Hydra™ Negative Pressure, Closed-Loop Mold Temperature Controllers

INSTRUCTION MANUAL

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Foreword

The intent of this manual is to serve as a guide for placing your positive/negative pressure temperature control unit in service and operating and maintaining it properly. This manual is supplemented as required to accommodate any special items that may have been provided for a specific application. The written information contained in this manual, as well as various drawings, are intended to be general in nature. The schematics included in this manual are typical only. We strive to maintain an accurate record of all equipment during the course of its useful life. While every effort is made to standardize the design features of these units, the various options may make it necessary to rearrange some of the components; therefore, some of the general drawings in this manual may differ from your specific unit.

Specific references to current applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment are avoided due to their ever-changing nature. 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.

Install the temperature control unit in a well-ventilated area, especially if open flames are present. Failure to follow these instructions could result in a hazardous condition. It is recommended that good piping practices are followed and that the information in this manual is adhered to. We cannot be held responsible for liabilities created by substandard piping methods and installation practices external to the unit.

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.

Installation

Receiving Inspection

Each temperature control unit is skid mounted and crated to protect it during shipping. Before accepting delivery, check the crate for visible damage. If damage is evident, it should be properly documented on the delivery receipt and the crate should be immediately removed to allow for detailed inspection of the unit. Check for broken water lines, damaged controls, or any other major component torn loose from its mounting point. Any sign of damage should be recorded and a claim filed immediately with the shipping company. In order to expedite payment for damages it is important to record and document damage. An excellent way to do this is by taking pictures. Our Customer Service Department will provide assistance with the preparation and filing of your claims, including arranging for an estimate and quotation on repairs.

Rigging, Handling, and Locating Equipment

The temperature control unit has a base frame on casters that has been designed to allow the unit to be easily wheeled into position. If using a forklift or overhead crane proper rigging methods must be followed 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.

The temperature control unit is designed for indoor use. If it is necessary to store the unit in an unheated indoor area when not in use, be sure that all water is drained or that an adequate amount of antifreeze is added to prevent freeze-up of the unit. In no case should this unit be installed or stored outdoors.

A primary concern when designing your unit was serviceability, therefore, the unit should be located in an accessible area. In addition, due to the operating temperatures of this unit it must be located in a well ventilated area away from any heat source. All of the air opening vents of the units must be open and clear of obstruction to ensure proper ventilation of the unit. Improper location may result in overheating and damage to the unit.

Electrical Power

All wiring must comply with local codes and the National Electric Code. Minimum circuit ampacities and other unit electrical data are on the unit nameplate and are shown in the Electrical Specification section at the back of this manual. A specific electrical schematic is shipped 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 in Table 1.

Table 1 - Voltage Utilization Range

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

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%.

A terminal block is provided for main power connection to the main power source. The main power source should be connected to the terminal block through an appropriate disconnect switch. A separate lug for grounding the unit is also provided in the main control panel. 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 operation and can 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.

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.

WARNING: The control panel and safeties are wired such that connecting the appropriate power source to the main terminal block energizes the entire electric circuitry of the chiller. A control transformer has been factory wired to step down the incoming power to the control power voltage. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance. The unit must be properly grounded in compliance with local and national codes.

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 anc 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 chilled 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 piping connections are secure.

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 water and ready to operate. If the temperature control unit has never been filled or if the water level in the reservoir is insufficient, the digital displays with read FILL, the level LED will light and the unit will initiate an initial automatic fill cycle. This cycle will open the fill solenoid valve and allow the cooling source water to fill the reservoir.

7. After the reservoir is sufficiently full of water and the pump is operating, press the Temperature Adjustment key to display the current set point temperature.

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 temperture.

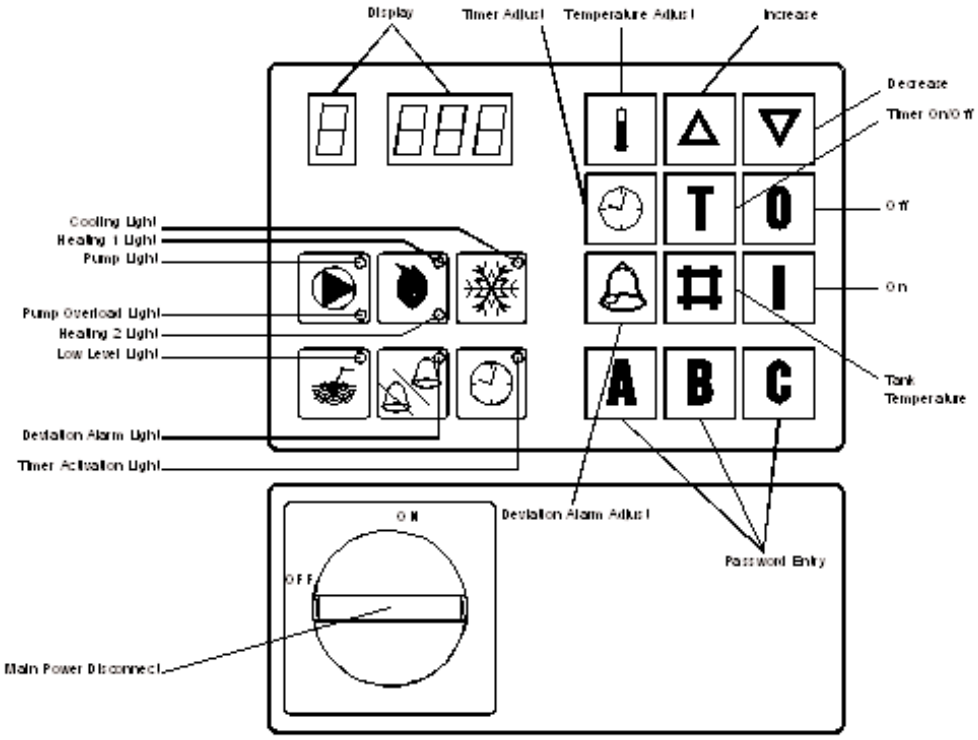
9. Adjust the positive/negative flow through the mold by using the vacuum adjusting valve on top of the back panel. Start by fully closing this valve so that the injector makes a vacuum in the return line from process. At the leak, air is drawn into the circuit. The adjusting valve should be opened slowly to allow water to flow to the mold and pressurize the supply line. The leak will reappear as the pressure increases. At this point, the adjusting valve must be closed until the leak is eliminated.

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.

Controller Operation

Figure 1 – Control Panel



The temperature control unit includes a microprocessor controller designed to perform all control function from the front panel. When a key is depressed, a click will be felt. Unless instructed otherwise, only one key should be pressed at a time.

Table 2 – Microprocessor 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	

Operating Keys

On I

Depressing the On button will enable the control circuit. If the water level in the reservoir is below the level required to satisfy the low level sensor, the controller will initiate an initial fill sequence. During this sequence, the fill valve opens and will remain open until the proper water level is achieved. The automatic fill cycle has a four-minute timer that will close the fill solenoid valve and stop the pump. This safety has been included in case there is a leak present that does not allow the reservoir to fill up. After the initial fill cycle is complete, the unit will automatically fill the tank if the level gets too low. If the fill valve remains open for more than 20 seconds, the unit will close the fill solenoid valve and shut off the pump. The display will show a "1" as the first digit followed by the tank temperature.

Off 0

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

CAUTION: Stopping the unit without cooling the water in the reservoir can lead to potential user injury during servicing of the unit. In order to allow the water 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 water in the reservoir is below 105°F (40°C). The automatic cool down cycle can be stopped at any time by depressing the Off button.

Temperature Adjust

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

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

Decrease

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

Timer Adjust

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.

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

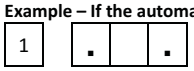
Depressing the Timer Adjust button twice and then immediately depressing the Timer On/Off button once will reset the display to show the settings for Monday. When reviewing the settings for each day of the week, the first digit on the left of the display indicates the day of the week as follows.

Table 4 – Timer Day Values

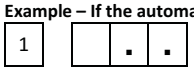
Day	Display Value
Monday	1
Tuesday	2
Wednesday	3
Thursday	4
Friday	5
Saturday	6
Sunday	7

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 – If the automatic start/stop is active for Monday the display will show



Example – If the automatic start/stop is not active for Monday the display will show



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 T

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 Adjust

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.

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

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

Password Entry A B C

Depressing 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.

Operating Lights

There are eight operating lights, each located within a corresponding icon for that operational function.

Pump 

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 

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 

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

Low Level 

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

Deviation Alarm 

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 

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 water through a process while precisely, automatically, and reliably maintaining the water temperature at the selected set point temperature. The operating range of the unit is from 50°F (10°C) to 205°F (96°C). 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 water to the process through the discharge line and 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 element turns 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 water level is to the correct level. The unit will automatically fill the tank to the correct level using the cooling water supply. When the unit is operating and there is too little water in the tank, the Low Level light turns on, the pump stops and heating ceases. As soon as the water level is high enough to satisfy the Low Water Level sensor the unit will start automatically.

The microprocessor controls the temperature and water 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.

If a leak occurs in the mold or in the process, the built-in push-pull system permits stable temperature control without interrupting production. Using the vacuum adjusting valve, the push-pull system makes it possible to supply pressure to the leak and vacuum from the leak back to the unit. If a leak occurs, the flow through the circuit must be such that the leak is at the of the water circuit.

Adjusting The Vacuum

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 created allows air to enter the circuit through any leaks that are present. Opening the adjusting valve slowly allows water to flow to the mold and pressurizes the supply line. The leak will reappear as the pressure increases. Slowly closing the adjusting valve now eliminates the leak.

Draining the Mold

The temperature control unit is equipped with a specific program that can automatically cool to 105°F (40°C) 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 unit the tank temperature drops to 105°F (40°C). When the tank temperature reached 105°F (40°C) the alarm horn will sound to signal the mold is ready for draining. Once the unit has cooled to 105°F (40°C), close the vacuum adjusting valve and remove the hose on the valve. The vacuum created will automatically pull the water 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.

Preventive Maintenance

Once your positive/negative pressure 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, reduce repair costs, and an extended useful lifetime for the unit.

Once a Week

1. Check all water line connections for signs of leaks. Replace or repair water 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 (3°C) 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.**

Once a Year

Repeat items 1 through 7 as listed above and continue with the following.

8. **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.

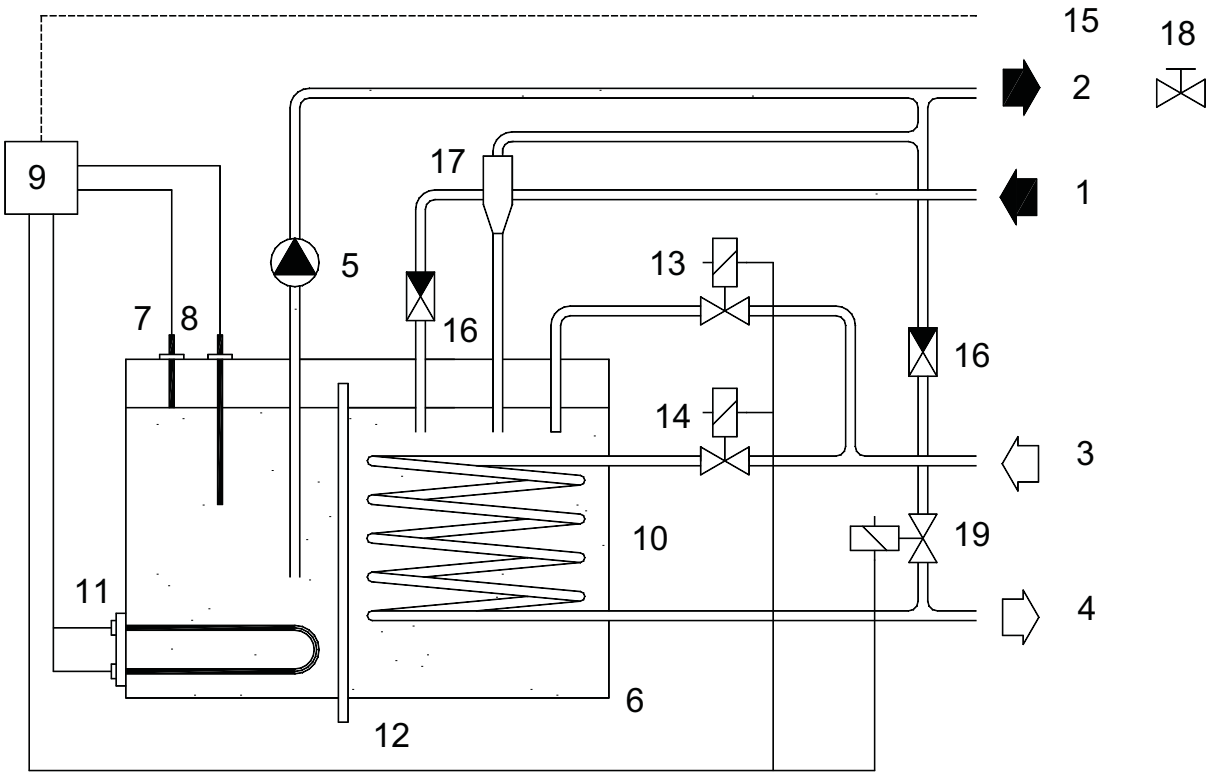
Troubleshooting

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 water circulation, even though the pump is rotating	Pump is rotating in the wrong direction	Change two of the incoming power leads
	Process water 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
Water comes out the overflow pipe	Tank overfilled	Drain some water
	Dirt in the fill solenoid valve	Take apart the valve, clean out, replace if required
	Level sensing probe dirty or defective	Clean probe, replace if required
The unit does not fill the tank, level lamp is not on	Level sensing probe dirty or defective	Clean probe, replace if required
	Defective microprocessor	Contact factory
The unit does not fill the tank, level lamp is on	Water supply not connected	Connect supply
	Defective fill solenoid valve	Replace if required

Charts and Drawings

Figure 2 – Principle of Operation



1. From mold
2. To mold
3. Cooling water in
4. Cooling water out
5. Pump
6. Tank
7. Level sensor
8. Temperature sensor
9. Microprocessor control
10. Heat exchanger
11. Heating element
12. Overflow pipe
13. Solenoid valve for water filling
14. Solenoid valve for cooling
15. Connection for external sensor
16. Check valve
17. Venturi
18. Adjusting valve, vacuum
19. Solenoid valve, mold draining

Figure 3 – Microprocessor Control Board (Drawing 592)

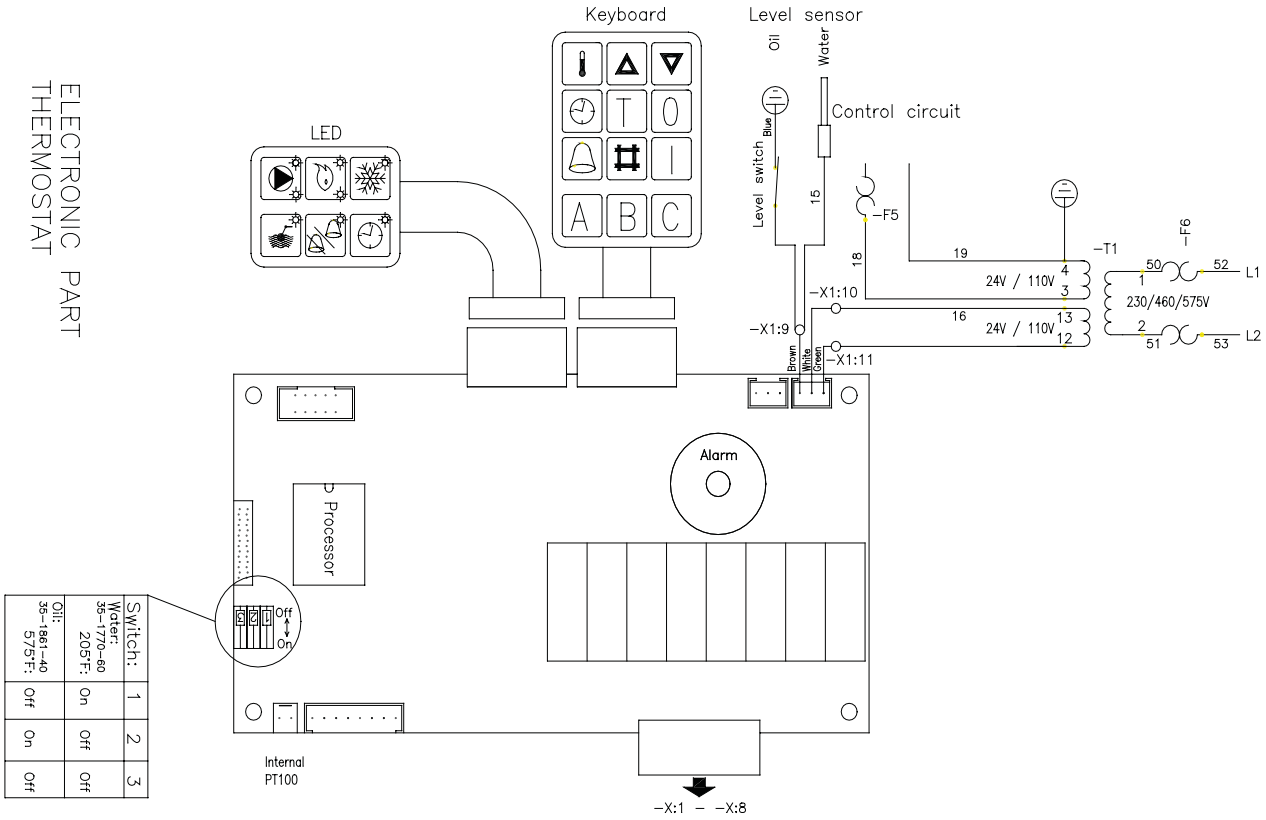


Figure 4 – Pump Curves (SPA-1076)

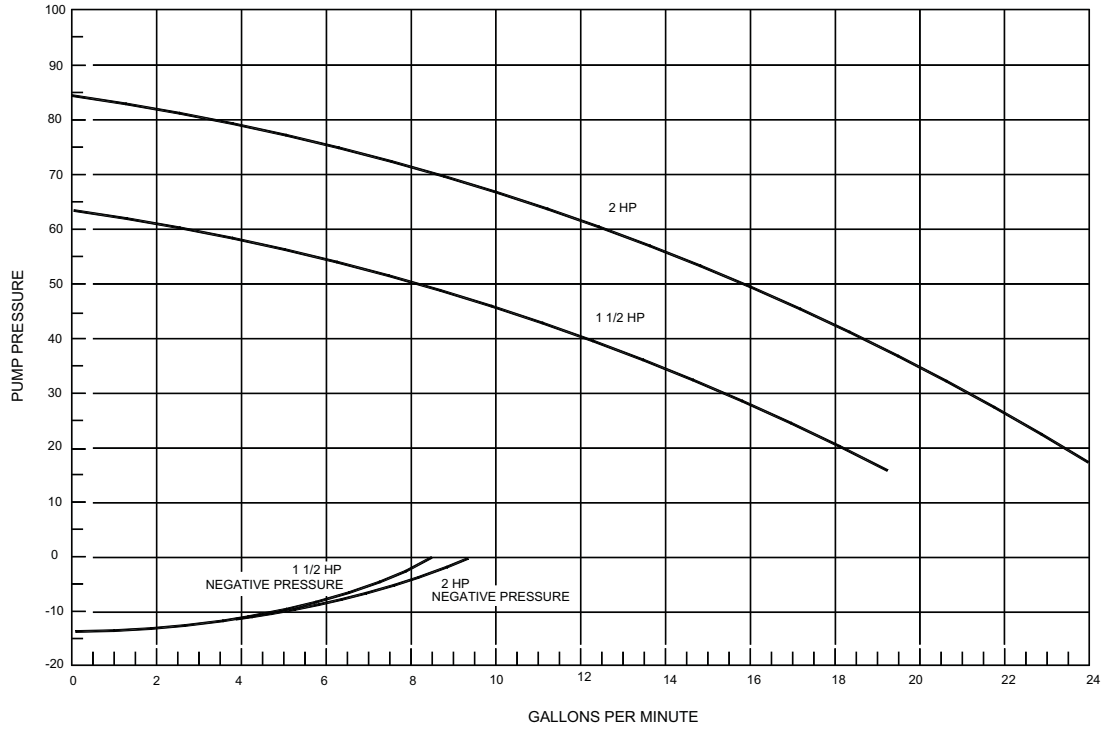
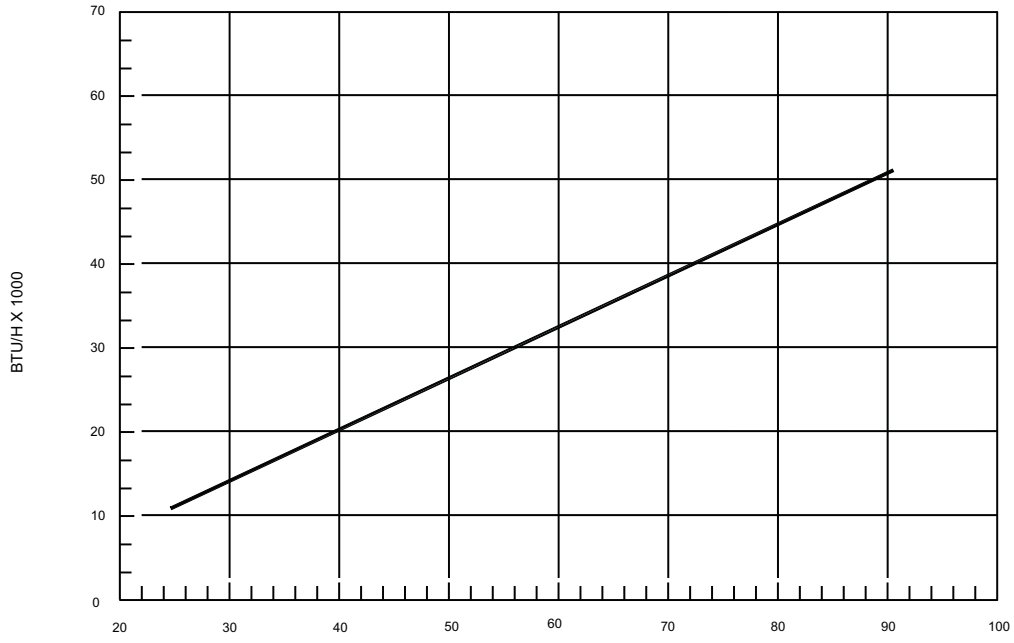


Figure 5 – Cooling Capacity (SPA-1079)



△ T(°F) = TANK TEMPERATURE LESS COOLING WATER TEMPERATURE

NOTES