THERMAL CARE

Superior equipment, Exceptional service

Temperature Controller

OPERATION, INSTALLATION, AND MAINTENANCE MANUAL

Oiltherm RO

Where water means business.

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Foreword

The temperature control unit is a packaged unit that typically includes a fluid pump, electric immersion heater, and temperature control valve in a cabinet. The purpose is to provide circulation and temperature control of a cooling fluid.

This manual is to serve as a guide for installing, operating, and maintaining the equipment. Improper installation, operation, and maintenance can lead to poor performance and/or equipment damage. Use qualified installers and service technicians for all installation and maintenance of this equipment.

This manual is for our standard product. The information in this manual is general in nature. Unit-specific drawings and supplemental documents are included with the equipment as needed. Additional copies of documents are available upon request.

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.

Safety Guidelines

Observe all safety precautions during installation, start-up, and service of this equipment. The following is a list of symbols used in this manual and their meaning.

General Warning

Electricity Warning

Sharp Element Warning

Hot Surface Warning

Flammable Material Warning

Explosive Material Warning

General Mandatory Action

Wear Eye Protection

Wear Protective Gloves

Wear Ear Protection

Disconnect Before Carrying Out Maintenance or Repair

Connect an Earth Terminal to Ground

Only qualified personnel should install, start-up, and service this equipment. When working on this equipment, observe precautions in this manual as well as tags, stickers, and labels on the equipment.

WARNING: Any use or misuse of this equipment outside of the design intent may cause injury or harm.

WARNING: This equipment contains hazardous voltages that can cause severe injury or death.

WARNING: This equipment contains hot oil and water or coolant under pressure. Accidental release of hot water or coolant under pressure can cause personal injury and or property damage.

WARNING: This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.

WARNING: The exposed surfaces of motors, piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.

CAUTION: Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Shut off the electric power at the main disconnect before opening access panels for repair or maintenance.

CAUTION: Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

CAUTION: The equipment will exceed 70 dBA sound pressure at 1 meter distance and 1 meter elevation when operating. Wear ear protection as required for personal comfort when operating or working in close proximity to the chiller.

CAUTION: Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

Pre-Installation

Receiving Inspection

When the unit arrives, verify the information on the unit nameplate agrees with the order acknowledgement and shipping papers. Inspect the equipment for any visible damage and verify all items shown on the bill of lading are present. If damage is evident, document it on the delivery receipt by clearly marking any item with damage as "unit damage" and notify the carrier. In addition, notify our Customer Service Department and they will provide assistance with preparing and filing freight damage claims, including arranging for an estimate on repair costs; however, filing the shipping damage 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 damage, and take photos of any damage found. Once received, equipment owners have the responsibility to provide reasonable evidence that the damage did not occur after delivery. Photos of the equipment damage while the equipment is still partially packed will help in this regard. Refrigerant lines can be susceptible to damage in transit. Check for broken lines, oil leaks, 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, notify our Customer Service Department and they will provide assistance with preparing and filing freight damage claims, including arranging for an estimate on repair costs; however, filing the shipping damage claim is the responsibility of the receiving party.

Unit Storage

When storing the unit it is important to protect it from damage. Blow out any water from the unit; cover it to keep dirt and debris from accumulating on or getting in and store in an indoor sheltered area that does not exceed 145°F.

Installation - Mechanical

Foundation

Install the unit on a rigid, non-warping mounting pad, concrete foundation, or level floor suitable to support the full operating weight of the equipment. When installed the equipment must be level within ¼ inch over its length and width.

Unit Location

The unit is available in many different configurations for various environments. Refer to the proposal and order acknowledgement document for the equipment to verify the specific design conditions in which it can operate.

To ensure proper airflow and clearance space for proper operation and maintenance allow a minimum of 12 inches of clearance between the sides of the equipment and any walls or obstructions. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service.

Rigging

The unit has a base with casters 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 may occur.

Fluid Distribution Piping

Ensure all piping and fittings are suitable for the maximum operating temperature and pressure of

the unit. Proper insulation of chilled process fluid piping is crucial to prevent condensation. The formation of condensation adds a substantial heat load to the cooling system.

The importance of properly sized piping cannot be overemphasized. See the ASHRAE Handbook or other suitable design guide for proper pipe sizing. In general, run full size piping out to the process and then reduce the pipe size to match the connections on the process equipment. One of the most common causes of unsatisfactory unit performance is poor piping system design. Avoid long lengths of hoses, quick disconnect fittings, and manifolds wherever possible as they offer high resistance to water flow. When manifolds are required, install them as close to the use point as possible. Provide flow-balancing valves at each machine to assure adequate water distribution in the entire system. Install shut-off valves at each machine to allow for isolation of the unit.

Installation - Electrical

All wiring must comply with local codes and the National Electric Code. Minimum Circuit Amps (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 terminal block 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. 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. Operation of the unit with incorrect electrical phase sequencing will result in improper pump performance. 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.

WARNING: This equipment contains hazardous voltages that can cause severe injury or death.

WARNING: This equipment contains hot water or coolant under pressure. Accidental release of hot water or coolant under pressure can cause personal injury and or property damage.

WARNING: This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.

WARNING: The exposed surfaces of motors, piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.

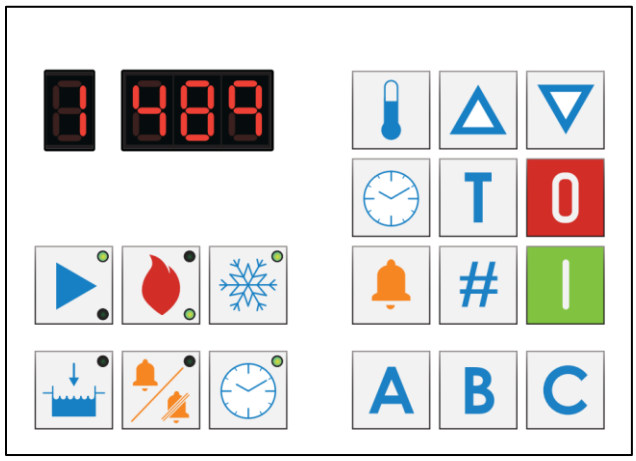
CAUTION: Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance.

CAUTION: Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

CAUTION: Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

CAUTION: Wire the unit ground in compliance with local and national codes.

Controller Operation



The controller uses a set of digital LED displays to show various temperatures as well as status and alarm conditions.

Start

To start the unit press the Start button. If the oil level in the reservoir is too low, the display will show F I L L and the Low Level Alarm Indicator light will turn on. The Low Level Alarm Indicator light will remain on until the oil level is sufficient for operation.

Oil becomes thick and is hard to pump when it is cool. To protect the pump from stress at start-up the unit will only start the pump if the temperature in the tank is above 68°F. If the unit starts and the oil temperature in the tank is below 68°F, the heaters will come on; however, the pump will not run. When the oil temperature is above 68°F the pump will turn on and the heaters will heat the oil until the oil temperature reaches 85°F. While in the initial heat-up mode the display will only show an 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 status display will show a I and the remaining digits will show 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 and the unit will enter into normal temperature control mode.

Stop

To stop the unit press the Stop button. When the unit is stops, the status display and the last digital display on the right will display a dot.

WARNING: 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 cool 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. To stop the automatic cool down cycle at any time depress the Stop button.

Temperature Adjust

The Temperature Adjust button is used to view and change the set point temperatures.

Display Set Point Temperature

To display the Set Point temperature press and release the Temperature Adjust button. This will show the Set Point temperature in the display. If no other buttons are pressed for 5 seconds, the display will return to the actual temperature.

Setting Set Point Temperature

To change the Set Point temperature press the Temperature Adjust button and release to display the current Set Point temperature and then immediately used the Increase or Decrease buttons to change the Set Point temperature until the desired temperature is displayed. Once the desired Set Point temperature displays, release all buttons. After 5 seconds, the display will return to the actual temperature and the new set point is active.

Increase

Pressing the Increase button increases the value of the set point, deviation alarm, and timer settings when those adjustment features are active.

Decrease 

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

Date & Time 

Press the Timer button to display and adjust pump running hours and automatic start/stop timers as indicated below.

Displaying Pump Running Hours

Press the Date & Time button and release and immediately press the Start button to display the pump running hours. The pump running hours will display for 5 seconds. If no other buttons are pressed for 5 seconds, the display will return to the actual temperature. The pump running hour counter counts running hours in intervals of 1 hour up to 9,999 hours.

Resetting Pump Running Hour Counter

Resetting the pump running hour counter requires three button presses in sequence. Press the Date & Time button and release, press the Start button and release, and press the Stop button and release to reset the pump running hour counter. If no other buttons are pressed for 5 seconds, the display will return to the actual temperature.

Displaying Clock Time

Press and release the Date & Time button once to display the current clock time. The time will display for 5 seconds. If no other buttons are pressed for 5 seconds, the display will return to the actual temperature.

Setting Clock Time

The clock timer is used for programming automatic start and stop times. If the power to the unit is disconnected, the clock resets to 0 0 0 0 hours (based on a 24-hour clock with 0000 hours being midnight) and will begin keeping time from that point forward until reset. To adjust the time, press the Date & Time button and release and immediately 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 5 seconds, the display will return to the actual temperature and the new time is set.

Displaying Day of the Week

Press and release the Date & Time button twice to display the internal clock timer day of the week. The day of the week will display for 5 seconds. If no other buttons are pressed for 5 seconds the display will return to the actual temperature.

Setting Day of the Week

The day of the week is used for programming automatic start and stop times. If the power to the unit is disconnected, the day resets to Monday (Day 1) based on a 24-hour clock and will begin keeping dates from that point forward until reset. To adjust the day, press the Date & Time button twice, release, and immediately use the Increase and Decrease buttons to set the current day of the week as follows.

Releasing all buttons sets the day to the one shown in the display. After 5 seconds, the display will return to the actual temperature and the new day is set.

Timer On/Off 

Pressing the Timer On/Off button is used to program times and days for which the automatic 7 day, 24 hour timer will start and stop the unit. This is an optional feature; however, it is available for applications that require automatic preheating and shutdown. It uses a common start and stop time for all days of the week programmed to be active for the timer program. Each day can be included or excluded; however, all days will have the same start and stop time. Once programmed, it is possible to turn the timer on and off as desired.

Display Status of Timer

To display the status of the timer, three keystrokes are required. Press the Date & Time button and release, press the Date & Time button again and release, and press the Timer On/Off button and release to display the current timer status.

Turning Timer On/Off

To change the status of the timer, four keystrokes are required. Press the Date & Time button and release, press the Date & Time button again and release, press the Timer On/Off button and release, and if the timer status is not as desired press the On button to toggle between timer on and timer off status until the desired status is displayed as shown

in the above examples. Release all buttons after selecting the timer status. If no other buttons are pressed for 5 seconds the timer status is set and display will return to the actual temperature.

Setting Start Time

To change the timer start time, press the Date & Time button and release, press the Timer On/Off button once and release. This 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 5 seconds, the display will return to the actual temperature and the new start time is set.

Setting Timer Stop Time

To change the timer stop time press the Date & Time button and release, press the Timer On/Off button and release, press the Timer On/Off button again and release. This will reset the display to 0000. To adjust the stop 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 5 seconds, the display will return to the actual temperature and the new start time is set.

Setting Timer 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 and the remaining four 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.

To change the day of the week, use the Increase and Decrease buttons. Once the desired day is displayed, use the On button to toggle the status of the timer for that day.

Examples of days of week displays

Monday (timer off)	1	. .
Monday (time on)	1	. .
Tuesday (timer off)	2	. .
Tuesday (timer on)	2	. .
Wednesday (timer off)	3	. .
Wednesday (timer on)	3	. .
Thursday (timer off)	4	. .
Thursday (timer on)	4	. .
Friday (timer off)	5	. .
Friday (timer on)	5	. .
Saturday (timer off)	6	. .
Saturday (timer on)	6	. .
Sunday (timer off)	7	. .
Sunday (timer on)	7	. .

Starting with Monday, toggle the schedule status using the On button until the desired status is reached, and then used the Increase button to move to the next day and repeat the process until all days are programed as desired and release all buttons. After 5 seconds, the display will return to the actual temperature and the days for automatic start/stop are set.

Deviation Alarm

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 tank temperature must rise above the set point before the alarm horn will activate. When active and an alarm condition occurs, the Deviation Alarm light illuminates, the alarm horn sounds, and voltage will be at terminal XI on the control board.

Note: There is a 45 minute time deviation alarm delay after initial start-up to minimize the potential for unwanted alarms during initial start-up as the unit brings the system up to operating temperature.

Setting Deviation Alarm Temperature

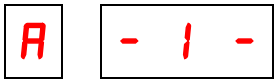
To change the deviation alarm temperature press the Deviation Alarm button and release and use the Increase and Decrease button to change the degrees of deviation from the set point temperature at which the deviation alarm will activate. Once the desired deviation is displayed release all button to set. After 5 seconds, the display will return to the actual temperature and the new deviation alarm is set.

Example of deviation set for 20°F off Set Point temperature

Activating Deviation Alarm

To activate the deviation alarm, press the Deviation Alarm button and release and immediately press the On button and release. After 5 seconds without a button push, the display will return to the actual temperature and the deviation alarm is activate.

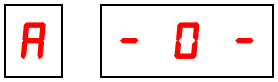
Example of deviation alarm activated



Deactivating Deviation Alarm

To deactivate the deviation alarm, press the Deviation Alarm button and release and immediately press the Off button and release. After 5 seconds without a button push, the display will return to the actual temperature and the deviation alarm is inactive.

Example of deviation alarm deactivated



Tank Temperature 

Pressing the Tank Temperature button shows the current tank temperature in the display.

Password Entry 

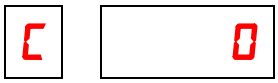
Pressing the Password Entry buttons will allow for secured access to the control program and will prevent unauthorized personnel from making changes. The correct four-letter password will be required to adjust temperatures or timer functions. The password remains in memory even if the power is disconnected.

Entering or Changing Password

To enter or change a password, use the following steps.

1. Press the Off button to stop the unit.
2. Press and hold the C button until the display shows the following. This opens the password menu.

   Example of password menu open

3. Enter four letters in the desire password sequence using the A, B, and C buttons. The controller will count the number of letters entered and will show the number entered in the far right digital display. When all four letters are entered, the display shows the following.

   Example of deviation alarm activated

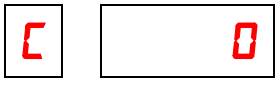
4. Press the Off button to confirm the password.
5. Press the On button to start the unit. The unit will now require a correct password for a change in set point temperature to occur.

Deleting Password

To delete the password, use the following steps.

1. Press the Off button to stop the unit.
2. Press and hold the C button until the display shows the following. This opens the password menu.

   Example of password menu open

3. Press the Off button to clear the password. The display shows the following.

Example of password deleted, no password entered

4. Press the On button to start the unit. The set point temperature can occur without the need for a password.

Pump Status Indicator 

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 Status Indicator 

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

Cooling Status Indicator 

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

Low Level Alarm Indicator 

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

Deviation Alarm Indicator 

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.

Automatic Timer Status Indicator 

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.

Automatic Cool-Down Prior to Stop

The unit features an automatic cool-down function that ensures the unit and the fluid cools down to a safe temperature prior to stopping the unit for maintenance or repair. This function will cool the unit to 122°F before stopping the pump. To activate this function press the Temperature Adjust button, release, and then press the C button. When activated the tank temperature displays with a C in front of it indicating the automatic cooling sequence is active. This sequence will stop at any time if the Stop button is pressed.

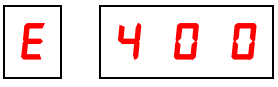
Controller Control Fault Logic

Alarm Condition	Indication
Tank Low Level	Low Level Alarm indicator light on Temperature display flashing Alarm horn on and X1 output powered
Temperature Deviation	Temperature Deviation Alarm indicating light on Temperature display flashing Alarm horn on and X1 output powered
Temperature Sensor Short Circuit	Temperature display flashing Alarm horn on and X1 output powered
Temperature Sensor Disconnected	Temperature display flashing Alarm horn on and X1 output powered

Vacuum Option Cool-Down (Vac units only)

With this option, the unit includes an internal venture and bypass line and a modified version of the automatic cool down function. This works similarly; however, instead of turning the unit off after the cool down is complete it will sound the alarm horn to indicate the unit is ready to be put into the vacuum mode and the pump remains on. To initiate a vacuum cool-down, press the Temperature Adjust button and release and then pressure the On button. When activated the tank temperature displays with a C in front of it indicating the automatic cooling sequence is active. This sequence will stop at any time if the Stop button is pressed.

Example of vacuum option automatic cooling, tank at 400°F



Start-up

Every unit is factory set to deliver oil in accordance with the standard operating specifications for that particular 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. Use a qualified technician to perform the start-up procedure in sequence. The following serves as a checklist for the initial start-up and for subsequent start-ups if the unit is out of service for a prolonged time.

WARNING: This equipment contains hazardous voltages that can cause severe injury or death.

WARNING: This equipment contains hot water or coolant under pressure. Accidental release of hot water or coolant under pressure can cause personal injury and or property damage.

WARNING: This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.

WARNING: The exposed surfaces of motors, piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.

CAUTION: Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance.

CAUTION: Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

CAUTION: Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.

CAUTION: Wire the unit ground in compliance with local and national codes.

Step 1 – Connect Main Power

Connect main power properly ensuring it matches the voltage shown on the nameplate of the unit. Check the electrical phase sequence prior to start-up. Operation of the unit with incorrect electrical phase sequencing will cause damage to components. Check the phasing prior to applying power. The proper sequence is "ABC." If the phasing is incorrect, open the main power disconnect and switch two line leads on the main power terminal blocks (or the unit mounted disconnect). All electrical components are in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals. After making proper power connection and grounding, turn the main power on.

Step 2 – Connect Oil Lines

Check all oil line connections to ensure they are the proper size and are rated for 150 psi at 600°F.

WARNING: Only use hoses and connectors suitable 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 hoses when connecting the unit to the process equipment. Always ensure the unit cooled and the power is off before connecting or disconnecting hoses or fittings.

Step 3 – Connection Cooling Source

Check all cooling source water line connection to ensure they are the proper size and suitable for used with water with a pressure of 50 psi at 250°F. Due to the fact the oil temperatures are typically significantly above the boiling point of water it is possible the return cooling source line may experience some momentary small amounts of steam when the cooling valve opens. This is expected and normal and it is recommend the cooling water supply and return lines are of metal composition (black steel, galvanized or copper).

NOTE: A cooling source inlet filter ships loose in the crate with the unit. Install this in the inlet of the chilled water line before connecting the cooling source line.

Make sure that the cooling source is the appropriate temperature and pressure for your application. In most cases, the cooling source is between 40°F and 85°F. The cooling source fluid pressure must be above the set point of the pressure switch in order for the unit to start. For most applications, the design cooling source supply pressure is between 25 psi and 50 psi.

System Fill Water Chemistry Requirements

The properties of water make it ideal for heat transfer applications. It is safe, non-flammable, non-

poisonous, easy to handle, widely available, and inexpensive in most industrialized areas.
When using water as a heat transfer fluid it is important to keep it within certain chemistry limits to avoid unwanted side effects. Water is a "universal solvent" because it can dissolve many solid substances and absorb gases. As a result, water can cause the corrosion of metals used in a cooling system. Often water is in an open system (exposed to air) and when the water evaporates, the dissolved minerals remain in the process fluid. When the concentration exceeds the solubility of some minerals, scale forms. The life giving properties of water can also encourage biological growth that can foul heat transfer surfaces.

To avoid the unwanted side effects associated with water cooling, proper chemical treatment and preventive maintenance is required for continuous plant productivity.

Unwanted Side Effects of Improper Water Quality

- Corrosion
- Scale
- Fouling
- Biological Contamination

Cooling Water Chemistry Properties

- Electrical Conductivity
- pH
- Alkalinity
- Total Hardness
- Dissolved gases

The complex nature of water chemistry requires a specialist to evaluate and implement appropriate sensing, measurement and treatment needed for satisfactory performance and life. The recommendations of the specialist may include filtration, monitoring, treatment and control devices. With the ever-changing regulations on water usage and treatment chemicals, the information is usually up-to-date when a specialist in the industry is involved. The table below shows the list of water characteristics and quality limitations.

Table 1 - Fill Water Chemistry Requirements

Water Characteristic	Quality Limitation
Alkalinity (HCO_3^-)	70-300 ppm
Aluminum (Al)	Less than 0.2 ppm
Ammonium (NH_3)	Less than 2 ppm
Chlorides (Cl^-)	Less than 300 ppm
Electrical Conductivity	10-500µS/cm
Free (aggressive) Carbon Dioxide (CO_2)†	Less than 5 ppm
Free Chlorine(Cl_2)	Less than 1 PPM
HCO_3^-/SO_4^{2-}	Greater than 1.0
Hydrogen Sulfide (H_2S)	Less than 0.05 ppm
Iron (Fe)	Less than 0.2 ppm
Manganese (Mn)	Less than 0.1 ppm
Nitrate (NO_3)	Less than 100 ppm
pH	7.5-9.0
Sulfate (SO_4^{2-})	Less than 70 ppm
Total Hardness (dH)k	4.0-8.5

† Dissolved carbon dioxide calculation is from the pH and total alkalinity values shown below or measured on the site using a test kit. Dissolved Carbon Dioxide, PPM = TA x $2^{[(6.3-pH)/0.3]}$ where TA = Total Alkalinity, PPM as $CaCO_3$

Table 2 – Recommend Glycol Solutions

Chilled Water Temperature	Percent Glycol By Volume
50°F (10°C)	Not required
45°F (7.2°C)	5 %
40°F (4.4°C)	10 %
35°F (1.7°C)	15 %
30°F (-1.1°C)	20 %
25°F (-3.9°C)	25 %
20°F (-6.7°C)	30 %

CAUTION: When your application requires the use of glycol, use industrial grade glycol specifically designed for heat transfer systems and equipment. Never use glycol designed for automotive applications. Automotive glycols typically have additives engineered to benefit the materials and conditions found in an automotive engine; however, these additives can gel and foul heat exchange surfaces and result in loss of performance or even failure of the chiller. In addition, these additives can react with the materials of the pump shaft seals resulting in leaks or premature pump failures.

WARNING: Ethylene Glycol is flammable at higher temperatures in a vapor state. Carefully handle this material and keep away from open flames or other possible ignition sources.

Step 4 – Fill with Heat Transfer Oil

Fill the unit with heat transfer oil suitable for continuous operation at 575°F. There are many manufacturers of heat transfer oils and each has their own unique qualities. When selecting your heat transfer oil, make sure the manufacturer guarantees performance and suitability for use in this application. We recommend Paratherm NF heat transfer oil. This is available from our Parts Department in 5 gallon (P/N 4203500) or 55 gallon (P/N 9620303) drums.

Step 5 – Start the Unit

To start the unit press the Start button. If the oil level in the reservoir is too low, the display will show **FILL** and the Low Level Alarm Indicator light will turn on. The Low Level Alarm Indicator light will remain on until the oil level is sufficient for operation.

Oil becomes thick and is hard to pump when it is cool. To protect the pump from stress at start-up the unit will only start the pump if the temperature in the tank is above 68°F. If the unit starts and the oil temperature in the tank is below 68°F, the heaters will come on but the pump will not run. When the oil temperature is above 68°F the pump will turn on and the heaters will continue to heat until the oil temperature reaches 85°F. While in the initial heat-up mode the display will only show an **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 status display will show a **I** and remaining digits will show 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 and the unit will enter into normal temperature control mode.

Step 6 – Check Pump Rotation

Check the rotation of the pump by visually confirming the motor shaft rotation matches the directional arrow sticker on the motor case. If the pump is running backwards, switch two of the main power leads, after shutting off the disconnect switch.

Step 7 – Enter Set Point Temperature

To display the Set Point temperature press and release the Temperature Adjust button. This will show the Set Point temperature in the display. If no other buttons are pressed for 5 seconds, the display will return to the actual temperature.

Setting Set Point Temperature

To change the Set Point temperature press the Temperature Adjust button and release to display the current Set Point and then immediately used the Increase or Decrease buttons to change the Set Point until the desired temperature displays. Once the desired Set Point displays, release all buttons. After 5 seconds, the display will return to the actual temperature and the new set point is active.

The unit is now ready for service.

Adjusting Vacuum (Vacuum Units Only)

Some versions of the oil units have a special internal venture and bypass line and an external valve to allow some of the positive pump pressure to go through the venture to create a vacuum on the oil return line. This allows for evaluation of the mold by pulling oil out of the mold.

Step 1 – Initiate a Vacuum Cool-Down Sequence

Units specially constructed to include an internal venture and bypass line feature a modified version of the automatic cool down function. This functions similarly; however, instead of turning the unit off after the cool down is complete it will sound the alarm horn to indicate the unit is ready for the vacuum mode and the pump remains on. To initiate a vacuum option cool-down, press the Temperature Adjust button and release and then pressure the On button. When activated the tank temperature displays with a C in front of it indicating the automatic cooling sequence is active. This sequence stops when the Stop button is pressed..

Step 2 – Adjust Vacuum Valve

The vacuum adjust valve is located on top of the back of the unit. Start by fully closing this valve so that the injector makes a vacuum in the return line from process. The vacuum created will allow air to enter the circuit through any leaks or openings in the mold circuit. Operate the unit until the mold is drained and press the Off button. Remember to open the vacuum control valve to make the unit ready for normal operation.

Preventive Maintenance

Once the unit is in service, we suggest following the maintenance procedures as closely as possible. 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. The following is a list of suggested periodic maintenance.

Once a Week

1. Check to make sure that the To Process temperature is reasonably close to the Set Point temperature. If the temperature stays more than 5°F away from the set point, there may be a problem with the unit. If this is the case, refer to the General Troubleshooting section of this manual or contact our Customer Service Department.

2. Check the pump discharge pressure. Investigate further if the pressure starts to stray away from the normal operating pressure.

3. Check the pump for leaks in the seal area. Replace pump seal if necessary.

Once a Month

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

4. With the main power shut off, 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 temperature control 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.

General Troubleshooting

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 the Customer Service Department
No oil circulation, even though the pump is rotating	Pump is rotating in the wrong direction	Switch two of the incoming power leads
	Process oil lines clogged	Clean lines
The unit does not heat	Contactor defective	Replace contactor
	Control board defective	Replace control board
	Heating element defective	Replace heating element
	Safety fuse defective	Replace safety fuse
	Temperature sensor short or disconnected	Replace or connect sensor
The unit does not cool	Cooling solenoid valve defective	Replace solenoid valve
	Cooling heat exchanger clogged	Clean coil
	Control board defective	Replace control board
	Temperature sensor short or disconnected	Replace or connect sensor
The unit cooling all the time	Dirt in the cooling solenoid valve	Clean valve, replace if required
	Control board 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

Drawings & Charts

Figure 1 – Pump Curve (60 Hz)

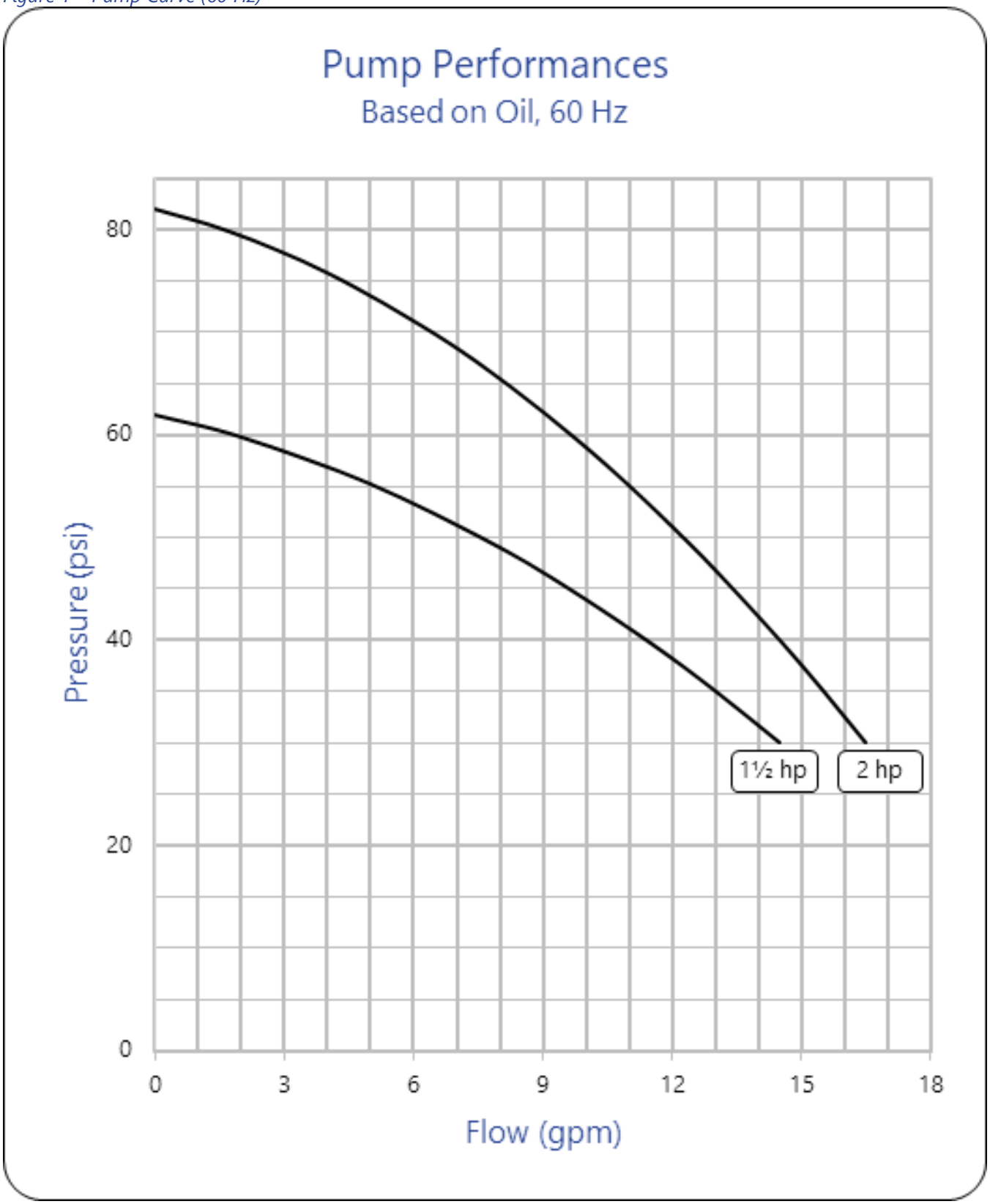


Figure 2 – Cooling Capacity

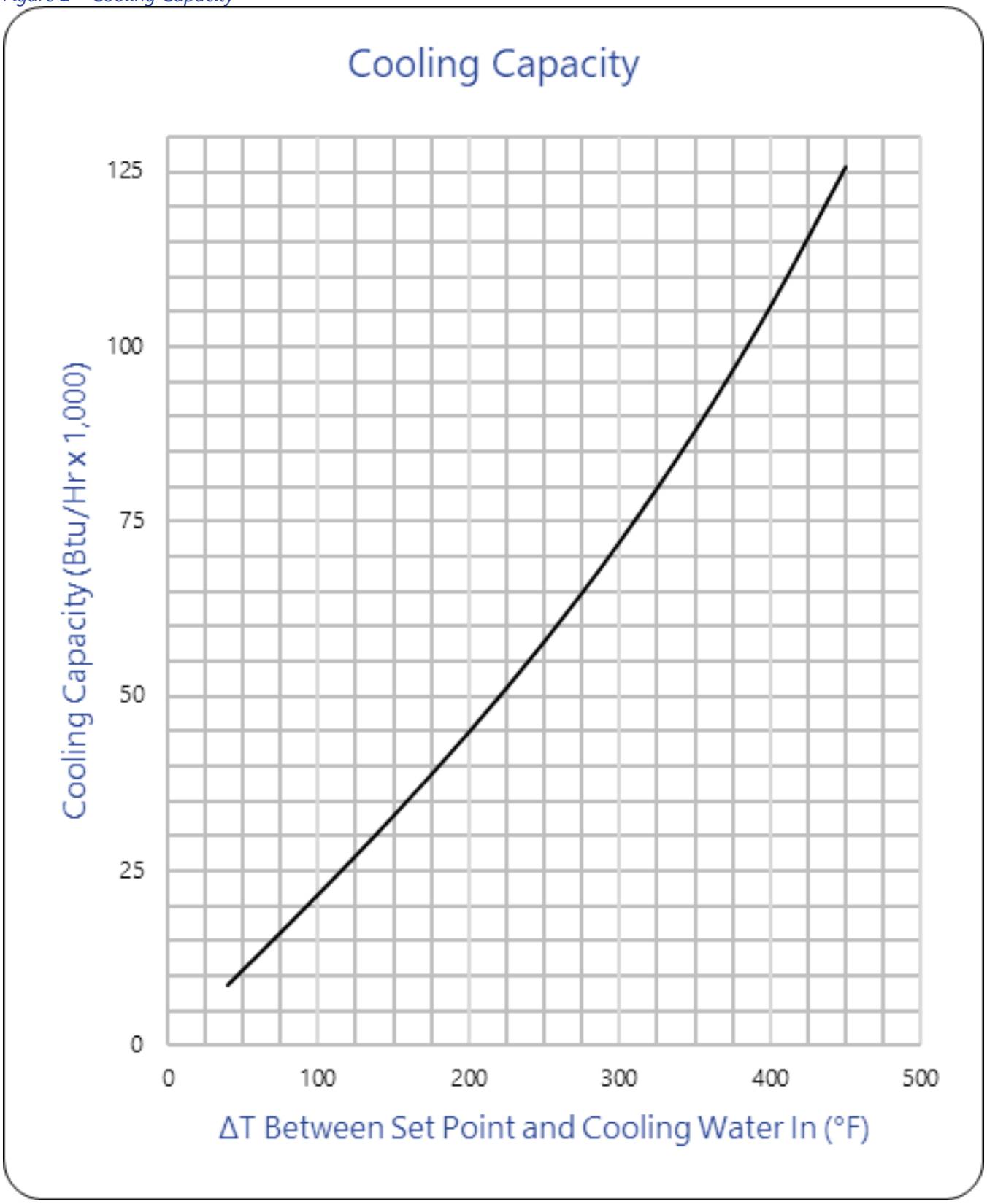


Figure 3 –High Voltage Wiring Diagram

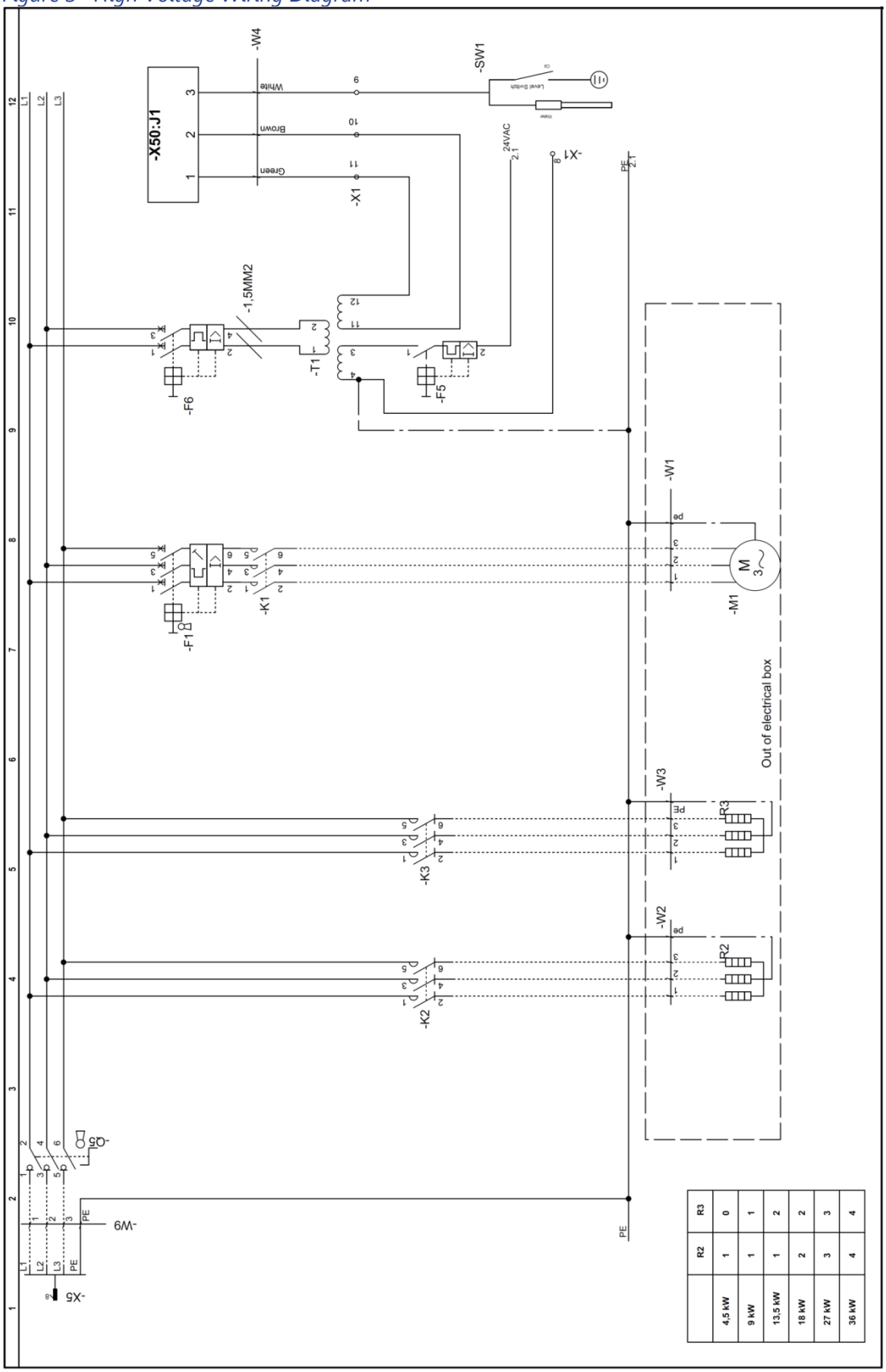


Figure 4 – Low Voltage Wiring Diagram

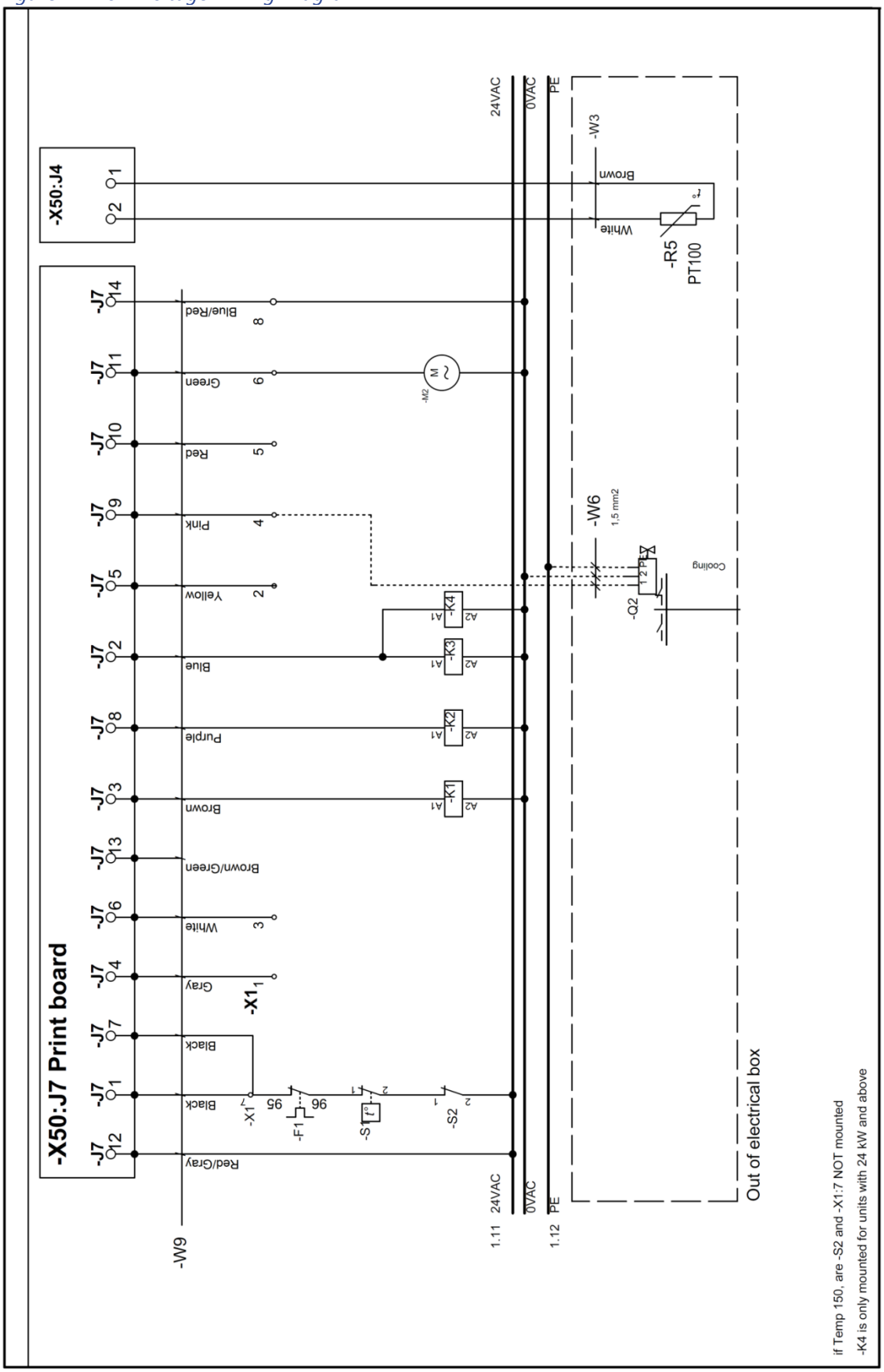
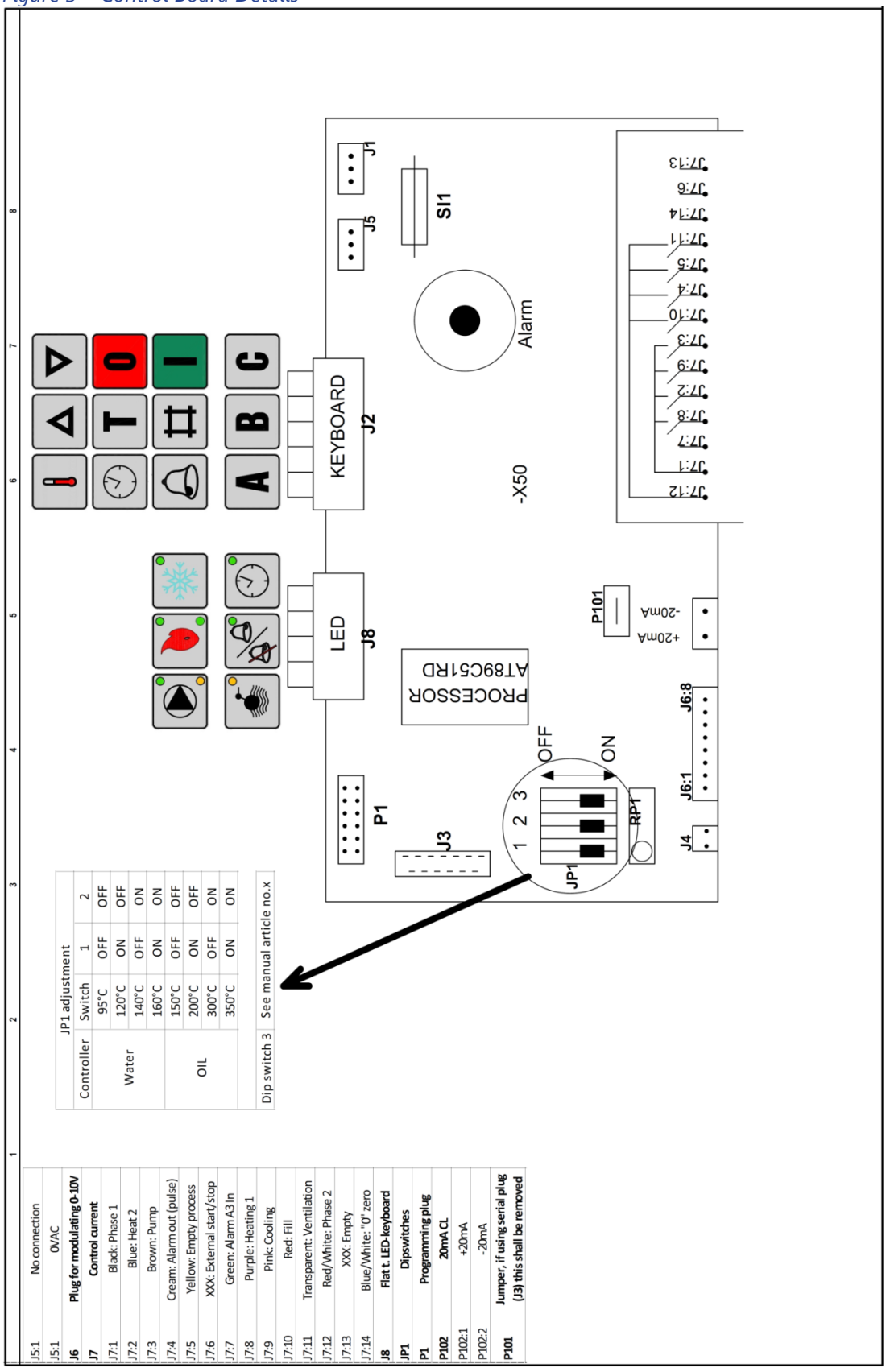


Figure 5 – Control Board Details



J5:1	No connection
J5:1	0VAC
J6	**Plug for modulating 0-10V**
J7	**Control current**
J7:1	Black: Phase 1
J7:2	Blue: Heat 2
J7:3	Brown: Pump
J7:4	Cream: Alarm out (pulse)
J7:5	Yellow: Empty process
J7:6	XXX: External start/stop
J7:7	Green: Alarm A3 In
J7:8	Purple: Heating 1
J7:9	Pink: Cooling
J7:10	Red: Fill
J7:11	Transparent: Ventilation
J7:12	Red/White: Phase 2
J7:13	XXX: Empty
J7:14	Blue/White: "0" zero
J8	**Flat t. LED-keyboard**
JP1	**Dipswitches**
P1	**Programming plug**
P102	**20mA CL**
P102:1	+20mA
P102:2	-20mA
P101	**Jumper, if using serial plug (J3) this shall be removed**

JP1 adjustment			
Controller	Switch	1	2
Water	95°C	OFF	OFF
	120°C	ON	OFF
	140°C	OFF	ON
	160°C	ON	ON
OIL	150°C	OFF	OFF
	200°C	ON	OFF
	300°C	OFF	ON
	350°C	ON	ON
Dip switch 3	See manual article no.x		

Figure 6 – Heating Element Details

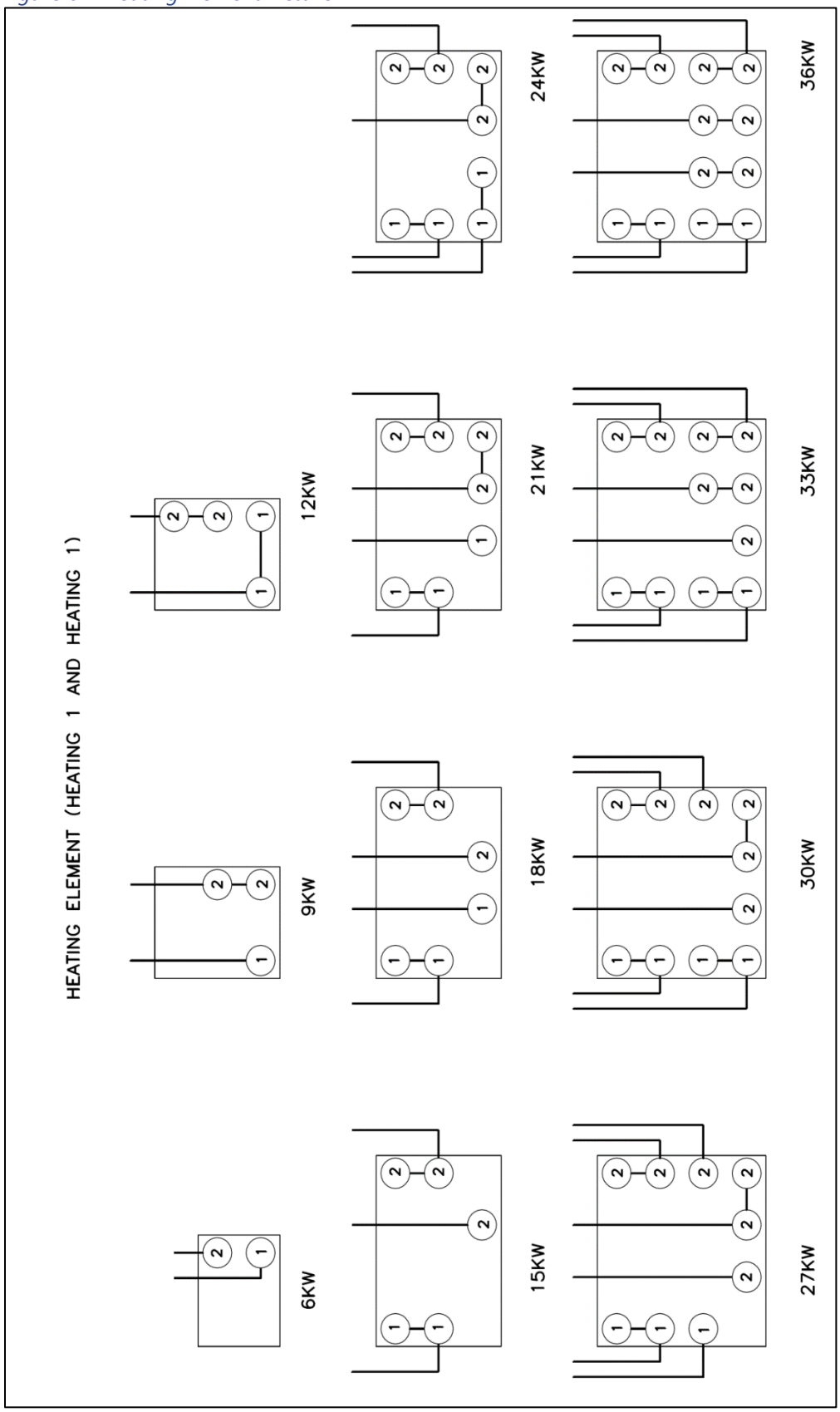
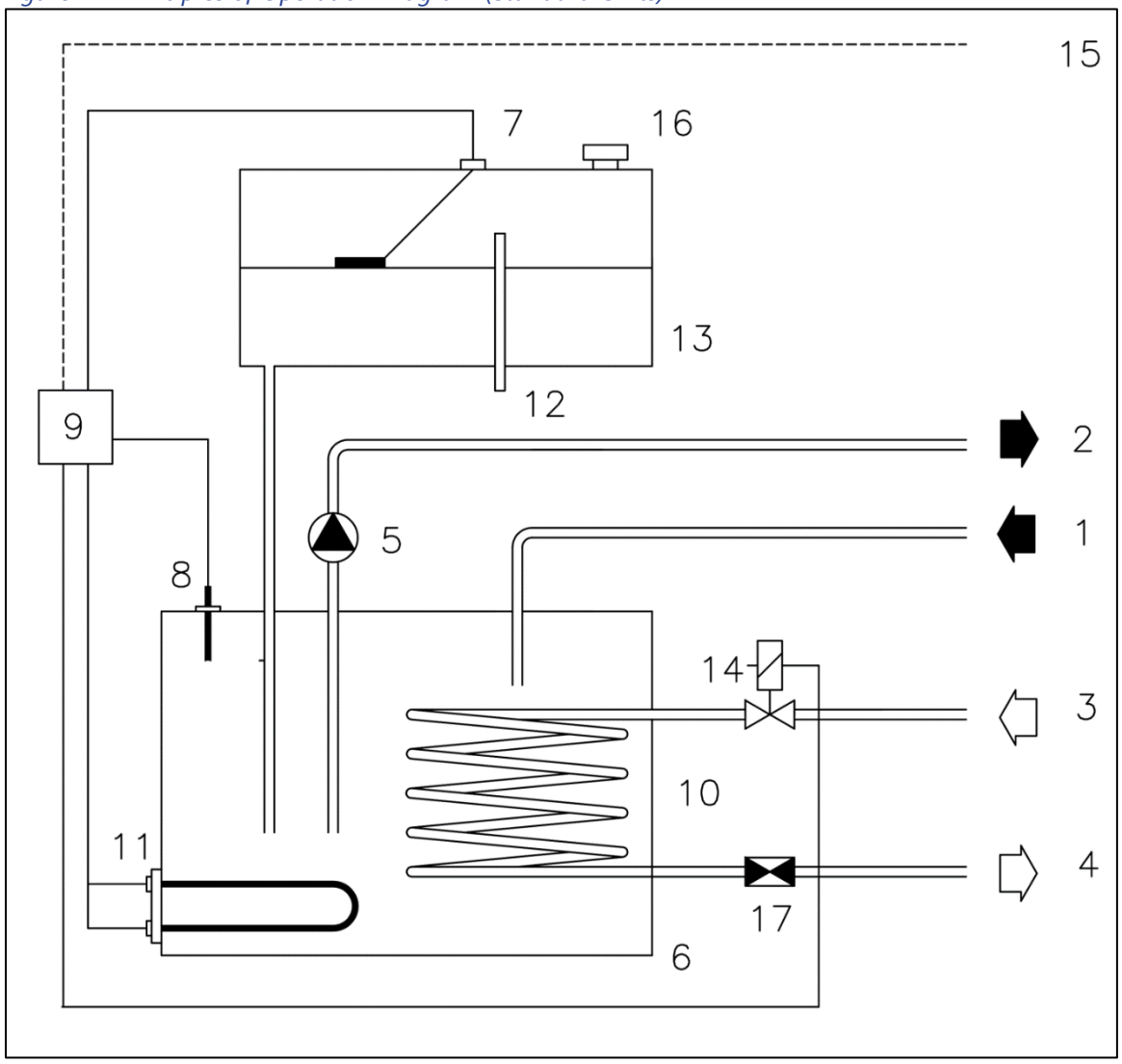
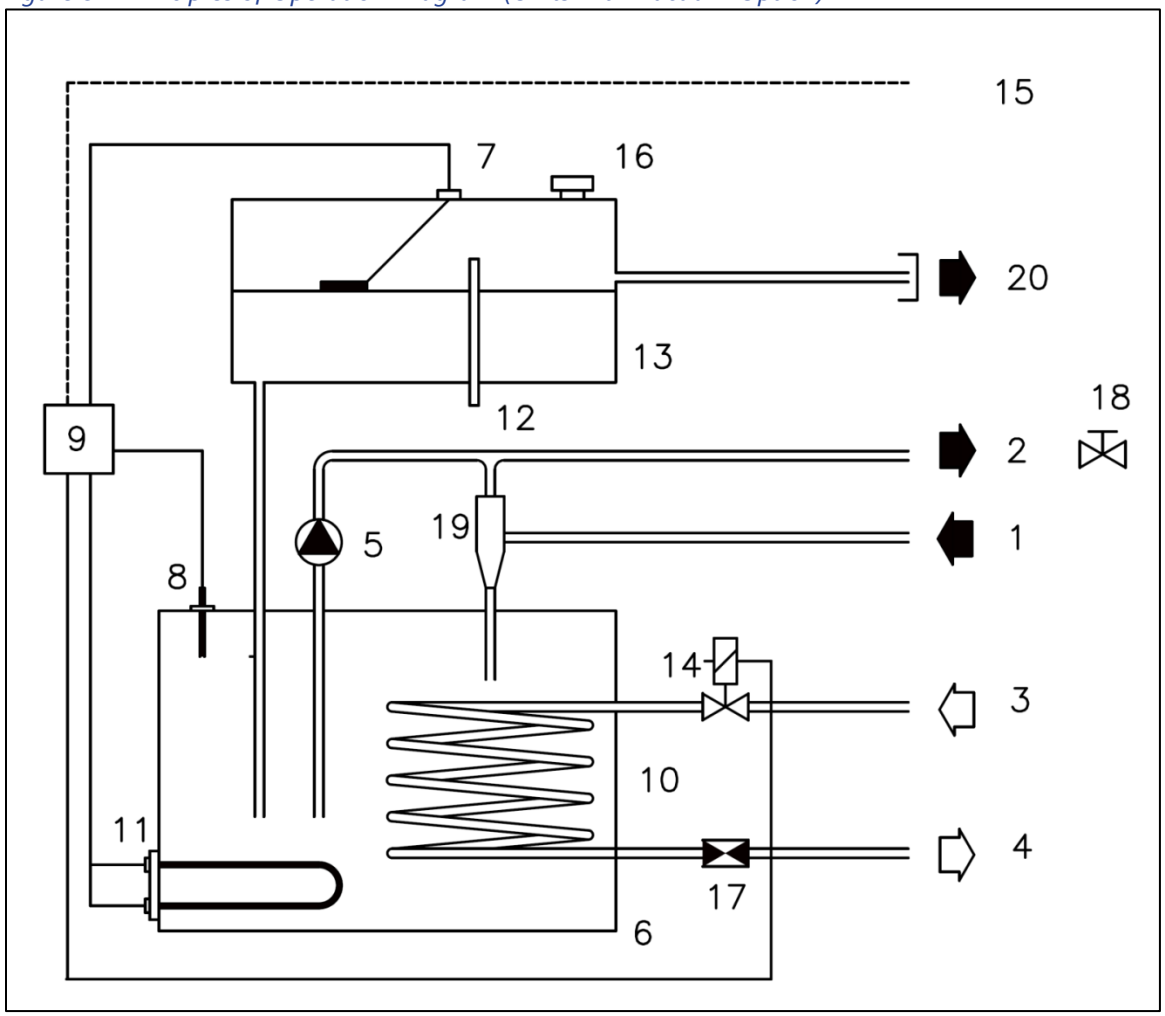


Figure 7 – Principles of Operation Diagram (Standard Units)



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

Figure 8 – Principles of Operation Diagram (Units with Vacuum Option)



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)

Notes

5680 W. Jarvis Ave. • Niles, IL 60714
847-966-2260 • info@thermalcare.com
www.thermalcare.com

New Equipment Sales
847-966-2260 • 847-966-9358(fax)
info@thermalcare.com

Customer Service
847-966-2636
service@thermalcare.com

Parts Department
847-966-8560 • 847-966-9358(fax)
tcparts@thermalcare.com