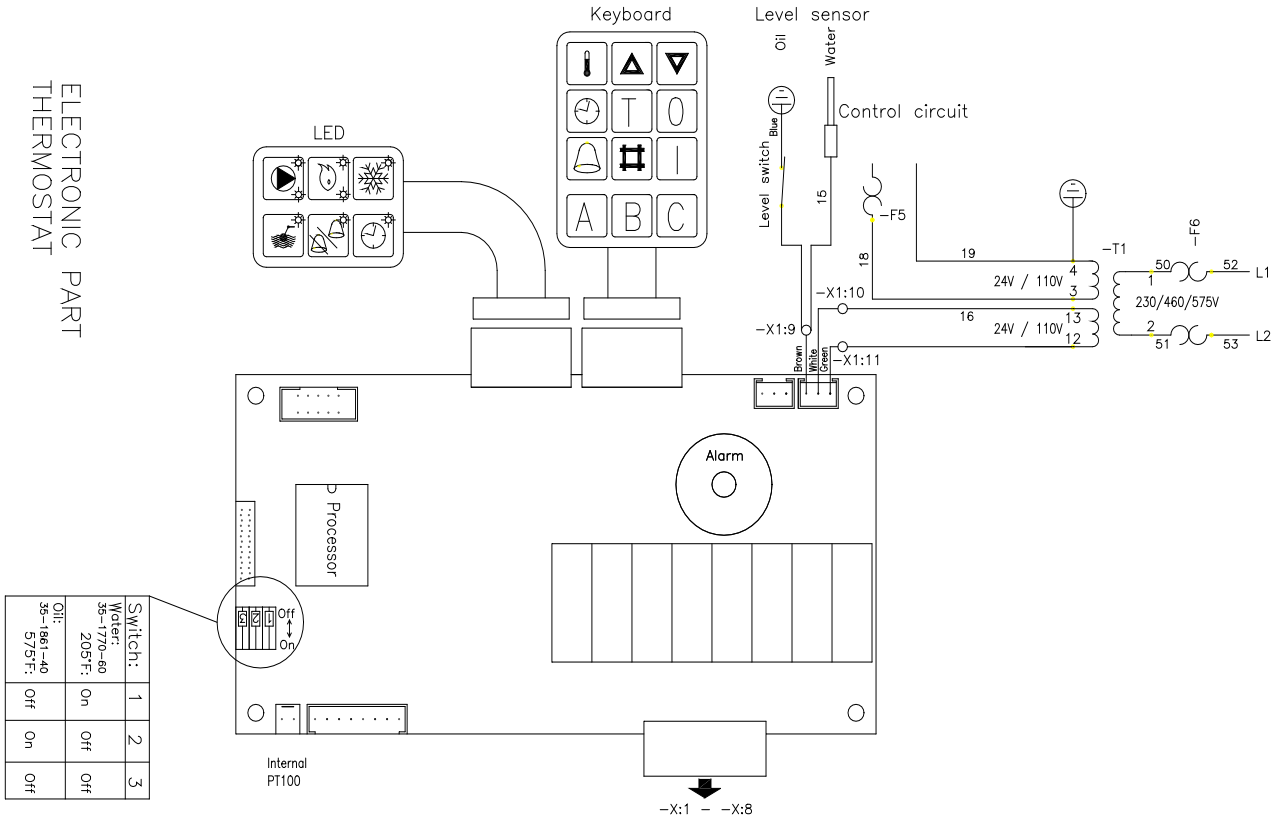
Charts and Drawings

Figure 4 – Principle of Operation



1. From process
2. To process
3. Cooling water in
4. Cooling water out
5. Pump
6. Tank
7. Level switch
8. Temperature sensor
9. Microprocessor control
10. Heat exchanger
11. Heating element
12. Overflow
13. Expansion tank
14. Solenoid valve for cooling
15. Connection, remote sensor (optional)
16. Fill
17. Check valve
18. Negative pressure adjustment valve (negative pressure units only)
19. Negative pressure venture (negative pressure units only)
20. Drain (negative pressure units only)

Figure 5 – Microprocessor Control Board Drawing (Drawing 592)



Warranty

Thermal Care warrants its equipment to be free from defects in material and workmanship when used under recommended operating conditions.

Thermal Care's obligation is limited to repair (i.e. rewind a motor) or replacement (not adjustment or maintenance), F.O.B. the factory of any parts supplied by Thermal Care within a period as shown below from the date of shipment to the original purchaser.

Model	Parts	Labor[1]
SQ, LQ	18 months	12 months
EQ	12 months	12 months
EQR, LQR, SQR(remote condensers)	12 months	12 months[2]
TCW, TSW, TXW	12 months	12 months
TCR, TSR, TXR (remote condensers)	12 months	12 months[2]
Optional Compressor Warranty	5 years	
Chilled Water Systems	See note[3]	12 months[4]
FT or FC Tower Systems	See note[3]	12 months[4]
FT Cooling Tower	12 months (10 years - shell)	
FC Cooling Tower	5 years (10 years - shell)	
RA, RB	(See Warranty Sheet – Form 1-415)	
All other products	12 months	

[1]Continental U.S.A., Canada, and Puerto Rico only.
[2]Refrigerant and any labor associated with its evacuation or replacement are not covered for remote condenser systems.
[3]See individual product listing for parts warranty coverage.
[4]The labor warranty covers all equipment purchased at the same time consisting of a minimum of at least one pumping system and one cooling tower and/or chiller.

This warranty does not cover the cost of labor during overtime hours (after normal working hours or during weekends and holidays). Any cost differential for overtime labor will be the responsibility of the customer. Thermal Care is not responsible for any sales, use, excise or other applicable taxes associated with the replacement of parts under this warranty. This warranty will be voided when, in Thermal Care's opinion, the equipment and/or system has been subject to misuse, negligence or operation in excess of recommended limits, including freezing, or has been altered, and/or repaired without express factory authorization. If equipment is installed in hostile environments, unless such conditions were specified at the time of purchase; or the serial number has been removed or defaced, this warranty shall not apply. This warranty is not transferable.

Under no circumstances shall Thermal Care be liable for loss of prospective or speculative profits, or special, indirect, incidental or consequential damages.

Thermal Care must authorize all warranty service prior to work being performed and have a Thermal Care purchase order issued. All defective parts become the property of Thermal Care and must be returned as advised by Thermal Care.

Thermal Care neither assumes, nor authorizes any person to assume for it, any liability not expressed in this warranty. There is an implied warranty of merchantability and of fitness for that particular purpose; all other implied warranties, and any liability not based upon contract are hereby disclaimed and excluded by this warranty. This warranty is part of the standard conditions and terms of sale of Thermal Care.

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Form 1-410.11
Effective 4/9/07

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