DIVERSIFIED HEAT TRANSFER INC.

Installation, Operation, and Maintenance Manual

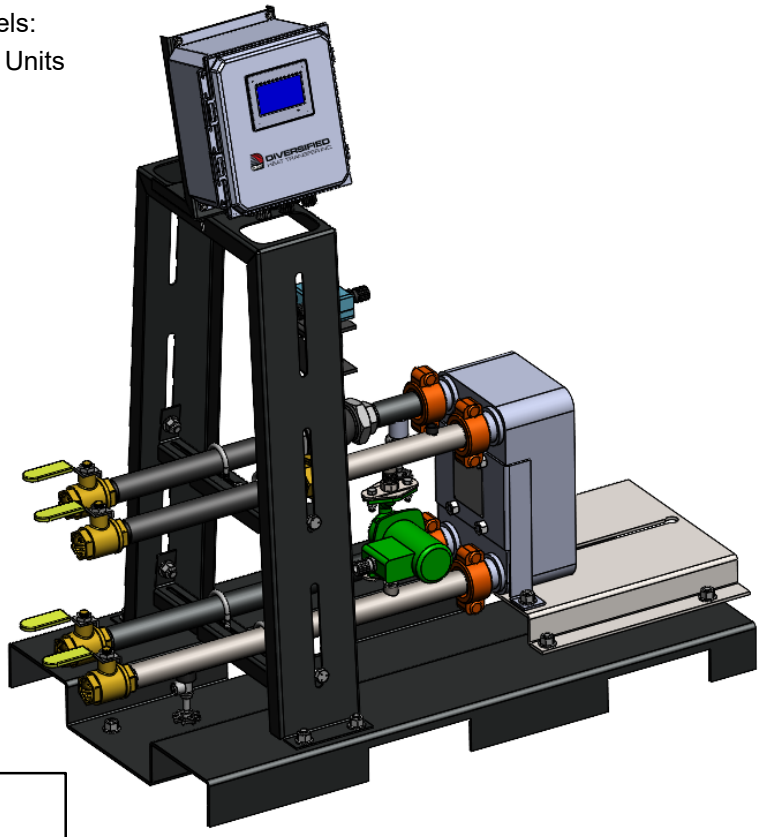
SPC Series

Indirect Fired, Semi-Instantaneous, Liquid to Liquid Cooler

(Brazed Plate units)

This manual applies to the following models:

- SPC Series Single Wall Brazed Plate Units



DHT SPC SERIES LIQUID COOLER

CONTRACTOR / FACILITY DATA

NOTE: This user manual must always accompany the specific unit as recorded below:

Model #: _____

Serial #: _____

Install Date: _____

Latest Update: 10/15/2024

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SECTION 1: GENERAL INFORMATION

1.1 INTRODUCTION

The purpose of this manual is to provide an installation, operation, and maintenance procedural guide for the SPC Series Liquid to Liquid cooler, which includes the following models:

- SPC Series Single Wall Brazed Plate

These are Chilled Water to process water units.

1.2 DESCRIPTION

The Diversified Heat Transfer SPC Series Liquid to Liquid Coolers are the engineered solutions for facility owners/managers who need water-to-water heat transfer solution in a small space. They are constructed of carbon steel piping to ensure long, leak-free operation. Each liquid to liquid cooler is equipped with a control panel, 3-way control valve, and fittings etc., which makes it ideal for new and retrofit installations.

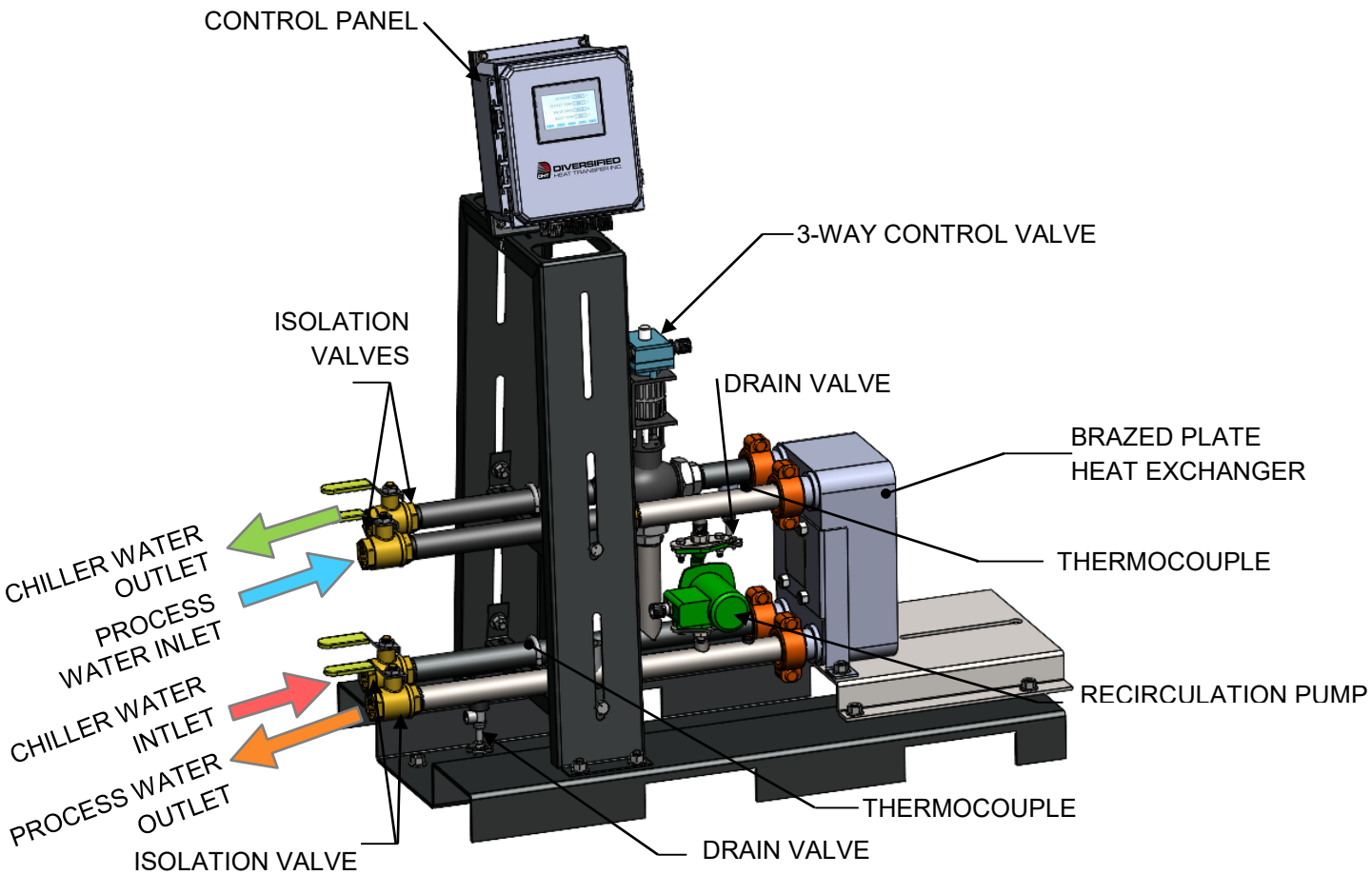


FIGURE 1.2: SPC Series Component and Function Diagram (Brazed Plate Heat Exchanger Shown)

The units are engineered using chilled water as the cooling medium Because the liquid cooling systems feature a compact plate heat exchanger, they require less floor space, making them perfect for mechanical rooms where space is limited.

1.3 FEATURES

- Compact design to fit in small mechanical rooms and standard doorways
- Complete packaged system with components engineered to specific application requirements
- Energy efficient
- High recovery
- Stainless steel plates
- Single Wall Brazed Plate construction heat exchanger
- ASME compliance heat exchanger

1.4 APPLICATIONS

SPC Series units are used in wide range of liquid cooling applications including either new construction or replacement of existing units. Most common application examples include:

- Liquid Cooling
- MRI Cooling
- Hospitals/medical centers/nursing homes
- LINAC Cooling
- Schools/colleges/universities/dormitories
- Factories/industrial facilities
- Research Facilities

NOTE:
Contact your DHT sales representative or DHT factory to determine if any applications-related information is required.

1.5 ENERGY SOURCES

DHT SPC Series liquid coolers are engineered and manufactured to use one of the following energy sources to produce cooler process water:

- Chilled Water

1.6 DESIGN CONDITIONS

DHT has design, engineering, and manufacturing capabilities to produce products to satisfy a wide range of our customer requirements. DHT standard design conditions for SPC Series units are:

Design Pressure, PSIG	**200**
Design Temperature, °F	**250**

NOTE:
Consult the design specifications for the unit or the name plate attached to the unit for maximum pressure

1.7 CONSTRUCTION

All DHT SPC Series units are designed and manufactured from superior materials of highest quality. Each unit meets or exceeds requirements of ASME Section VIII, Div.1 Code.

Heat exchangers: Heat exchangers are available in brazed plate constructions. Plates are stainless steel construction and available in single-wall plates configurations.

Controls and trim: DHT SPC Series units are equipped with electronically activated fully modulating 3-way control valves and feed forward controls which offer tight temperature control performance in water cooling applications. DHT SPC Series units are equipped with an advanced control panel with touchscreen user interface display, easy adjustable set points, and set points for safety alarm system, if it is required a data port for a communication with Building Management System. Backup LCD display on PID controller is also available behind the front door.

Standard package also includes water piping and recirculating water line with circulator.

Fabricated skid package includes single point inlet and outlet piping connections to produce process water using chilled water. Carbon steel construction piping manifolds including fittings and accessories.

1.8 SAFETY

1.8.1 Operating Precautions

In order to achieve maximum performance from the unit, the precautions and procedures described below must be strictly followed:

- The unit should be installed, operated, and serviced only in accordance with the information in this manual.
- The unit should be installed according to designs prepared by qualified facility engineers, including those of a structural, mechanical, electrical, or other applicable disciplines.
- The unit should not be operated or serviced until a safety training program has been established by the customer.
- The unit should be operated and serviced only by qualified technical personnel in accordance with all applicable codes, laws, and regulations.
- The unit must be used according to the specification given to DHT.
- Pressure and temperatures should not exceed limits indicated on the DHT name plate attached to the unit.
- For initial startup refer to all instructions in **Section 3.7: Unit Startup Procedures**.
- The cooling and heated liquids should be free from any debris.
- The unit should operate only with liquid that it was designed for.
- The system should be designed to prevent the unit from encountering pressure shocks.
- All strainers should be installed ahead of on the unit should be periodically cleaned as per DHT maintenance schedule. (See Recommended Inspections Time Interval).
- Refer to **Section 2.6: Electrical Connections** for proper grounding of the unit.

1.8.2 Storage and Transportation

The units should be stored in a clean place away from a corrosive environment or weather elements (e.g. rain, snow), preferably indoors and maintained between 32°F and 110°F ambient operating temperature. During transportation, ensure that they are not exposed to mechanical damage. Units should not be exposed to cold or hot temperatures beyond those specified by DHT.

1.8.3 Safety Features

The customer is responsible for maintenance of the safety features of the SPC Series liquid cooler such as guards, safety labels, safety controls, interlocks and lockout devices.

1.8.4 Safety Notation

In this manual there will be four levels of important note types in regards to those accompanying the text of this document. Note headers will appear as shown and described below:

NOTE:
Important information, but not associated with safety practices.

CAUTION!
Indicates potential safety concerns, possible material damage, and unsafe practices that may lead to damage of property, injury or death.

WARNING!
Indicates a potential health hazard that *MAY* lead to injury or death.

DANGER!
Indicates an immediate health hazard that *WILL* lead to injury or death.

1.8.5 Proper Training

Proper training is the best protection against accidents. Operating and service personnel must be thoroughly familiar with the basic construction and operation of the SPC Series semi-instantaneous liquid cooler and all applicable safety precautions. If any of the provisions of this manual are not fully and completely understood, contact DHT technical service for advice and information. Please have the serial number of the unit available. The serial number is located on the name plate attached to the front of the unit below the control panel.

1.8.6 Safety Precautions

DANGER!

- ***WATER TEMPERATURES OVER 125ºF CAN CAUSE SEVERE BURNS INSTANTLY, OR DEATH FROM SCALDS.***

- **Children, disabled persons, and the elderly are at the highest risk of being scalded.**
- **See instruction manual before setting temperature at liquid cooler.**
- **Feel water before bathing or showering.**
- **Contact DHT technical support at 800-221-1522 for more information.**

WARNING!

- Liquids under pressure may cause injury to personnel or damage to equipment when released. Be sure to shut off all incoming and outgoing water shutoff valves. Carefully decrease all trapped pressures to zero before performing maintenance.
- Before attempting to perform any maintenance on the unit, shut off all electrical power to the unit from an exterior switch.
- Electrical voltages up to 120 VAC may be used in this equipment; therefore, the front panel door on the unit's power box must be closed at all times, except during maintenance and servicing.
- A three-pole switch must be installed on the electrical supply line of the unit. The switch must be installed in an easily accessible position to quickly and safely disconnect electrical service. Do not affix switch to any part of the liquid cooler itself.

CAUTION!

DO NOT use this unit if any part has been under water. Call a qualified technician to inspect and replace any part that has been under water.

SECTION 2: INSTALLATION INSTRUCTIONS

CAUTION!

In order to maintain the warranty on the SPC Series liquid cooler, the startup must be completed within six (6) months of shipment, and the start-up report must be furnished to DHT within thirty (30) days of the startup. The warranty may be found in Section 7, and the Startup and Installation forms can be found in Section 6.5.

WARNING!

- INSTALLER MUST COMPLY WITH STARTUP AND INSTALLATION INSTRUCTIONS TO AVOID A DANGEROUS SITUATION.
- Startup and installation forms MUST be submitted to a DHT representative or risk loss of coverage under warranty.
- The inspection log must be maintained and up-to-date and kept in close proximity to the SP Series unit for inspection of DHT personnel.

NOTE:

The startup must be performed by DHT factory personnel or a factory authorized representative.

2.1 RECEIVING, HANDLING, AND STORAGE

SPC Series liquid cooler base frame is designed in such a way that they can be carried from all four directions using forklifts or pallet jacks provided. The unit must be properly supported over the forks, as indicated by the arrows in Figure 2-1.

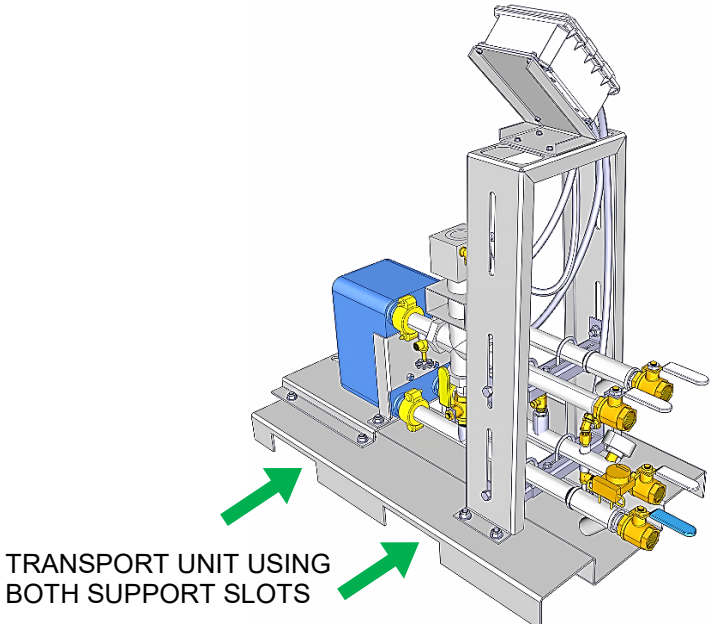


FIGURE 2-1: Support Slots for Transport

2.1.1 Examining the Unit

SPC Series liquid coolers are thoroughly inspected and tested prior to shipment. Upon receipt of the SPC Series liquid cooler, please carefully inspect the entire unit and its components for any damages during shipping. If any evidence of damage is detected that could affect the safe operation of the unit, contact DHT or the authorized sales representative to report the damage and to receive instructions on how to proceed.

After the inspection has been completed, we advise that all pressure and control components be checked to assure that they meet design specifications, the name plate and the specification tags. In case of any discrepancy, contact DHT or an authorized sales representative, before proceeding with the installation.

2.1.2 Compliance with Codes

The SPC Series liquid cooler is constructed and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII – Division 1. Other codes or approvals which apply will be labeled on the SPC Series liquid cooler.

The SPC Series liquid cooler installation must be performed only by technically qualified persons. The installation must conform to all national, state, or provincial and local code requirements established by the authorities having jurisdiction as well as specific instructions in this manual. Authorities having jurisdiction should be consulted before installations are made.

2.2 SITE PREPARATION

- A firm and level foundation is required (a six- to eight-inch thick concrete pad is preferable).
- Secure the SPC Series liquid cooler to the building floor or mounting pad. For attachment to the foundation, use the four holes in the base.

NOTE:
Seismic anchorage information is available upon request. Contact your DHT sales representative for more information.

- Proper rigging techniques should be followed while moving unit around.
- The SPC Series liquid cooler must be plumb and level to function properly.
- The SPC Series liquid cooler should be placed with at least 12” headroom clearance.

2.3 INSTALLATION CLEARANCES AND UNIT DIMENSIONS

The SPC Series minimum acceptable clearances are shown in Figure 2-1 and dimensions are shown in Figure 2-2a and 2-2b. The minimum clearance dimensions are indicated in the drawings. However, if local building codes require additional clearances, the local building codes shall supersede these requirements.

All water piping and electrical conduit or cable must be arranged so that they do not interfere with the removal of any panels, or inhibit service or maintenance of the unit.

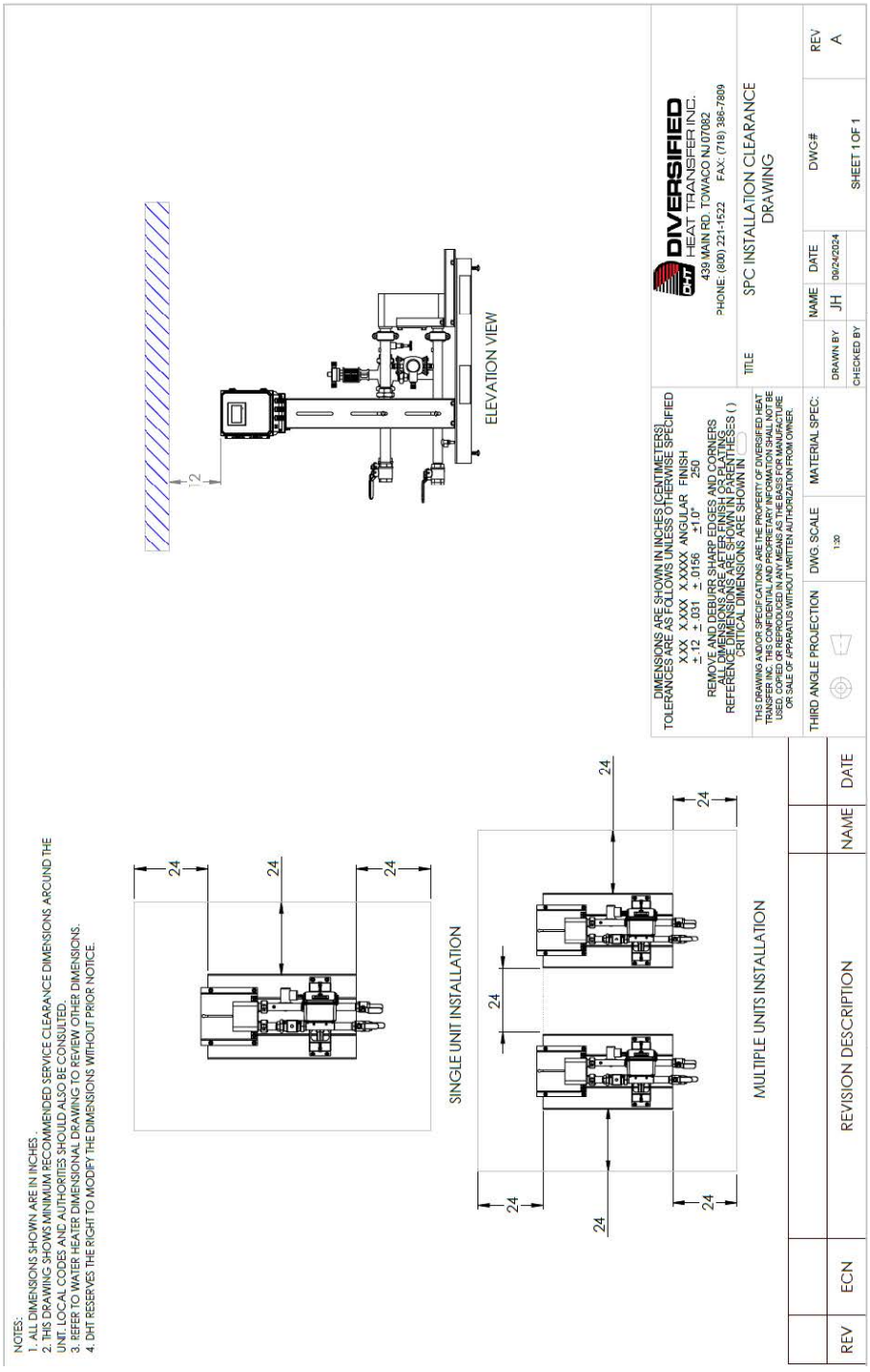


FIGURE 2-1: SPC Series Installation Clearance Drawing

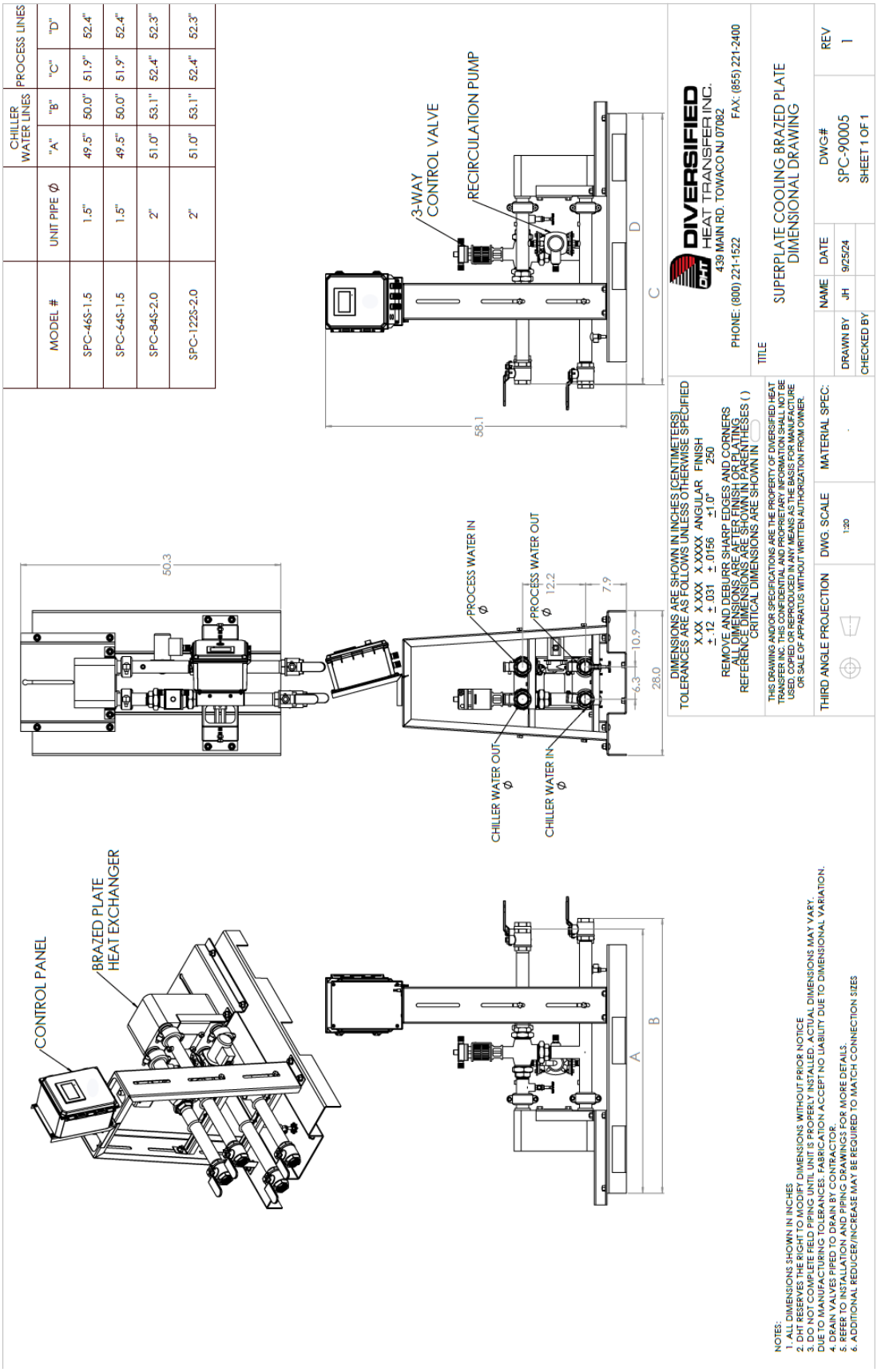


FIGURE 2-2: SPC Series Brazed Plate Dimensional Drawing

2.4 UNIT PLACEMENT

The unit should be mounted to the suitable floor, concrete pads, or structural construction, following DHT guidelines and applicable architectural and local code requirements to assure the safe operation of the unit.

NOTES:

1. Proper rigging techniques should be followed while moving heavy equipment.
2. Maintain proper levels in order for the unit to function properly and follow clearance, dimensional, and applicable piping drawings.

CAUTION!

Refer to **Section 2.5 Piping Installation and Unit Connections** for piping and installation instructions. SPC Series units must be installed to permit relief valve drain per local codes.

2.5 PIPING INSTALLATION AND UNIT CONNECTIONS

SPC Series units can be installed in various liquid applications within the rated temperature and pressure conditions. Refer to Section 6.3 for appropriate Piping and Installation Drawings per your application requirements before making piping connections. CAD drawings are also available on the DHT website for layout specification. If any special application help is needed, please call your local DHT representative or DHT factory for specific application information.

NOTE:
Also consult local codes and authorities in addition to DHT typical Piping and Installation Drawings.

- **Liquid piping:** The exact location of water inlet and outlet ports of the unit, as well as pipe diameters and thread/flange size, can be determined for the drawing supplied with the unit. Properly sized water lines should be connected to the unit. All piping and fittings should be clean and free of debris. It is important that the piping systems are balanced when two or more units are in parallel in order to achieve the combined capacity and proper temperature control. Refer to typical Piping and Installation Drawings in Section 6.3. The most up-to-date drawings are available at www.dhtnet.com.
- **Chilled water piping:** Chilled water inlet and return piping to be sized per given flow rates to the control valve.

  CAUTION!
  High temperature water can present a very dangerous situation because of the high pressures and temperatures. Follow all mandatory and recommended procedures and safety rules to avoid any hazardous situation.

  All valves on the source line should be closed during the installation process. Connect the energy source to the piping leading to the control valve. Determine the exact location of the inlet connections and piping size using the drawing of the unit. Refer to typical Piping and Installation Drawings in Section 6.3.
- **Drain discharge piping:** All DHT SPC Series units are equipped with drain connections.

They should be piped directly to a safe drain according to appropriate plumbing codes as explained in Piping and Installation Drawings in Section 6.3.

2.6 ELECTRICAL CONNECTIONS

All field wiring connections for power and controls are inside the control panel at the front of the SPC Series liquid cooler. The wiring label is attached to the inside aluminum door of the control box. An external electrical disconnect (not supplied with the liquid cooler) with adequate overload protection is required. The liquid cooler must be grounded in accordance with national, state or provincial, and local codes.

Connect the system to the correct voltage. The SPC Series liquid cooler requires 120V AC, 15Amp service with ground (H, N, G) supplied from a suitable circuit breaker or fused disconnect. The circulation pump has a 120V constant speed fractional HP motor that operates continuously when the power to the unit is on.

Refer to **Section 6.4** for standard electrical wiring drawings/schematics/terminal block connections.

CAUTION!

All electrical wiring must be in accordance with all local, state, and national codes that apply. Do not exceed the rated current of the D.C. power supply (100MA) or the form 'C' relay outputs (5A/240VAC resistive).

WARNING!

Hazardous voltages are present within the enclosure. Installation or service should be carried out only by trained personnel.

CAUTION!

Do not operate the pump without water in the unit! Do not turn on power before filling with water! Failure to do so can cause damage to the pump.

2.7 WATER QUALITY

- Before piping the unit into the system, the system must be thoroughly flushed to remove sediment, flux, filings, and other foreign matter. The heat exchanger can be damaged by build-up of corrosion due to sediment.
- The manufacturer cannot be held responsible for any damage caused by incorrect use of additives in the system.
- Mineral buildup in the heat exchanger reduces heat transfer, overheats the heat exchanger, and causes failure. Leaks in the cooler or piping must be repaired at once. Leakage of water is unsafe and needs to be repaired immediately.
- Air elimination is extremely important from the water system. Ensure proper air vents are installed in the piping systems that are prone to trap air pockets.
- Consider using water hammer arrestors or an expansion tank to dampen the spikes in water pressure since water hammering can lead to premature failure of the unit.
- Water hardness contributes to the formation of scaling, which impacts the performance of the cooler exchanger and may lead to premature heat exchanger failures. Water softening may be required if it is high.
- Do NOT use artificially softened water since artificial softening agents generally use salt, which causes corrosion of the heat exchanger and piping components. Do NOT use deionized water.
- Elevated chloride levels in water accelerate corrosion of the heat exchanger and piping system materials.
- The pH must always be within the acceptable limits of the heat exchanger.

NOTES:
- Consult DHT factory before using SPC Series units for any other non-standard applications.

SECTION 3: OPERATION AND CONTROLS

3.1 INTRODUCTION

This chapter provides information and instructions for following topics:

- SPC Series functional description
- Preparation of unit for operation
- Unit startup procedure instructions
- Unit shutdown procedure instructions
- Controller overview & startup settings

3.2 SPC SERIES FUNCTIONAL DESCRIPTION

DHT's SPC Series units are engineered using chilled water as the cooling medium. Heat exchanger is either available in both brazed plate and plate. SPC Series incorporates the proven DHT PID controller coupled with the high efficiency brazed plate heat exchangers. The DHT SPC Series liquid cooler is designed to satisfy water cooling needs in commercial and institutional environments. The packaged system utilizes simple, easy-to-understand, real-time load tracking and responsive controls to maintain accurate hot water temperatures under various load patterns. DHT SPC Series can be coupled with chillers with wide range of operating temperature ranges to achieve high efficiency within an optimized space. The control system features temperature sensors installed on inlet and outlet piping, transmitting a millivolt signal through quality twisted shielded wiring. The signal transmits directly into the DHT designed PID controller which, in turn sends a 4-20 MA signal to the electrically activated three-way control valve to achieve accurate temperature control over various demand situations.

The SPC Series can efficiently produce cooler water depending upon the temperature rise and available chiller water temperature and flow rate. Skid mounted with a state-of-the-art PID control panel with touchscreen user interface, brazed plate or plate and frame heat exchanger, electric three-way control valve and non-ferrous circulator pump.

Easy removal of heat exchanger via flanged or Victaulic connections allow the complete removal of the heat exchanger without disturbing the liquid cooler piping. Isolation valves, backflush connections provided for scheduled maintenance.

Cold water enters the heat exchanger through the cold water inlet connection (as shown in Figures 3-1a and 3-1b). It is distributed over the plates in the heat exchanger and flows downwards. Cooler water then exits the heat exchanger from the process water outlet connection on bottom of the unit. Unit also includes a constant speed recirculation pump which continuously circulates the process water through the heat exchanger to ensure there is always cold water present in case of demand. The cold water supply temperature is maintained by either electronic operated 3-way control valve.

Chilled water enters the heat exchanger through the inlet connection located on the bottom and flows upwards to have counter flow arrangement for effective heat transfer. Control valve which is modulated by the 4-20 mA output from the controller, depending upon the reading from the temperature sensor on the process water outlet of the heat exchanger. Unit employs closed loop feedback control system to maintain target temperature set point in tight range. Chilled water exits through the outlet connection on the top of the heat exchanger as shown. Flow rate of cooling medium is modulated to maintain the desired set point in varying load conditions.

The control panel can be rotated 180 degrees to orient the control surface in the desired direction.

CONTROL PANEL

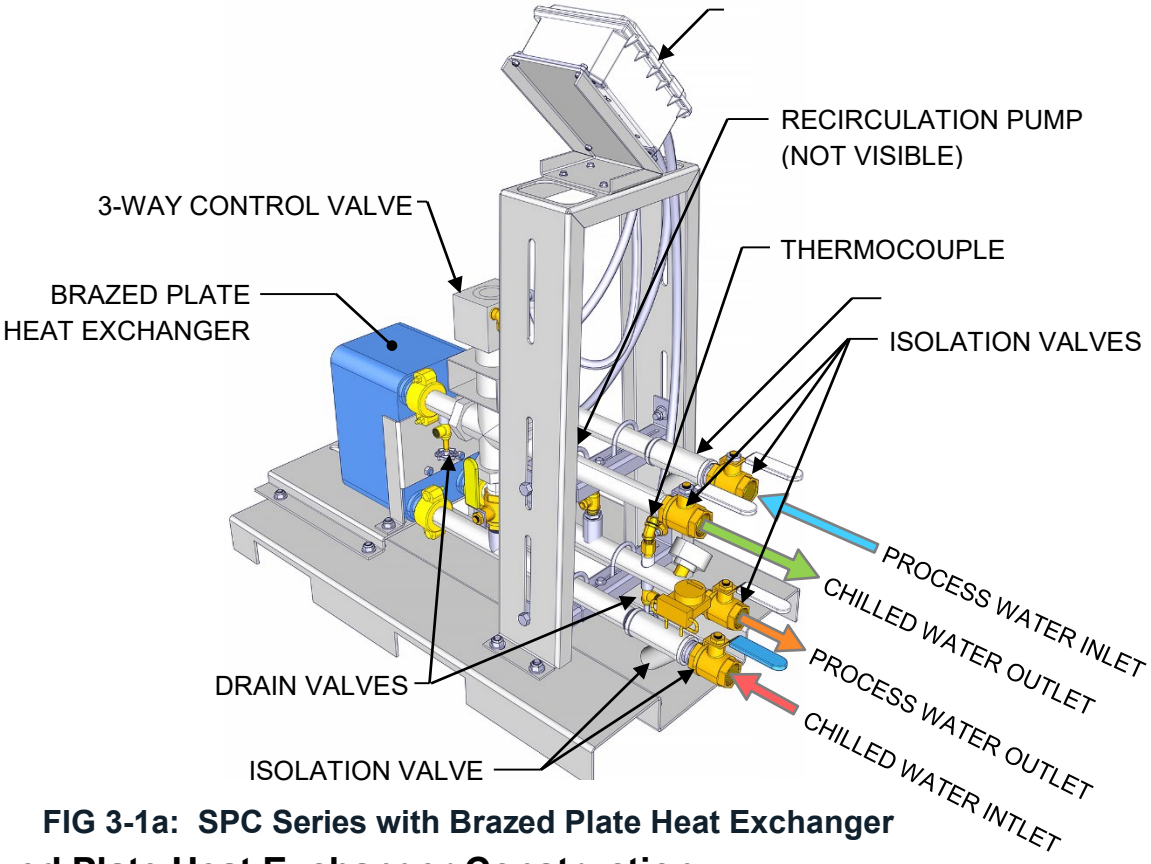
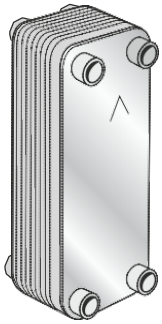


FIG 3-1a: SPC Series with Brazed Plate Heat Exchanger

3.2.1 Brazed Plate Heat Exchanger Construction

Although there is no disassembly possible for brazed plate heat exchangers, it should be understood that they do essentially work the same way as plate and frame heat exchangers, and can come configured in a number of ways.

Brazed plate heat exchangers are constructed as modules in the configuration desired. They can be cleaned with cleaning agents and Clean-In-Place procedures, but are not disassembled for maintenance or plate replacement. They are replaced at the effective end of service life.



See below for instructions for replacing the brazed plate heat exchanger module in the SPC Series liquid coolers.

NOTE: Optional heat exchanger insulation is available.

3.3 Safety Controls

Automatic over-temperature limit function is included, which will cut off electricity supply to the fail-close control valve during over temperature condition. Power supply is restored to the control valve when the unit goes back to normal operating temperature conditions.

The unit includes alarm functionality in the safety controls. A red light turns on when the hot water temperature reaches the alarm setting, and its warning message starts flashing in red

color on the HOME screen. In the next step, the power supply to the control valve is interrupted, causing it to close. Hot water outlet piping includes pressure and temperature relief valve to release high temperature hot water to safe drain in order to protect the unit. When the unit goes back to normal operating temperature conditions, unit status changes to green color and the alarm message disappear from screen display. Power to the control valve is restored, and the unit goes back into normal operation.

3.4 3-Way Control Valve

Two types of 3-Way Control Valves are available, one with NPT connections of up to two inches (2") in size, and one with larger sized flanged connections. Both are shown in Figure 3-3.

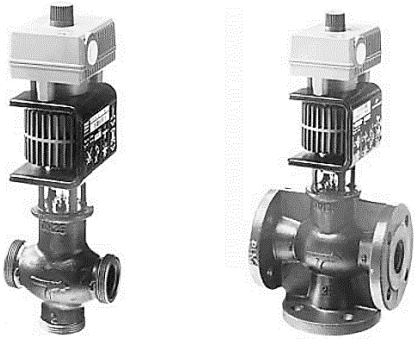


FIGURE 3-3: 3-Way Control Valves with NPT (left) and Flange Connections (right)

3.4.1 Performance Data (3-Way Control Valve)

- SPC Series liquid coolers include MXG-461 3-Way Control Valve actuators.
- Control valve modulates the flow of boiler/HTHW through the heat exchanger based upon the signal from the controller to maintain DHW supply temperature to target setpoint.
- Valve is fast positioning: < 2 seconds
- High rangeability: (1000:1)
- Low leakage rates: Leakage at ΔPv = 14.5 psi (0.1 Mpa) (1bar).
  - A → AB Max. 0.02 % Cv (to IEC534-4).
  - B → AB Depends on operating conditions (<0.2% Cv).
- Temperature of medium = 34°F to 266°F (1°C to 130°C)
- UL listed
- Before shipment, every unit is inspected to make sure the valve is opening and closing with respect to signal from the controller.
- 3-Way Control Valve is factory set to "Automatic" mode of operation.
- 3-Way Control Valve is powered by 24VAC electricity.
- 3-Way Control Valve is actuated by 4 to 20 mA signal from the controller.
  - 4mA means valve is in fully bypass position (flow direction from port B to AB). Flow path from A to AB is closed when valve is de-energized (fail safe feature).
  - 20mA means valve is in full open position (flow direction from port A to AB)

3.4.2 Calibration Instructions (3-Way Control Valve)

3-WAY CONTROL VALVE DIPSWITCH FUNCTIONS			
Switch #	**Switch Function**	**OFF (down)**	**ON (up)**
1	Characteristic	Linear	Equal percentage*
2	Control signal	0 to 10 Vdc*	2 to 10 Vdc or 4 to 20 mA
3	Volts or mA	0(2) to 10 Vdc*	4 to 20 mA

* Factory setting: equal percentage valve characteristic, 4-20 mA control signal.

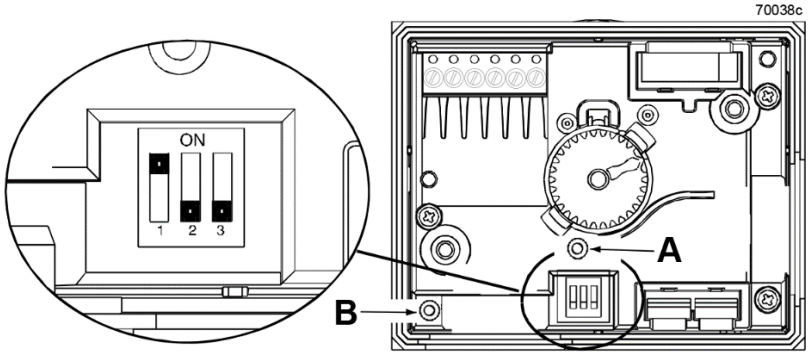


FIGURE 3-4: 3-Way Control Valve DIP Switch Functions

The 3-Way Control Valves are factory-calibrated at 0% and 100% stroke. When commissioning the valves (especially under extreme usage conditions), there may still be some leakage via control path A → AB with a 0% stroke control signal (4 mA). In this case, the valve can be recalibrated as follows:

- Use a pin or paper clip to push the button in opening (A) in the terminal housing.
- During calibration, the LED light (B) in the electronics module will flash green for approximately 10 seconds. The valve will be briefly closed and fully opened.

CAUTION!
This valve is suitable for straight-through normally closed or three-way applications only, and should be installed only in a mixing arrangement.

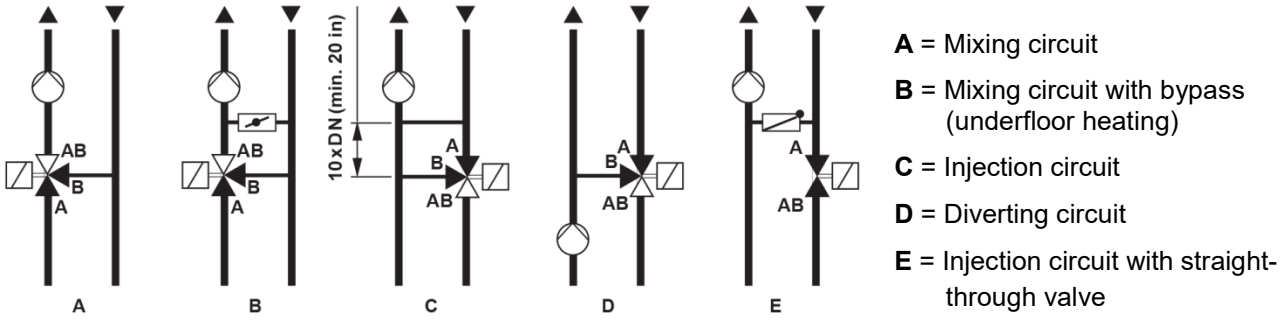


FIGURE 3-5: 3-Way Control Valve Hydraulic Circuits Application Example

3.4.3 Auto and Manual Control (3-Way Control Valve)

The 3-Way Control Valve Automatic and Manual control modes can be selected using the knob shown in Figure 3-6.

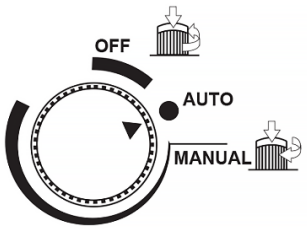


FIGURE 3-6: Selecting AUTO or MANUAL Control

3.4.3.1 AUTO Control

The control signal is converted by the microprocessor in the electronics module into an output signal that generates a magnetic field in the core. This causes the only moving part, the armature, to change its position in accordance with the interacting forces (magnetic field, counter-spring, hydraulics, and so on). The armature responds rapidly to any change in signal, transferring the corresponding movement directly to the control disc, enabling fast changes in load to be corrected quickly and accurately. The valve position is measured continuously. The positioning controller ensures an exactly proportional relationship between the control signal and the valve stroke.

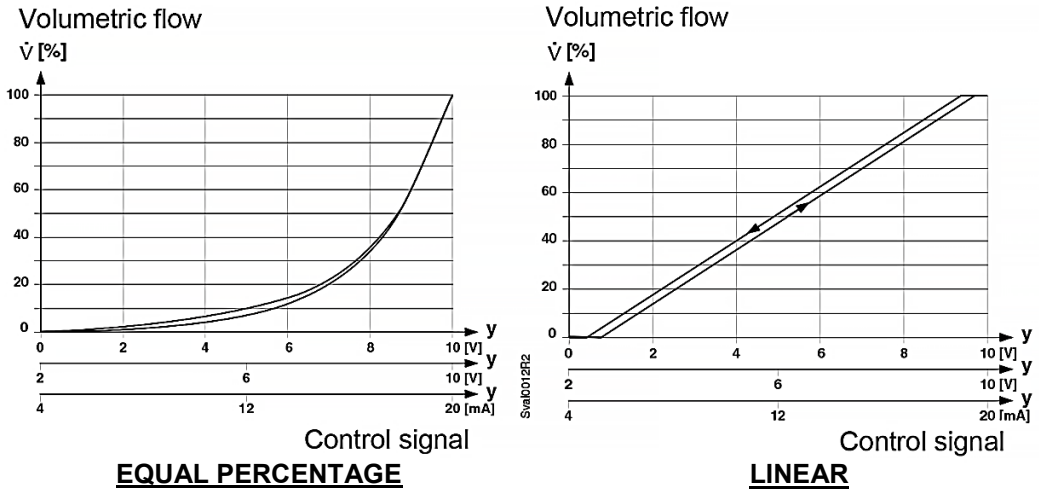


FIGURE 3-7: Valve Characteristics - Equal Percentage (L) and Linear (R)

In the event of a power failure, or if the power is switched off, the spring force closes the valve automatically (control path ports A → AB normally closed).

3.4.3.2 Manual Control

The valve control path (ports A → AB) can be opened mechanically up to 95% of the full stroke by pressing the knob inward and turning it clockwise (to the MANUAL position). This disables the control signal from the controller.

To disable automatic control of the valve, press the knob (Figure 3-6) inward and turn it counterclockwise (to the OFF position). The valve will close.

For automatic control, the knob (Fig. 3-6) must be set to the AUTO position (knob will spring out).

WARNING!
The valve knob (Figure 3-6) MUST be set to AUTO position for proper operation of the SPC Series

unit.

3.4.4 3-Way Controller Status LED Indication

Open the electronics module of the 3-Way Controller Valve to view the two-color LED display, which indicates the operating status of the valve. The table below identifies what the behavior and color of the LEDs indicate.

3-WAY CONTROL VALVE STATUS LEDs		
LED Display	**Status**	**Description**
Green LED	On continuously	Automatic mode: Auto (normal, no faults)
	Flashing	– Mechanically set to MANUAL – Mechanically set to OFF – Currently in auto-calibration mode
Red LED	On continuously	– General fault – General calibration fault – Microcontroller fault
	Flashing	– Faulty 24 VAC supply (or low power)
LED Off		– No 24 VAC supply – Fault with electronics module

The LED will typically assume only the conditions in this table (continuously red or green, flashing red or green, or off).

3.5 PREPARATION OF UNIT FOR OPERATION

It is important to make sure that the unit is installed and all piping and electrical connections are made per instructions in Chapter 2. Also make sure that the connecting piping has been cleaned out before starting up the unit.

3.6 UNIT STARTUP PROCEDURES

Follow the instructions below to start up the SPC Series unit:

➢ UNIT STARTUP PROCEDURE INSTRUCTIONS

1) Assure that all manual shutoff valves on chilled water and process water lines are closed.

2) Slowly open the manual shutoff valve on the process water inlet line, checking to ensure that there are no leaks at the valve or any joints.

3) Adjust the operating temperature control to the desired temperature. Refer to Section 3.10 and Section 3.11 for the exact location of controls and detailed adjusting procedure.

4) Adjust the high temperature limit per actual operating conditions. It is normally factory set at 20°F above the setpoint, which is default 140°F operating supply water temperature.

5) Open the chilled water return valve.

6) Slowly open the manual shutoff valves on the power source inlet.

.

7) If no leaks are found, slowly continue to open the manual shutoff valves on the chilled water source inlet.

8) As the unit is initially cooling the water, carefully re-inspect the water inlet, the water outlet, chilled water inlet and return lines and joints for signs of leakage.

9) As unit approaches the desired operating temperature, check that the temperature on the unit is within the desired range. If necessary, readjust the temperature control valve. See the Submittal documents and the temperature control valve component manual, included with the unit, for the exact location of the valve and detailed adjusting procedures.

10) After the unit has reached operating temperature, re-inspect all joints for signs of leakage. In addition, check all gauges and controls to verify that the energy source pressures are within design specification.

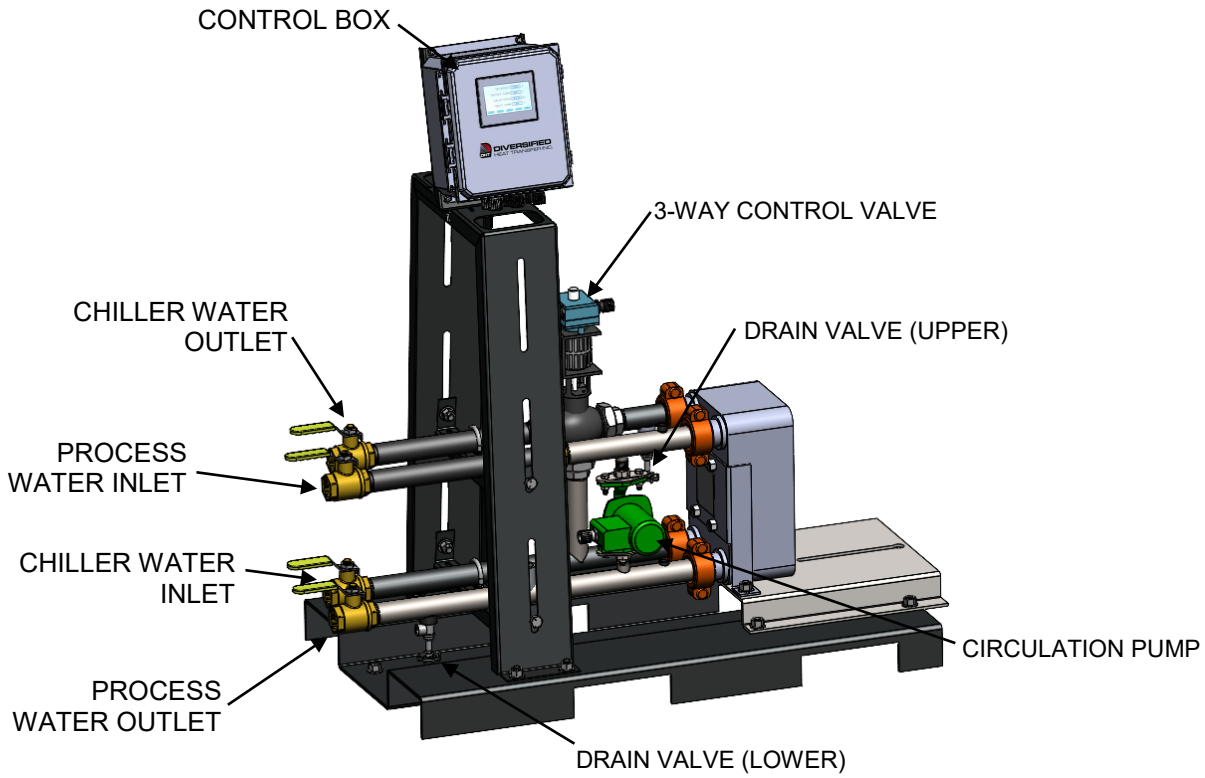
11) The unit is now ready for normal operation. Proceed to Section 3.7 for setting the temperature and other initial startup parameters using the controller.

3.7 UNIT SHUTDOWN PROCEDURES

All maintenance procedures require the liquid cooler to be properly shut down. Follow the instructions below in order to shut down the SPC Series unit:

➢ UNIT SHUTDOWN PROCEDURE INSTRUCTIONS

1. Close all valves in the energy source inlet line.
2. Turn off all power to the electric control.
3. When possible, relieve the pressure from energy source line (boiler water or high temperature water), between the shutoff valve and the unit.
4. Wait 5 minutes or until dial thermometer starts dropping. Close all remaining valves in the system in this order.
    a. Chilled water outlet line
    b. Process water inlet line
    c. Chilled temperature water return line.
5. After the system has cooled, drain the unit by opening the heat exchanger drain valve and holding the relief valve in the open position. This will prevent the formation of a vacuum and increase the drainage flow.
6. Proceed with the required maintenance or repairs.
7. After performing the required maintenance or repairs, return the unit to operation by following the startup procedures described above in Section 3.7.



SPC SERIES STARTUP / SHUTDOWN COMPONENTS

3.8 CONTROLLER INTRODUCTION

The DHT Liquid cooler Controller is a microprocessor based, state-of-the-art, device offering unmatched performance and full user configurability through HMI interface for water cooling applications.

It is used with type ‘J’ thermocouple sensor.

Menu based programming, all parameters and setpoints are user configurable via menu prompts. The preconfigured screens and ‘pull-down’ sub menus with English prompts assures rapid setup and commissioning.

Process indication is displayed on the front colored touchscreen display as shown below on Home Screen. All aspects of the unit are user configurable through the ‘plain English’ menus and combinations of the touchscreen menus. Backup interface on PID controller display is also available behind the front door when front HMI interface is down. Standard communication between HMI and PID controller is through MODBUS RTU protocol.

Utilizes 1/8 DIN advanced programmable PID temperature controller factory configured for full range of math, logic, totalizer and specialized functions required for single loop process and temperature control of water cooling applications.

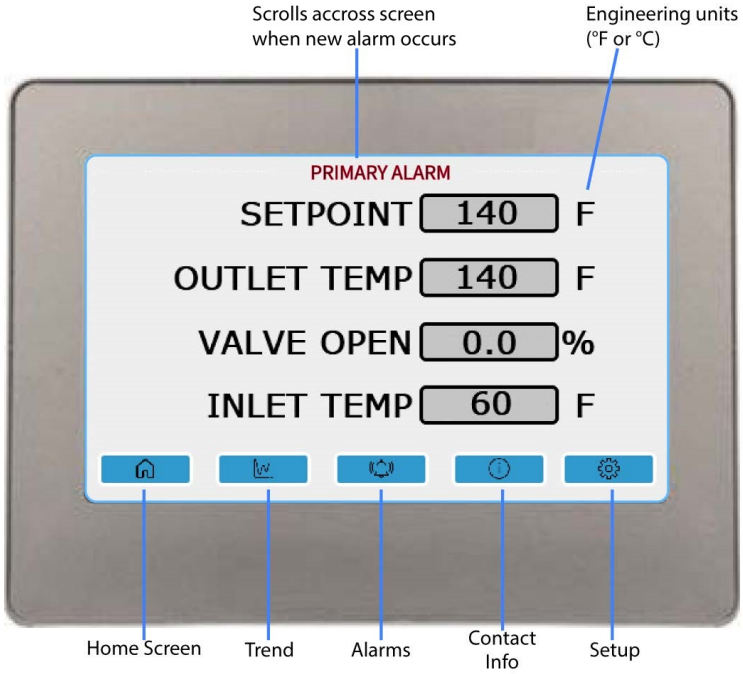
MODBUS RTU®: RS485Network allows single or multiple units to be connected for distributed applications, remote monitoring SCADA applications (optional).

MODBUS TCP/IP and **BACnet UDP/IP:** Ethernet Network allows single or multiple units to be connected for distributed applications, remote monitoring SCADA applications (optional). Ethernet port is available on the rear side of the temperature controller.

Optional building automation communication gateway can be used for communication with Modbus RTU or other protocols.

3.8.1 HMI Overview

This section shows the description of the main display on the front screen and menu functions of the controller of touchscreen user interface.



Display Touchscreens Navigation:

- **Home Screen:** As shown in above picture, this screen displays the real time operating process variables along with the SPC Series liquid cooler picture. Unit operating status is shown in green (normal operation) and red (faulty operation) colors. Alarm also flashes on top of the screen when error/fault event occurs.

- **Trend Screen:** Data logging collects and stores values in device addresses associated with variables. You can specify the timing for collecting data and how much data is stored. Display real-time acquired logging data in a Trend Graph for water set-point, outlet and inlet temperature variables, and the control valve open percentage.
  Logged data is automatically exported after USB memory drive is inserted in its slot behind HMI for a backup memory or an external storage in a .txt format.

- **Alarms Screen:** When an error condition, such as over temperature or sensor failures, etc., is detected by the controls (when value is outside the limit condition), an alarm appears on top of the display screen. It allows user to check the alarm type, its status, and date/time when an alarm condition is triggered.
  Logged data is automatically exported after USB memory drive is inserted in its slot behind HMI for a backup memory or an external storage in a .txt format.

- **Contact Info Screen:** displays the DHT factory and local sales representative company address and contact information in 'plain English' format for ease of access. Unit and controls serial number information is also displayed on the screen at the bottom along with the software revision levels on the top of the display screen.

- **Setup Screen:** allows user to make changes to the factory default settings. Access to the setup screen is password protected. There are two levels of login access and end user level login allows operator to make adjustments to common operating process and communication variables. Advanced settings are higher level password protected for normal operation of the unit.

Following time-out applies to display

- If no button presses are detected within a timeout period (default is 30 min.), the display will revert back to the Level 1 “HOME screen.”
- If no button presses are detected within a timeout period (default is 5min.), the display screen turns off in order to save power, and the PID controller is operational in the background to maintain the target hot water set point. The display returns back to life quickly with a single click on the touchscreen.

NOTE:
USB memory drive kit is available as an accessory with the unit. Contact your DHT sales representative or DHT factory if it is required.

3.8.2 PID Controller Overview

This section shows the description of the display and button functions of the controller, which may be required for backup interface when HMI is being replaced or repaired.

General Description of Operator Buttons:
Temperature Controller has six buttons (four navigation and two function) available as shown in

following button layout:

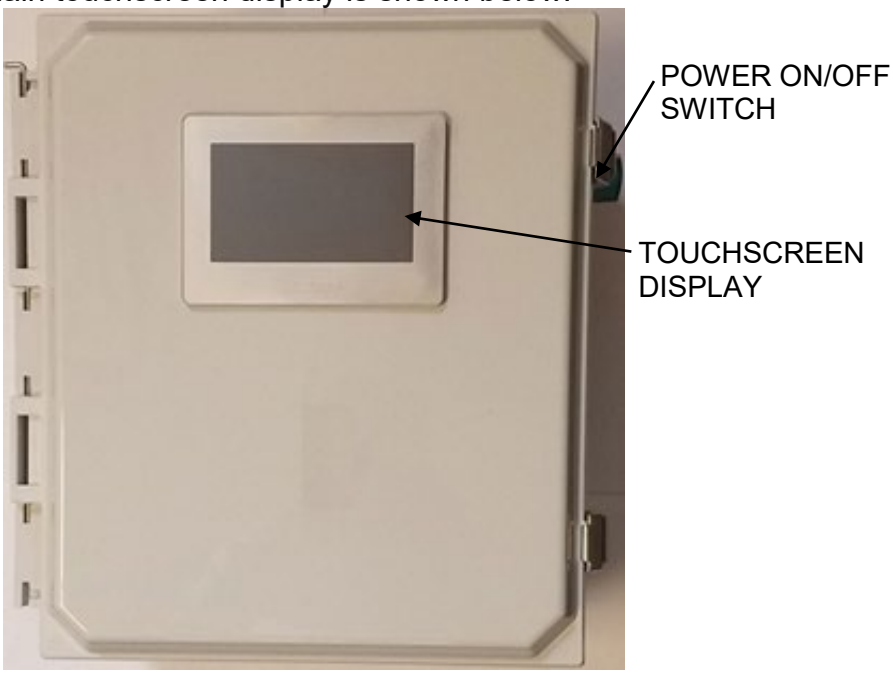
Button Operation

- **Raise:** The raise button increments parameter values to limits.
- **Lower:** The lower button decrements parameter values to limits.
- **Page:** In Operator levels 1 or 2, the Page button will select between the Home display or the Programmer Edit and Run lists (if one of the programmer features is enabled).
  In Levels 3 or Config the Page button will scroll through list headers (no auto-repeat). If the Page button is pressed within a list, the display reverts to the top of the list. The top of the list shows only the list header with no initial parameters.
- **Page (held for >3 seconds):** The Goto parameter is selected directly. This operation can be performed from any display. If the Page is held for >3 seconds at power-up, the Quick Start Mode is selected following the entry of a passcode.
- **Page+Raise:** Scroll back the list headers (with auto-repeat).
- **Scroll:** Select parameters in turn, returning to the first parameter in the list or to a list header if Level 3 or Configuration level is selected. If the button is held down the list will auto-repeat. In levels 1 and 2 this button also scrolls through promoted parameters when the HOME screen is selected.
- **Scroll+Raise:** Scroll back through parameters from bottom to top (with auto-repeat).
- **Page+Scroll - all variants:** Jump directly to the "HOME page." The current operating level remains unchanged. If the HOME page is already selected, these buttons will perform the custom function. The default is Alarm Acknowledge.
- **Raise+Lower (Run/Hold):** If a programmer option is enabled and a program is configured, a momentary press of these keys toggles between Run and Hold modes.
- **Raise+Lower (hold for >3 seconds - Mode):** If a programmer option is enabled, and a configured program is running, holding these buttons will abort the program.
  If the HOME page is selected, and the Programmer is not running, holding these buttons will invoke the 'Mode' display where the Loop Mode parameter will allow selection of Auto or Manual mode.
- **F1 and F2:** the functionality of these buttons is set by the Instrument function block. The default settings are:
  - F1: Auto/Man
  - F2: Run/Hold

NOTE:
A time-out applies to all displays. If no button presses are detected within a timeout period (default is 30 min.), the display will revert back to the “HOME screen.”

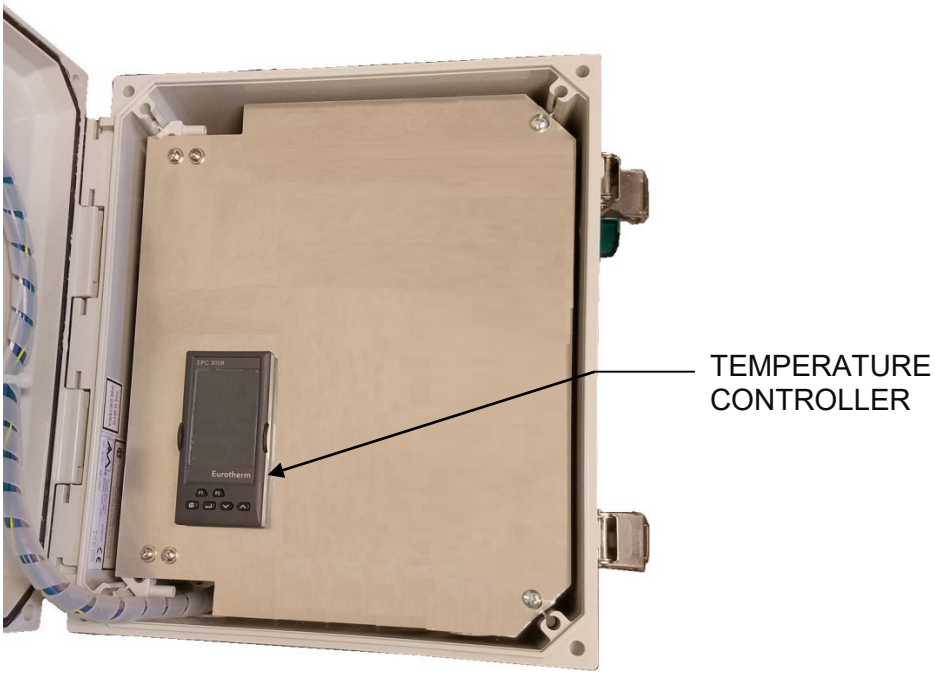
3.9 CONTROLS STARTUP

Location of controls main touchscreen display is shown below.



SPC SERIES CONTROL PANEL FRONT

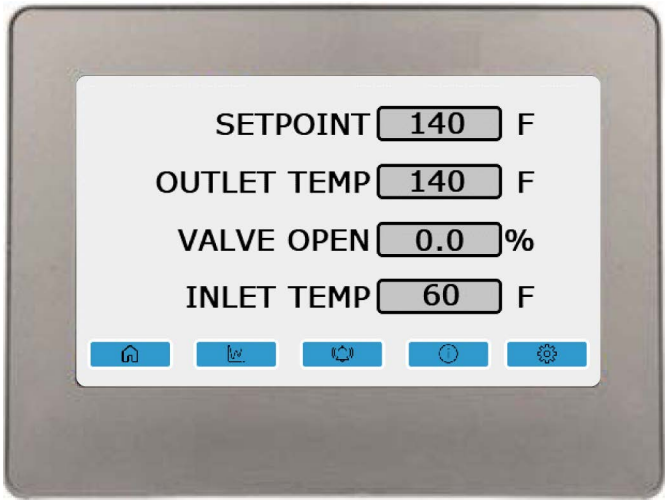
Location of temperature controller is shown below, which can be used as a backup interface when front HMI screen interface is down.



PID CONTROLLER LOCATION BEHIND THE FRONT DOOR

Upon power up, the opening screen on touchscreen shows the DHT logo and then defaults to the display “HOME screen” below.

NOTE:
The setpoint shown in this section is for information purposes only. User has to manually adjust the number, depending upon required application operating conditions following the programming sequence in Section 3.11.



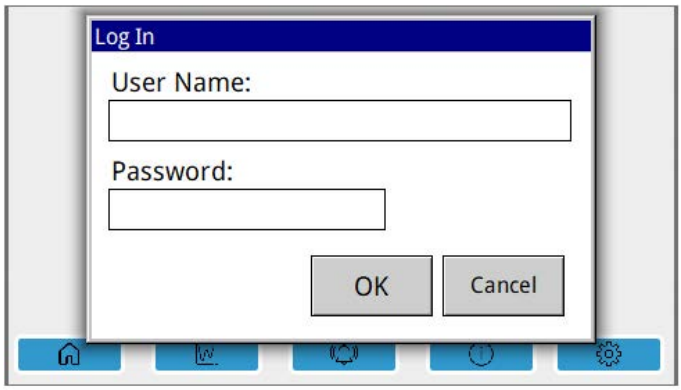
DEFAULT SPC SERIES HOME SCREEN

To program the controller for operation, follow the instructions in the following sections.

3.10 PROGRAMMING THE SEQUENCE

➢ ENTERING THE PASSWORD

1. Some of the display screens have password protection for proper operation of the liquid cooler. The figure below shows the login screen on HMI display and operator level login information which is required to make any adjustments to the default factory settings:



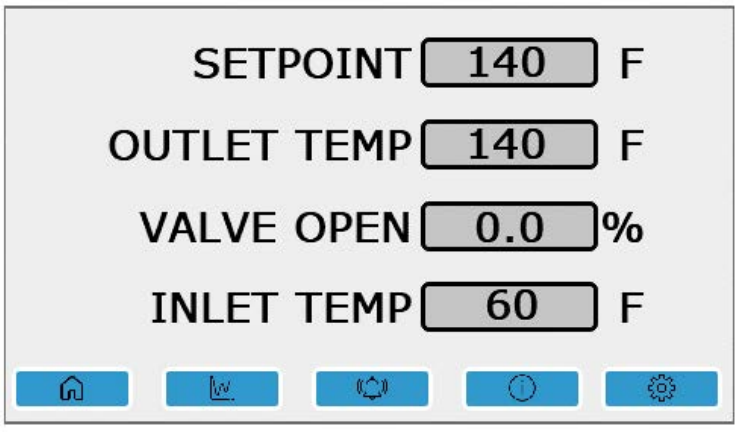
2. Click on required empty box inside the touchscreen display and a keypad appears on the screen. Use this keypad to enter the access login name and password.

NOTES:

- Use default operator level User Name “L1” and password “0439” to gain access.
- A time-out applies to logout within a timeout period (default is 30 min.) and the controller automatically logs out to save the recent setting adjustments.

➢ DISPLAY SCREENS AND ADJUSTMENTS

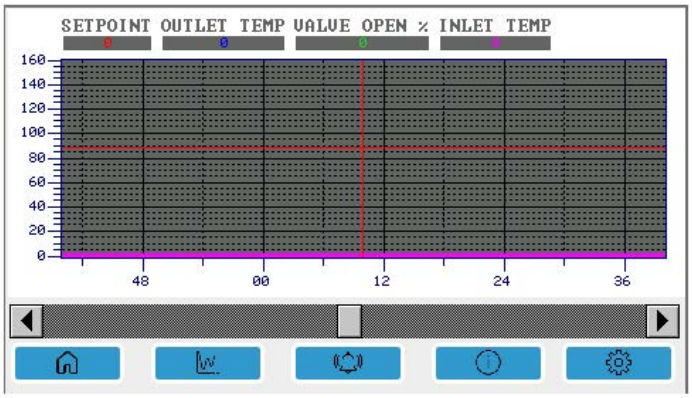
3. The SPC Series default “HOME screen” as explained in Section 3.9.1. Factory default hot water set point is 140°F. This screen shows the adjustable water set point as well as currently measured outlet temperature, inlet water temperature and control valve output open percentage.



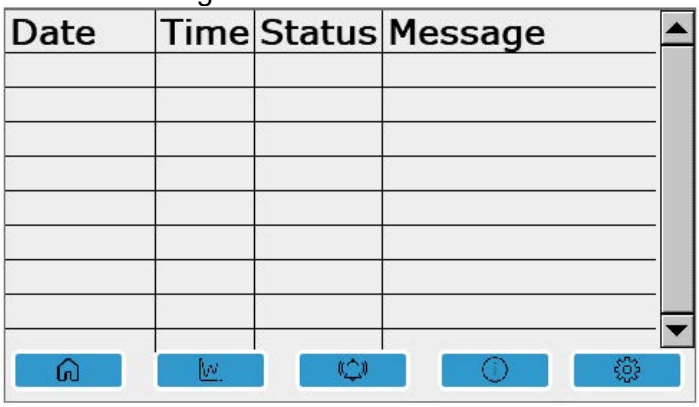
4. The hot water set point can be adjusted anywhere within the range of 35-180°F by entering the operator level password as shown in steps 1 and 2 above.
5. The high temperature alarms are default set to 20°F above the set point. If water outlet temperature reading is equal to or higher than this number, the unit status changes from green to red in color and “HIGH TEMP ALARM” message starts flashing in red color on the

center top side of the HOME screen with warning message display on the screen. Controller will close the control valve, stopping the flow of boiler water or HTHW supply to heat exchanger. When unit goes back to normal operating temperature conditions, unit status changes to green in color and the flashing alarm message disappear from the screen.

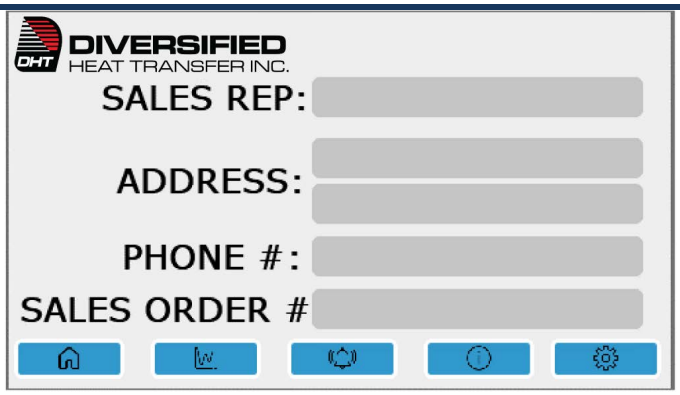
6. The low temperature alarms are default set to 20°F below the set point. If water outlet temperature reading is equal to or lower than this number, the unit status changes from green to red in color and “LOW TEMP ALARM” message starts flashing in red color on the center top side of the HOME screen. This merely serves as a warning that unit is not able to maintain the target setpoint.
7. The “Trend screen” shown below displays the real-time trend graphs of outlet & inlet water temperatures, setpoint and control valve output open percentage as explained in Section 3.9.1 This screen is empty on the startup. It starts logging data and displaying graphs as soon as the unit is started.



8. The “Alarms screen” shown below displays the status of the standard alarms, whether each alarm is active or not along with time and date when it occurred.



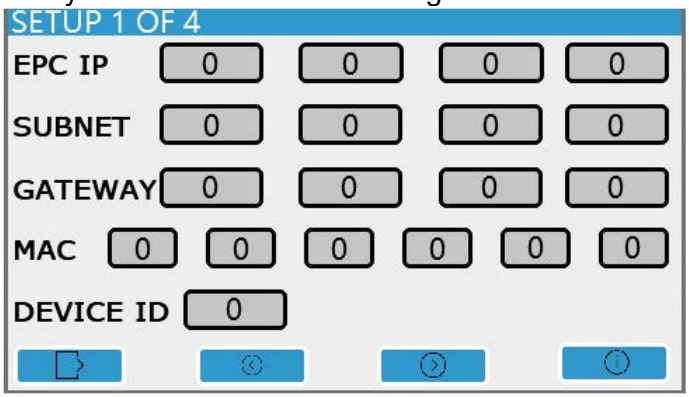
9. The “Contact Information screen” shown below displays the DHT factory and local sales representative company contact information as well as the serial number information of controller and liquid cooler, which are preconfigured before unit is shipped from factory. Each unit is factory configured to display appropriate information on this screen.



10. Refer to next section for information about the last settings display screen.

➢ SETTINGS SCREEN

11. The “Setup Screen,” shown below, is also operator level password protected. Refer to steps 1 and 2 above in order to gain access to this screen. This screen includes the building automation system communication settings and status related information.



12. Click on “Log Out” at the lower left hand corner of the screen.
13. Click on “Leave Config” at the bottom of this screen which then defaults to home screen.

NOTES:

- Not recommended to use manual positioning when unit is in operation. Always leave the unit in AUTO (Automatic) setting.
- Valve % shows the live output percentage signal to the control valve.
- There are three more screens available under settings which are higher level password protected in order to prevent any issues with the unit’s normal operation.

CAUTION!

Do not forget to logout and leave configuration after the desired parameters have been changed.

➢ SYSTEM DIAGNOSTICS

14. During startup or in normal operation, unit performs the self-diagnostics for a few seconds to check for any system errors. If an error condition is detected, it displays error message(s) on the home screen as shown below, which require corrective action.

Banner Items:

Domestic outlet temperature sensor fails

The following text scrolls across the HOME screen:

"DOM OUT SENSOR FAIL"

Note: Check V+ and V-

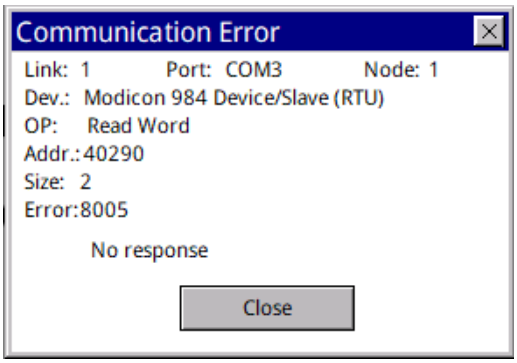
Domestic inlet temperature sensor fails

The following text scrolls across the HOME screen:

"DOM IN SENSOR FAIL"

Note: Check S+ and S-

Pop Up Items:



Note: Check HD, HE, HF

NOTES:

- Sometimes loose wiring connections can also cause these error conditions, which can be easily cleared by making proper connections.
- If error condition still exists, contact sales representative or DHT technical support for more information.

3.11 DATA COMMUNICATIONS

DHT SPC Series Liquid cooler control system allows the controller to communicate with external Building Automation System (BAS) or Energy Management System (EMS). It is compatible with standard Modbus RTU or TCP/IP and BACnet UDP/IP multi-protocols without the need for external gateway. Optional gateway is also available for communications with other protocols.

- Communication between HMI and Temperature controller is standard Modbus RTU.
- Use RJ45 port to connect PC or network computer system with PID controller.

WARNING!

- Maximum communication cable lengths without repeater

  RS485 Network – 4,000 feet

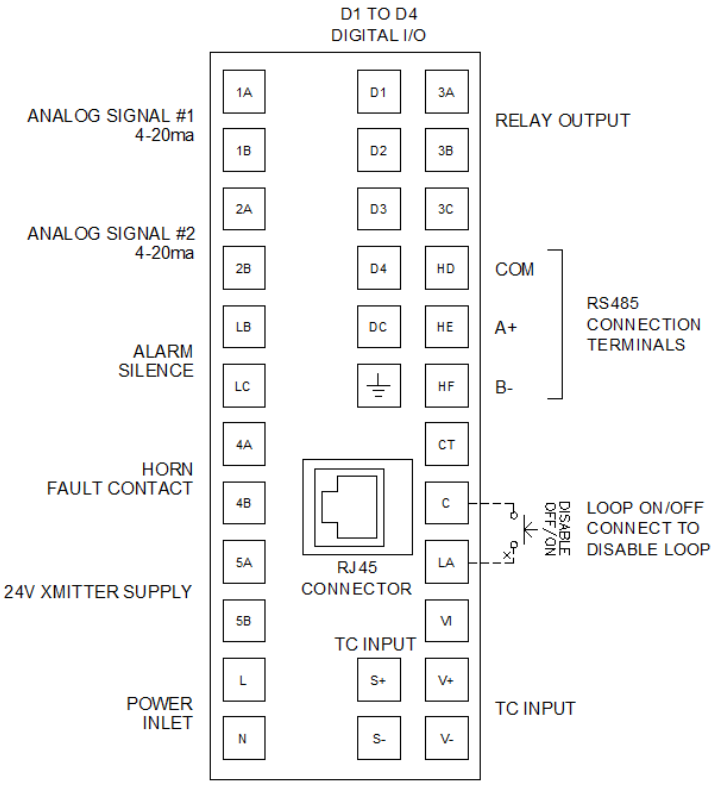
  Ethernet Network – 328 feet

- Communications and power wiring should never be routed together inside same conduit because it can cause nuisance related issues on communications side.

NOTES:

- To help prevent ground loops, the cable shield should be grounded at one point only.
- Use twisted, shielded-pair communication wiring.

3.11.1 Temperature Controller Terminals Layout



Where HD is Ground, HE (A+) receives data and HF (B-) transmits data

3.11.2 DHT controller communication features

1. DHT controller auto-detect the protocol of Modbus TCP/IP, BACnet UDP/IP.
    a. The two protocols share the same IP addresses, Subnet masks, default gateways.
    b. Auto-Discovery Mode – known as Zero-configuration networking (zeroconf)
        i. Utilized Bonjour Service released by Apple under a terms-of-limited-use license.
        ii. It is intended to use with itools (Eurotherm), not third party applications
        iii. For cybersecurity reasons, the Bonjour™ service is disabled by default, as enabled service makes it easier for a malicious user to discover and access the controller via the network.
    c. DHCP Mode
        i. Default: OFF
        ii. Enabling DHCP will auto-configure IP address, Subnet Masks, default gateway.
        iii. Dynamic IP addressing.
    d. Static Mode
        i. Default: ON
        ii. User can manually set up IP address, Subnet Masks, default gateway.
2. Ability to connect through Modbus RTU protocol.

3.11.3 DHT Default Settings Summary for communication

1. Auto-detection of Modbus TCP/IP, BACnet UDP/IP protocols, when connecting RJ45 port on the controller.
    a. Default Mode: Static (Need to manually set parameters)
    b. Default IP: 192.168.111.222
    c. Default Mask: 255.255.255.0
    d. Default Gateway: 0.0.0.0
    e. Mac is read-only (Introduced in the instruction)
2. Ability to connect to Modbus RTU when wiring to HD (COM), HE (A+), HF (B-).
    a. Default Baud Rate:19200
    b. Default Parity: None
    c. Default Data Length: 8
    d. Default Stop Bits: 1
    e. Default Slave ID: 1

3.11.4 Modbus/BACnet Data Addresses and Points

Item Description	Type	Modbus Address	BACnet Address	Register	Comments
Remote/Local Setpoint	Int16	2	Analog Value #38	RW	40-180°F Range (140°F Default)
Unit Remote On/Off	Int16	277	Analog Value #53	RW	0: On 1: Off
Outlet Process Water Temperature	Int16	289	Analog Input #1	RO	40-205°F Range
Inlet Process Water Temperature	Int16	290	Analog Input #2	RO	40-205°F Range
Control Valve Open %age	Int16	4	Analog Input #10	RO	0–100% Range
High Temperature Alarm Status	bool	2149	Binary Input #10	RO	0: Off 1: On (Default 20°F above Setpoint)
Low Temperature Alarm Status	bool	2245	Binary Input #14	RO	0: Off 1: On (Default 20°F below Setpoint)
Outlet Sensor Status	Unit8	1932	MSI#1	RO	0: Good 1: Fail
Inlet Sensor Status	Unit8	1948	MSI#2	RO	0: Good 1: Fail

Notes:

1. Modbus decimal address is offset from 400001
2. Abbreviations
    a. RO – Read Only
    b. RW – Read/Write

3.11.5 Instructions to Change Communication Settings Manually

IP addresses, Subnet Masks and default gateway

CAUTION!

- Do not go to the configuration menu while the controller is operating the liquid cooler.
- Do not power off the controller without completing all the steps in the configuration settings. Save and go back to the main screen.
- Configurations settings shall be performed only by trained and experienced personnel.
- Proper care must be taken to prevent any changes to other settings in the configurations.

Refer to following steps:

1. Open the front door on the control panel box in order to access the temperature controller main screen which is shown below:

2. Press and hold page button  on the main screen until following screen appears:

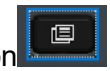
3. Now release the button. Again press and hold page button  until following screen appears:

4. Use raise and lower  buttons in the next step to navigate to the following screen:

5. Click on scroll button  and you will see passcode screen as shown below:

6. Click on scroll button  again to move to the next digit, and use arrow buttons  to select the passcode. The default passcode is **0004**.

7. If the entered passcode is correct, it will direct to configuration menu screen:

8. Now click on page button  and you will see following screen:

9. Click on page button  until “COmm” appears on the screen:

10. Click on scroll  button and you will see F.COm:

From the sub-menu, you are able to set up the parameters for Modbus RTU.

11. In order to change the appropriate communications settings:
    a. **Modbus RTU settings -** refer to step 12 below. Then jump to step 24.
    b. **Modbus/BACnet IP settings** - refer to steps 13 through 26. Ignore step 12 below.

12. Now click on scroll  button and then click on raise  button to select 

. Then click on scroll  and you will see the following parameters for Modbus RTU:

    a. 

Default Baud rate: 19200

    b. Click on scroll  button

    c. 

Default Parity: None

    d. Click on scroll  button

    e. 

Slave node. Default: 1

    Use the raise and/or lower arrow  buttons to change the parameters.

    Jump to step 25 in order to save the settings.

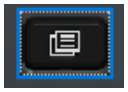
13. Use arrow buttons  to select the O.Com:

From the sub-menu, you are able to set up the parameters for BACnet/Modbus IP.

14. Click on scroll button  and you will see “mAIN” screen:

15. Click on raise button  to select  , then click on scroll button  , and you will see  (Auto-discovery mode):

*Default is OFF.

16. Click on  to move to the IP.MODE. Use arrow button to switch the mode:
    a.  is static mode – IP, Gateway, Subnet masks shall be manually setup
    b.  is DHCP mode – DHCP server shall be setup to assign IP, etc.
17. Click  to move to set up IP addresses. You will see the screen:
    a. 
    b. Use arrow buttons to change the IP addresses if required.
18. Continue to click  to see subnet masks (Indicator: IP.S1, IP.S2, IP.S3, IP.S4):
    a. Use arrow buttons to change the subnet masks if required.
19. Continue to click  to see default gateway (Indicator: IP.G1, IP.G2, IP.G3, IP.G4):
    a. Use arrow buttons to change the default gateway if required.
20. Continue to click on  to see mac addresses.
21. After setup, click  until you see:

22. Click arrow button until you see the screen below for BACnet setting

23. Click  to see parameter device ID for BACnet:

Use the arrow buttons to change device ID if required.

24. After the setup is complete, press and hold button  , until the following screen appears:

25. Click on  to go back to the main screen and the settings will be saved.

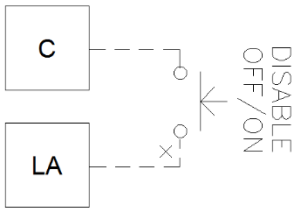
26. Now the controller is ready for normal operation.

3.12 DRY CONTACTS

The following two types of contacts are available for remote monitoring of unit:

3.12.1 Contact closure input (enable/disable)

Dry Contacts C and LA are available on the PID temperature controller to remotely start/stop the unit if required.

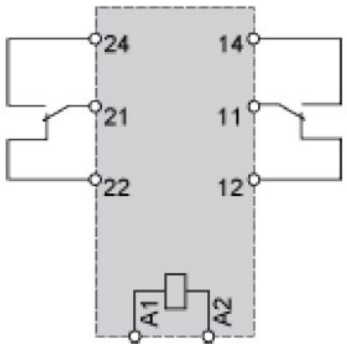


This input is supplied with the current transformer. Contact closure on the remote switch disable (stop) the unit.

3.12.2 Fault Relay Contacts

Fault relay R1 terminals 11 and 14 shown below (also shown in Section 6.4) available on the terminal block inside the control panel box for remote alarm indication purposes. This relay is a Double Pole Double Throw (DPDT) type which energizes when fault condition occurs.

It has one set of normally open contacts (between contacts 11 and 14 and 21 and 24) and normally closed contacts (between contacts 11 and 12 and 21 and 22). Normally open (NO) contacts are rated for 8 amps and maximum switching voltage is 400 VAC.



SECTION 4: MAINTENANCE

CAUTION!

All service on the SPC Series liquid coolers must be performed by trained and experienced technicians from appropriate service agencies.

This section covers the service and maintenance for SPC Series liquid coolers and provides instructions for the inspection and replacement of critical parts and components.

Any questions concerning maintenance procedures should be directed to DHT support at 1-800-221-1522. Please be prepared with model and serial numbers of the unit and heat exchanger coils prior to contacting DHT.

NOTE:
Taking the unit offline is required for many of the maintenance procedures in this section, so all technicians performing maintenance should be familiar with the procedures necessary for unit shutdown (Section 3.8) and unit startup (Section 3.7).

Any component(s) directly connected or linked to the component being replaced should carefully be examined before maintenance procedures are started. If any of the related components show signs of wear or improper operation, they should be considered for replacement at the same time.

4.1 CIRCULATING PUMP MAINTENANCE

DHT SPC Series liquid coolers are equipped with a circulating pump to assist in the even cooling of the water. If the unit is equipped with a circulating pump, the following procedure should be followed to replace the pump.

➢ CIRCULATING PUMP INSPECTION & REPLACE INSTRUCTIONS

1) Take the unit offline (Steps: 1 through 5 of the shutdown procedure, Sec. 3.8) before attempting to service the circulating pump.

WARNING!
TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

2) Test the pump according to manufacturer's instructions supplied with the test unit. If found to be defective or worn, replace the pump per the following steps:
   a) After assuring that the power has been turned off, disconnect the electric leads to the circulating pump.
   b) Drain the unit by opening the drain valves (See Figures 3-1a and 3-1b).
   c) Break the flanged joint between the pump and the inlet and outlet piping.
   d) Remove the pump.
   e) Reconnect the pump to the inlet and outlet piping. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and/or type of joint compounds or sealer at the connections.
   f) Reconnect the electric leads to the pump (reference wiring diagram provided with the unit to assure proper wiring).
   g) Follow the startup procedures (Section 3.1) to put the unit back online. Carefully check all connections for any sign of leakage.

4.2 POWER CONNECTION REWIRING

If any of the power connections must be rewired at the electrically activated controls or junction boxes, follow the steps listed below.

➢ POWER CONNECTION REWIRING INSTRUCTIONS

1) Follow Steps 1 through 5 of the shutdown procedure (Sec. 3.8) to take the unit offline before attempting any electrical service.

WARNING!
TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

2) After assuring the power has been turned off, disconnect and rewire the electrical connection in question. Refer to Section 6.4 for wiring details.
3) Turn the power on to check that the component that has been rewired is functioning properly.
4) Follow the startup procedure instructions in Section 3.7 of this manual to return the unit to operation.

4.3 PLATE HEAT EXCHANGER MAINTENANCE

This section describes how to clean and maintain the brazed plate heat exchangers for DHT SPC Series liquid coolers.

Brazed Plate type of heat exchangers cannot be disassembled for plate replacement, so maintenance is necessarily limited to CIP cleaning or replacement of the entire heat exchanger module when it has reached the end of its lifetime.

4.3.1 General Heat Exchanger Maintenance Procedures

- Every ~~6~~ six months to one year check temperatures and flows against the commissioning data.
- Check general condition and look for any signs of leakage.
- Wipe clean all painted parts and check surfaces for signs of damage.
- Check bolts and bars for rust and clean.
- Lightly coat threaded parts with molybdenum grease or a corrosion inhibitor (ensure that no grease, etc., falls onto the plate gaskets).

4.3.2 Clean-In-Place (CIP) Cleaning (Brazed Plate)

CIP cleaning is preferable when the scaling deposits on the plates are soluble. When CIP cleaning is used routinely, intervals between heavier maintenance is extended and gasket life is improved.

Two suggestions for cleaning solutions appropriate for plate and frame heat exchangers are listed below:

DEPOSIT TYPE	SOLUTION
Organic materials and grease	**Sodium Hydroxide (NaOH)** • Maximum concentration = 1.5% • Max. Temp. = 185 ºC. • Mixture for 1.5% concentration = 1.32086 gallon. • 30% NaOH per 26.4 gallon water
Limestone and other minerals	**Nitric Acid (HNO3)** • Maximum concentration = 1.5 % • Max. Temp. = 149 ºC. • Mixture for 1.5% concentration = 2.4 ltr. • HNO3 62% per 0.63 gallon water • Nitric acid also has an affective build up effect on the passivation film of stainless steel.

CAUTION!

- Nitric acid and Sodium Hydroxide may cause injury to exposed skin, eyes, and mucous membranes. Use of protective eyewear and gloves is strongly recommended.
- Under no circumstances should hydrochloric acid be used to clean stainless steel plates, nor should hydrofluoric acid be used to clean titanium plates.

Instructions for use of a CIP system are on the next page.

➢ CIP CLEANING INSTRUCTIONS (BRAZED PLATE)

NOTES:

- Choose a cleaning product appropriate for the materials used in the system that will come into contact with the cleaner. Follow all manufacturer's instructions when using any cleaning agent.
- Contact DHT at 800-221-1522 for suggested cleaning solutions for your system.

1) Isolate the heat exchanger from the system and connect the CIP unit to the heat exchanger with the flow direction opposite to normal operation.
2) Dilute and mix the cleaning agent with the CIP tank water according to the manufacturer's instructions, and heat to the required temperature.
3) The cleaning agent should be circulated through the system at the fastest flow rate available (10% to 20% above normal), but at the least should be at the normal operational flow rate.
4) Circulate the cleaning solution for at least 30 minutes and up to 4 to 6 hours. If possible, reverse the flow direction every 30 minutes.
5) After the cleaning interval, always rinse the system thoroughly with fresh water. Circulate fresh water through the system for at least 10 minutes after the cleaning operation. A solution of 1-2% sodium hydroxide (NaOH) or sodium bicarbonate (NaHCO3) before the final rinse ensures that all acid is neutralized.
6) Disconnect the CIP unit from the heat exchanger.
7) Check the performance of the liquid cooler against the data provided in the equipment manifest, such as the pressure drop data. Compare to pre-cleaning results. Noted performance differences can be used to trigger future maintenance.
8) Responsibly dispose of used cleaning chemicals.

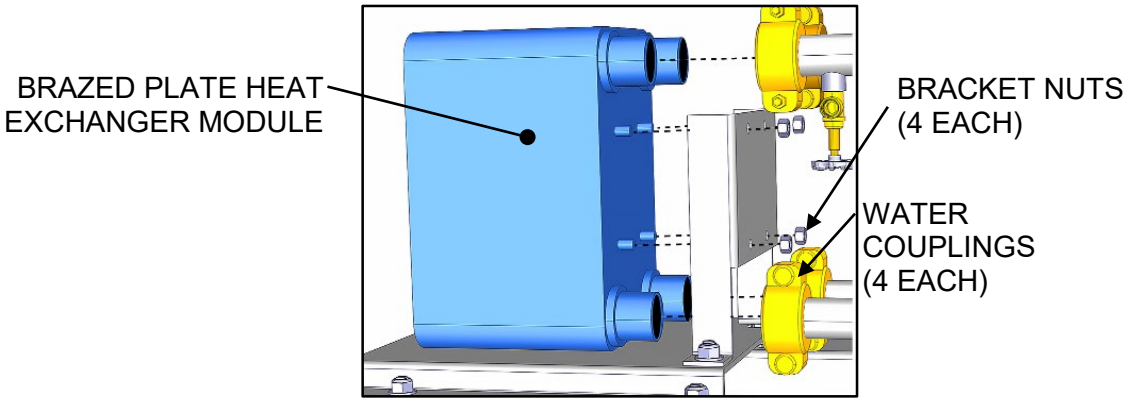
4.3.3 Brazed Plate Heat Exchanger Module Replacement

➢ REPLACING THE BRAZED PLATE HX MODULE

1. Shut down the heat exchanger as described in Section 3.8.
2. Shut off all water connections and shut off all power to the unit.

WARNING!
TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

3. Ensure to bleed all pressure from all parts of the unit. Open the drain valves.
4. Make sure the heat exchanger cools down to below 104 ºC; with EPDM < 219.2 ºC
5. Remove the four bolts that affix the module to the support plate.
6. Decouple the four connections to the heat exchanger module.



7. Replace the module, recouple to the four liquid cooler connections, and affix the four plate nuts.
8. After all adjustments have been made to satisfaction and all connections and fittings have been double checked, apply power and refer to **Section 3.47: Unit Startup Procedures** to initiate operation of the unit.
9. Unit should be checked for leaks and correct pressure levels to ensure proper operation.

4.4 STRAINERS INSPECTION AND REPLACEMENT

The strainers should be installed upstream of the energy and process shutoff valve. The strainers must be flushed periodically (approximately every three (3) to six (6) months) to prevent the buildup of any sediment.

➢ STRAINERS INSPECTION AND REPLACEMENT INSTRUCTIONS

1) Follow Steps 1 through 7 of the shutdown procedure in Section. 3.2 to take the unit offline before attempting this maintenance procedure.

WARNING!
TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

2) The exact location of the strainers can differ between units, but refer to Figure 3-1a and 3-1b for a typical location. Reference the drawing supplied with the Submittal sheet for the unit to identify the exact location of the strainers on the unit.

3) Carefully break the line connections on the inlet side of both strainers.

4) Carefully break the line connection on the outlet side of the strainers.

5) Remove and examine the strainers.

6) Remove any sediment that is present in the strainers. If they cannot be cleaned satisfactorily, replace with new strainers.

7) Place the strainers back-in-line in the system.

8) Reconnect the inlet and outlet lines to each strainer. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and/or type of joint compound or sealer at the connections.

9) Follow the startup procedures to put the unit back online. Carefully check all connections for any sign of leakage.

4.5 3-WAY CONTROL VALVE MAINTENANCE

The manufacturer documentation included with the unit gives specifics for operation and maintenance of the control valve. The Submittal sheet and drawing included with the unit will give the exact location, as well as interlocks with other components. This information should be reviewed before removal/replacement of the temperature control valve.

4.5.1 3-Way Control Valve Maintenance

The valves and actuators require no maintenance or service. The valve stem is sealed with a maintenance-free O-ring gland. Open the electronics module of the 3-Way Controller Valve to view the two-color LED display, which indicates the operating status of the valve. See the table below to determine if the valve may possibly be faulty.

3-WAY CONTROL VALVE STATUS LEDs		
LED Display	**Status**	**Description**
Green LED	On continuously	Automatic mode: Auto (normal, no faults)
	Flashing	– Mechanically set to MANUAL – Mechanically set to OFF – Currently in auto-calibration mode
Red LED	On continuously	– General fault – General calibration fault – Microcontroller fault
	Flashing	– Faulty 24 VAC supply (or low power)
LED Off		– No 24 VAC supply – Fault with electronics module

Should the valve electronics prove faulty, the electronics module should be replaced with a new one. Contact DHT for part numbers and ordering information. See the replacement information below for mounting and installation.

4.5.2 3-Way Control Valve Replacement

Mounting and operating instructions are printed on the actuator and on the electronics module.

The valve is suitable only for straight-through or three-way applications and may be installed only in a mixing arrangement. In the case of the straight-through valve, strict observance of the direction of flow is essential.

To replace a faulty or effective unit, refer to the following instructions.

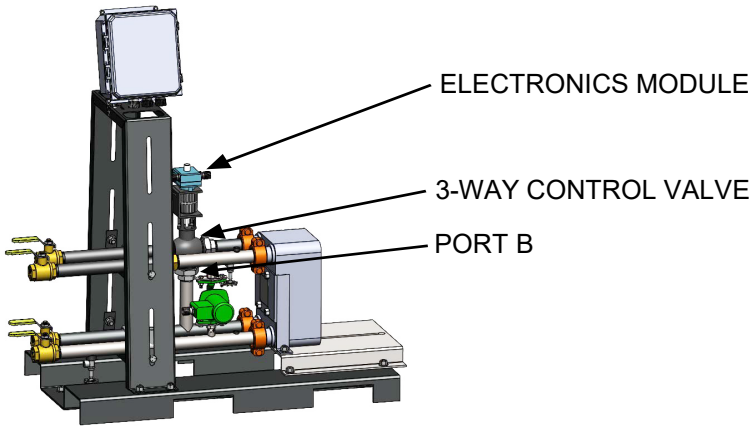


FIGURE 4-5: 3-Way Control Valve Component Locations

➢ 3-WAY CONTROL VALVE REPLACEMENT INSTRUCTIONS

1) Follow Steps 1 through 7 of the shutdown procedure in Section 3.8 to take the unit offline before attempting this maintenance procedure.

WARNING!
Boiler water or high temperature water present situations that can be **very dangerous** because of the high temperatures and pressures. To avoid possible injury or death, use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures.

WARNING!
TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

2) Assure that the energy source, water inlets, and outlets have been shut off; that the pressure has been bled from both the steam and energy source systems; that the unit has been completely drained; and that all components and surfaces have cooled.

3) Turn off the power and disconnect the leads to the valve.

4) Carefully break all connections to the control valve and remove the old valve from the unit.

When installing the replacement valve, do not mount with actuator below horizontal position. It is essential to maintain the specified minimum clearance above and to the side of the actuator and/or electronics module for servicing, installing, and heat dissipation:

- 1/2-inch to 1-1/4 inches = 4 inches
- 1-1/2 inches to 2-1/2 inches = 6 inches

Port "B" can be sealed with the accessories supplied (blanking disk, gasket, and the nut).

NOTE: Blanking disks are not available for the large flange models.

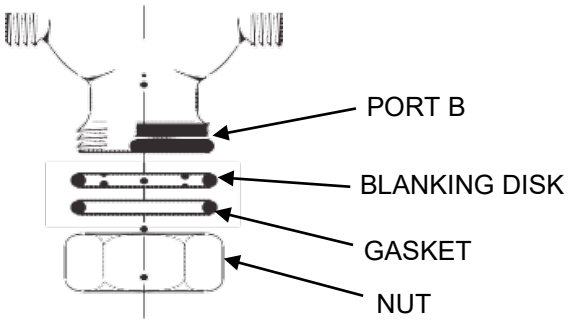


FIGURE 4-6: 3-Way Control Valve NPT Connection Components

NOTE: NPT screwed valves are flat-faced to facilitate sealing with the gaskets supplied. Do not use hemp, tape, or thread-sealing compound. Do not insulate the actuator.

5) Reattach electrical connections. Follow local codes or accepted contractor practices as to the use and/or type of joint compound or sealer at the connections.

6) Follow the startup procedures to put the unit back online. Carefully check all connections for any sign of leakage.

4.6 TEMPERATURE CONTROLLER

The temperature controller is a digital solid-state device, which requires no periodic maintenance. Occasional physical checks of the unit should be carried out for physical and mechanical security of mounting, terminal blocks, and electrical wiring.

4.7 REPLACEABLE PARTS LIST

The following is a list of parts that are generally replaceable by personnel trained/certified on DHT, Inc., liquid coolers. The replaceable parts may vary, depending on the unit and the particular design specifications in which the unit was constructed. If there are questions concerning the replaceable parts for the unit, refer to the original design specifications, or contact DHT, Inc.

Please have the unit's model and serial number available when contacting DHT, Inc.

NOTE:
Replaceable Parts may vary depending on design specification of the unit.

- 3-Way Control Valve
- Heat Exchanger Module
- T&P Relief Valve
- Recirculation Pump
- Thermocouples
- Strainers
- Isolation Valves
- Control Panel – HMI, Temperature Controller, etc.
- Support Frames/Brackets
- Hardware

NOTE:
Refer to Sections 4.12 and 4.13 for complete replacement part number information.

4.8 RECOMMENDED SPARE PARTS:

TABLE 4-3: RECOMMENDED SPARE PARTS

REFERENCE	ITEM NO.	QUANTITY PER UNIT	PART NAME
SEC 4.12	24	1	Recirculation pump
SEC 4.12	4	1	Control Valve Actuator Module
SEC 4.13	8 & 9	1	PID Controller
SEC 4.12	22	2	Thermocouples
SEC 4.12	3	1	Heat exchanger

4.9 ORDERING INFORMATION

All replacement parts for DHT SPC Series units can be ordered directly from your local authorized sales representative/agent. Visit Rep Locator page on DHT website if needed to find your local sales rep contact information.

NOTE:
If sales representative is not available, please contact DHT Sales.

Please include the model and serial number of the unit for which the parts are being ordered. If ordering by phone, please have this information readily available. All orders must be submitted via PO and sent to sales@dhtnet.com.

4.10 INSPECTION SCHEDULE

Table 4-4, below, summarizes the recommended time intervals for inspection of the liquid cooler, components, inlet and outlet water and energy source lines (boiler water or high temperature water), and power connections.

TABLE 4-4: RECOMMENDED INSPECTIONS TIME INTERVAL TABLE

TO BE INSPECTED	PER MANUFACTURE SPECS.	WEEKLY	MONTHLY	3 MONTHS	6 MONTHS	1 YEAR
Recirculation Pump	X					
Control Valve	X					
Temperature and Pressure Gauges				X		
Heat Exchanger Plates (measure performance)					X	
Inlet, Outlet and Return Connections				X		
Power and Ground Connections				X		
Isolation Valves		X				
Strainers				X		
Control Panel and Thermocouples					X	

4.11 PARTS AND ACCESSORIESS

COMMON PARTS FOR BRAZED (SHOWN HERE) UNITS:

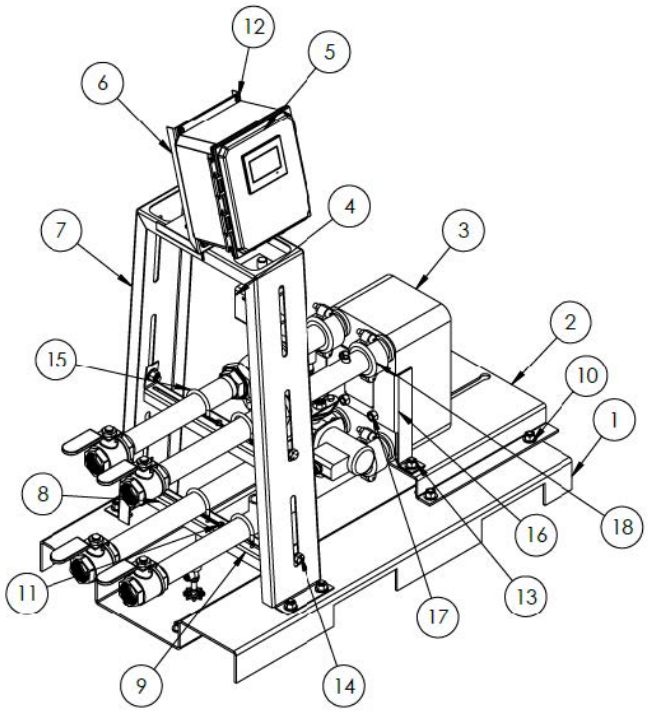


TABLE 4-5: BRAZED PLATE UNITS			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
1	40029	1	BASE SKID - SUPERPLATE
2	40030	1	PLATFORM, HEAT EXCHANGER
3	SEE TABLE 4-6	1	BRAZED PLATE HEAT EXCHANGER
4	22021-1.5	1	3-WAY CONTROL VALVE – 1-1/2” NPT
	22021-2		3-WAY CONTROL VALVE – 2” NPT
5	64002-SPC	1	CONTROL PANEL
6	40003	1	MOUNTING BRACKET, CONTROL PANEL
7	40031	1	A-FRAME
8	40032-L	2	PIPE SUPPORT, LEFT
9	40032-R	2	PIPE SUPPORT, RIGHT
10	10048-1.25	8	SQUARE NECK CARRIAGE BOLT - 5/8”-11 X 1.25"LG FULL THREAD - UNC 2B
	11003-.625	8	FLANGED LOCK NUT - 5/8”-11 - UNC 2B
11	10043-1.25	2	HEX BOLT - 3/8”-16 X 1.25"LG FULL THREAD - UNC 2B
	11001-0.375	2	FLAT WASHER – 3/8” – TYPE A
	11003-.38	2	FLANGED LOCK NUT - 3/8”-16 - UNC 2B
12	10042-0.75	8	HEX BOLT - 1/4”-20 X 0.75"LG FULL THREAD - UNC 2A

	11001-0.25	8	FLAT WASHER – 1/4” – TYPE A
	11003-.25	8	FLANGED LOCK NUT - 1/4”-20 - UNC 2B
13	10048-1.25	2	SQUARE NECK CARRIAGE BOLT - 5/8”-11 X 1.25"LG FULL THREAD - UNC 2B
	11003-.625	2	FLANGED LOCK NUT - 5/8”-11 - UNC 2B
14	10049-1.25	4	HEX BOLT – ZINC PLATED C.S. – 5/8”-11 X 1.5"LG FULL THREAD - UNC 2A
	11001-0.625	4	FLAT WASHER (NARROW) – 5/8” – TYPE B
	11004-.625	4	FLANGED LOCK NUT - 5/8”-11 - UNC 2B
15	10050-1.5	4	U-BOLT - C.S.(ZINC) – 1-1/2" NPS X 3/8-16 - UNC 2A
	10050-2		U-BOLT - C.S.(ZINC) - 2" NPS X 3/8-16 - UNC 2A
	11003-.38	4	FLANGED LOCK NUT - 3/8”-16 - UNC 2B
16	40004	1	MOUNTING BRACKET, BRAZED PLATE HEAT EXCHANGER
17	11002-.625	4	HEX NUT – 1/2"-13, SS
18	72035-2-1.5	4	REDUCING VICTAULIC COUPLING – 2” X 1.5” SIZE
	72034-2		VICTAULIC COUPLING – 2.0” SIZE

TABLE 4-6: HEAT EXCHANGER

ITEM NO.	PART NO.	QUANTITY	PART DESCRIPTION
3	**SINGLE WALL BRAZED PLATE**		
	80001-46	1	HEAT EXCHANGER (UNIT MODEL SPB-46S-1.5)
	80001-64		HEAT EXCHANGER (UNIT MODEL SPB-64S-1.5)
	80001-84		HEAT EXCHANGER (UNIT MODEL SPB-84S-2.0)
	80001-122		HEAT EXCHANGER (UNIT MODEL SPB-122S-2.0)

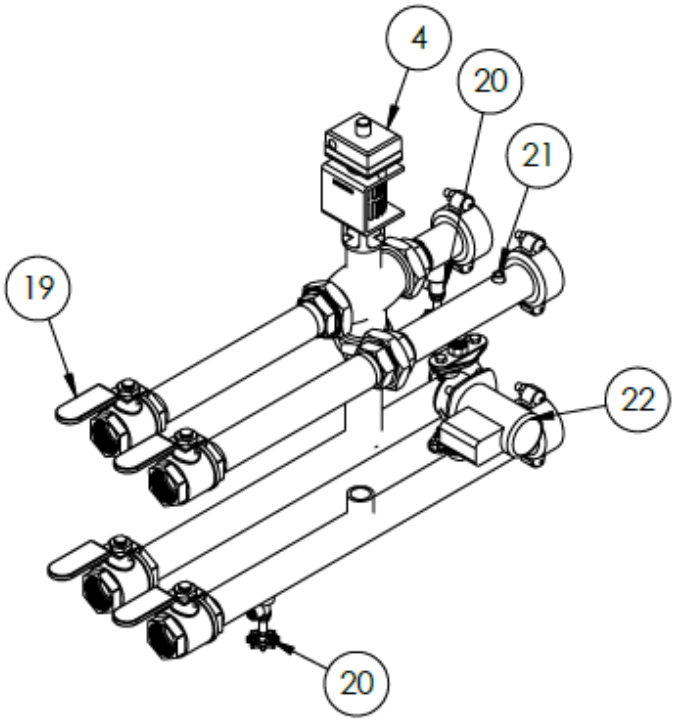
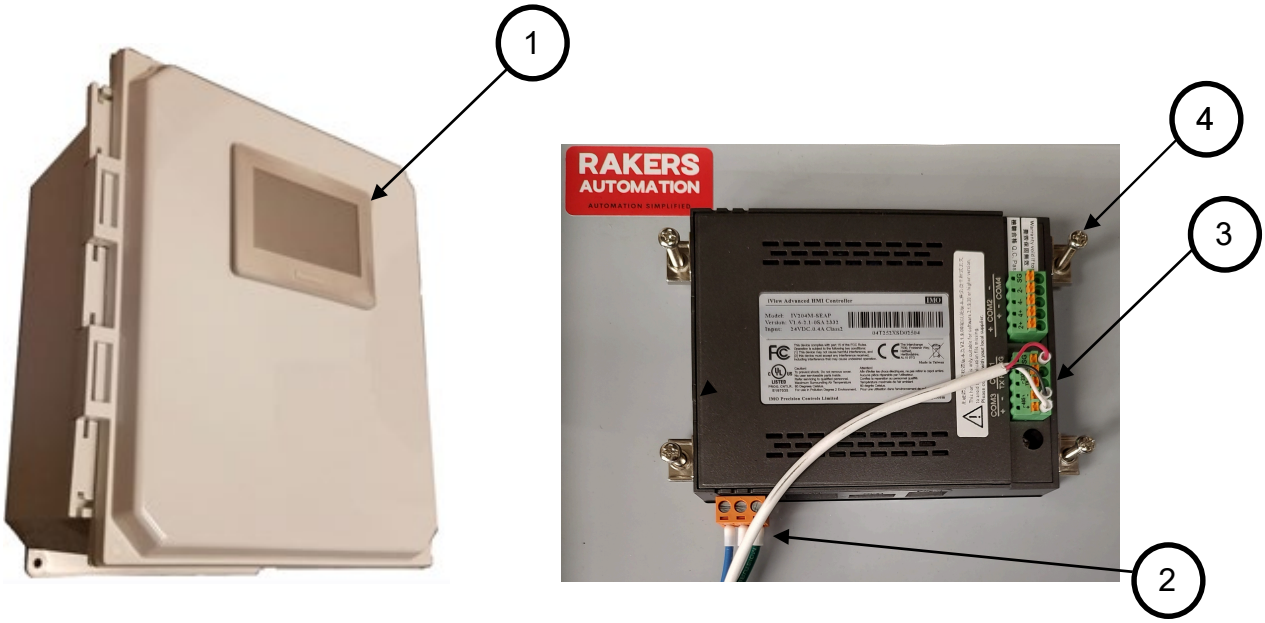
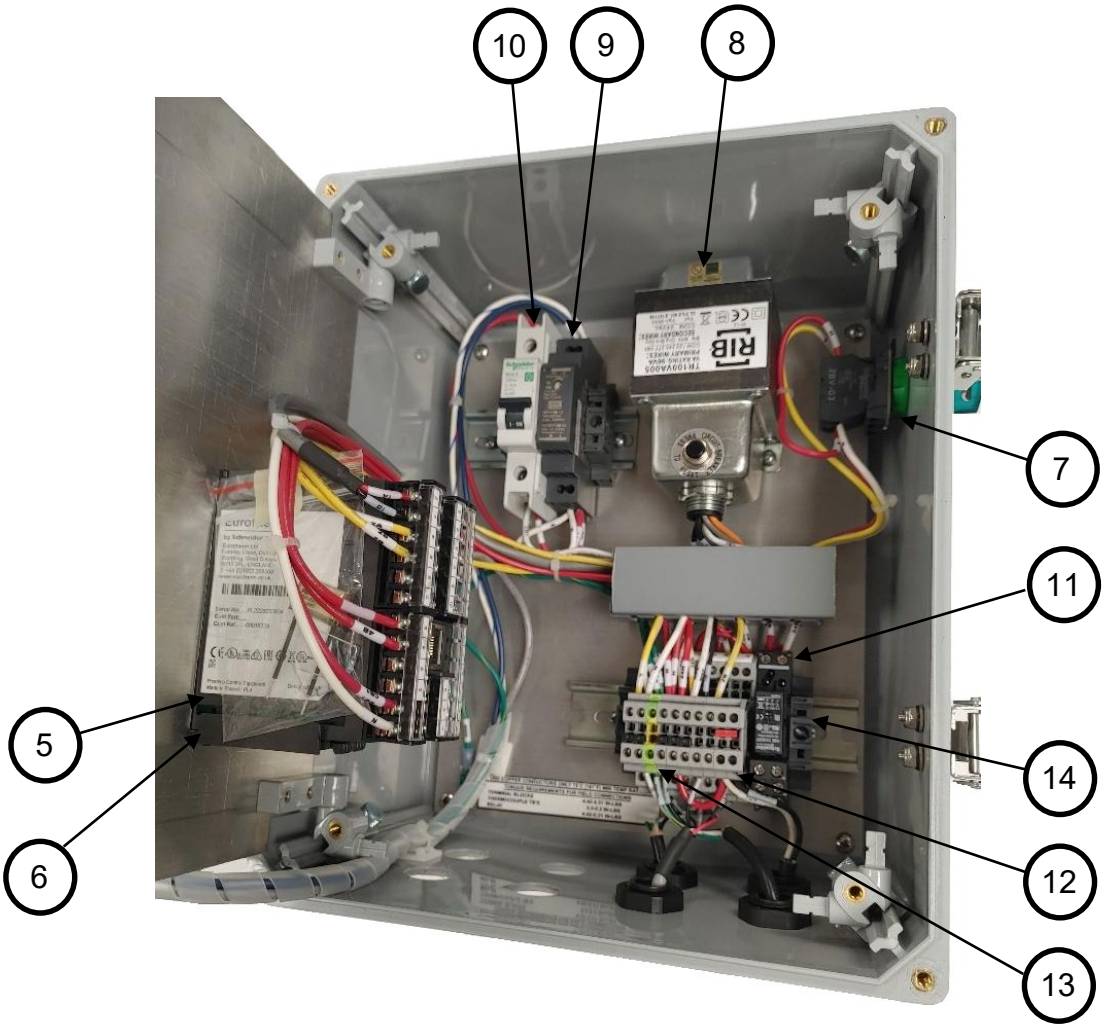


TABLE 4-7: CHILLER WATER ASSEMBLY			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
19	22018-1.5	4	BALL VALVE – 1-1/2” FNPT – LEAD FREE
	22018-2		BALL VALVE – 2” FNPT – LEAD FREE
20	22023-0.75	2	3/4” NPT DRAIN VALVE - LEAD FREE
21	62003-48	2	THERMOCOUPLE
22	22008	1	RECIRCULATION PUMP

4.12 CONTROL BOX PARTS





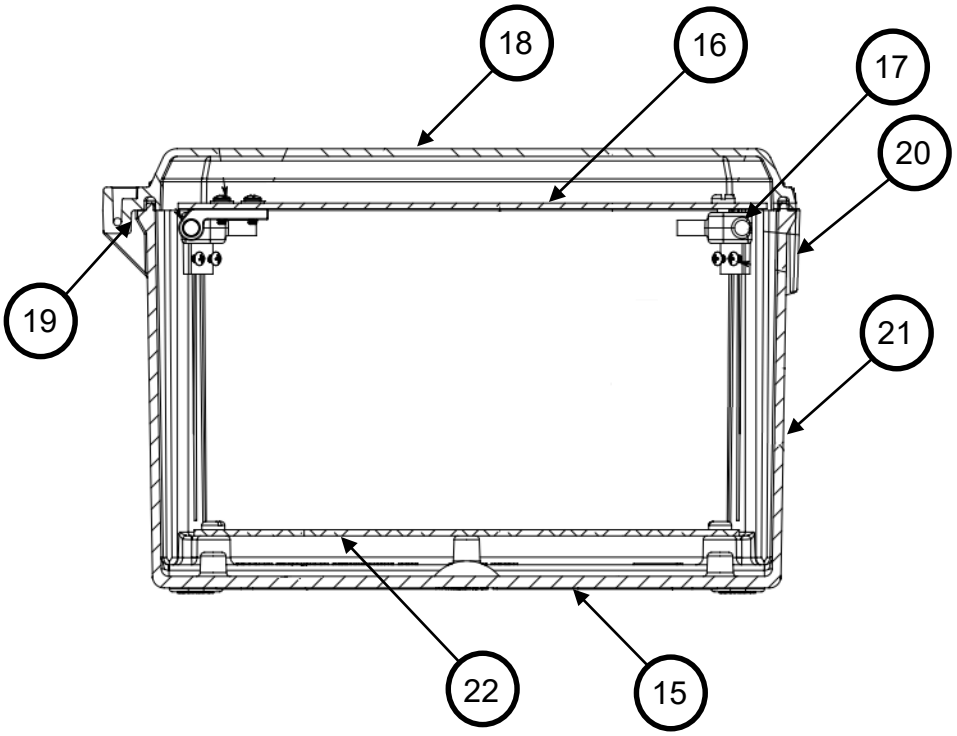


TABLE 4-13: CONTROL PANEL PART NUMBERS

ITEM	PART NO.	QTY.	DESCRIPTION
1	60010	1	HMI FRONT TOUCHSCREEN
2	63007	1	HMI POWER SUPPLY CONNECTOR
3	63008	1	HMI COM I/F CONNECTOR
4	67003	1	HMI INSTALLATION FASTENERS KIT
5	65026	1	PID CONTROLLER
6	67004	1	PID CONTROLLER MOUNTING CLIPS KIT
7	65010	1	POWER ON/OFF SELECTOR SWITCH
	65027	1	GREEN LED WITH N/O CONTACT
8	65028	1	TRANSFORMER
9	65029	1	24VDC POWER SUPPLY
10	65008	1	CIRCUIT BREAKER
11	65029	1	2 POLE RELAY SWITCH KIT
	65021	1	RELAY COIL ONLY
12	65006-W	8	DOUBLE HIGH TERMINAL BLOCKS
13	65006-G	1	DOUBLE HIGH GROUND TERMINAL BLOCK

14	65007	4	END ANCHORS
15	60001	1	CONTROL PANEL ENCLOSURE ASSEMBLY
16	67006	1	HINGED FRONT PANEL KIT
17	28005	1	HINGED PANEL HARDWARE REPLACEMENT KIT
18	67007	1	FRONT COVER
19	67008	1	STAINLESS STEEL HINGE PIN
20	67019	2	STAINLESS STEEL LATCH FOR ENCLOSURE
21	67010	1	ENCLOSURE BODY
22	67011	1	BACK PANEL

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SECTION 5: TROUBLESHOOTING

The following table summarizes problems that may be encountered over the life of a DHT SPC Series unit, and the procedures to remedy those problems. The left-hand column lists the symptoms. The remaining columns are suggested procedures or "remedies" that should be followed to identify and correct the problem.

SYMPTOM	PROBABLE CAUSE(S)	REMEDY
Liquid cooler is not able to maintain the required temperature at the rated capacity.	1. The liquid cooler temperature controls not set properly.	1. Check the set point settings on the controller. Readjust the set point settings if below the required temperature. Refer to programming sequence in section 3.11 for complete settings information.
	2. Control valve is not opening and closing properly.	2. See the adjustment and testing instructions contained in the supplied Installation/Operations Manual. Repair or replace the valve if necessary. Refer to Sections 3.5 and 4.6 Control Valve Technical Information if hard copy is not available. Make sure valve is in Automatic mode.
	3. Chilled water supply temperature is low.	3. Check to make sure the chilled water inlet temperature gauge reading is equal to the design conditions. Readjust the boiler supply water temperature if necessary.
	4. Chilled water flow rate is low.	4. Measure the chilled water supply flowrate using flowmeter and check the pump to make sure the flowrate is not lower than the design conditions.
	5. Chiled water inlet strainer is clogged.	5. Check the differential pressure/dirt gauge and blowdown the strainer until the gauge is in GREEN region.
	6. The heat exchanger is scaled on chilled water side.	6. Clean the heat exchanger per instructions in Section 4.3. Call DHT or your authorized representative for instructions on repair or replacement if necessary. Also ensure the water quality levels are within the allowable limits.
	7. Liquid cooler and control valve being used at higher than rated design capacity.	7. Check to make sure the operating conditions do not exceed the design conditions. Reduce the load or resize the heat exchanger.
	8. Recirculating pump malfunctions/failed.	8. Recirculation piping temperature should be same as the hot water outlet temperature when recirculation pump is operating properly. Check the power supply or repair/replace the pump if needed.
	9. Improper signal to control valve from control panel.	9. Open the valve cover and check 4-20mA control signal is present at valve terminals. Troubleshoot panel to restore proper signal to control valve if it malfunctions.

DHW supply temperature is too high.	1. The liquid cooler temperature control system/valve is not operating properly.	1. See the adjustment and testing instructions contained in Section 3.5 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace thermocouple if needed. Replace the control valve and/or actuator if necessary. Refer to Section 4.6 for replacement instructions.
	2. The temperature controller or thermometer indicates wrong value.	2. Inspect and replace the temperature controller, thermocouple and/or thermometer if any of them not functioning properly.
	3. Control Valve is set in MANUAL mode.	3. Make sure the Control Valve is set in AUTO mode.
	4. Control Valve requires calibration.	4. Recalibrate the control valve if needed per instructions in Section 3.5.
	5. Heat Exchanger is scaled on water side.	5. Clean the heat exchanger per instructions in Section 4.3. Call DHT or your authorized representative for instructions on repair or replacement if necessary. Also ensure the water quality levels are within the allowable limits.
DHW supply outlet temperature fluctuates significantly.	1. Control Valve does not open/close properly.	1. See the adjustment and testing instructions contained in the supplied manual for the specific temperature control valve installed on the unit. Replace the control valve and/or actuator if necessary. Refer to Section 4.6 for replacement instructions.
	2. Liquid cooler and control valve being used at higher than rated design capacity.	2. Call DHT or your authorized representative. Refer to the nameplate for the model and serial numbers of the unit and heat exchanger coil. Include these numbers in all correspondence.
	3. Recirculating pump malfunctions/failed.	3. Recirculation piping temperature should be same as the hot water outlet temperature when recirculation pump is operating properly. Check the power supply or repair/replace the pump if needed. Also check building recirculation pump aquastat settings if being used.
	4. Ground wiring connection is loose or disconnected.	4. Check the ground connection to make sure it is not loose, which can cause electrical nuisance for temperature control (building stray voltage).
	5. The liquid cooler temperature control system is not operating properly.	5. Refer to the PID settings adjustment and testing instructions contained in Section 3.11 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace it if needed.

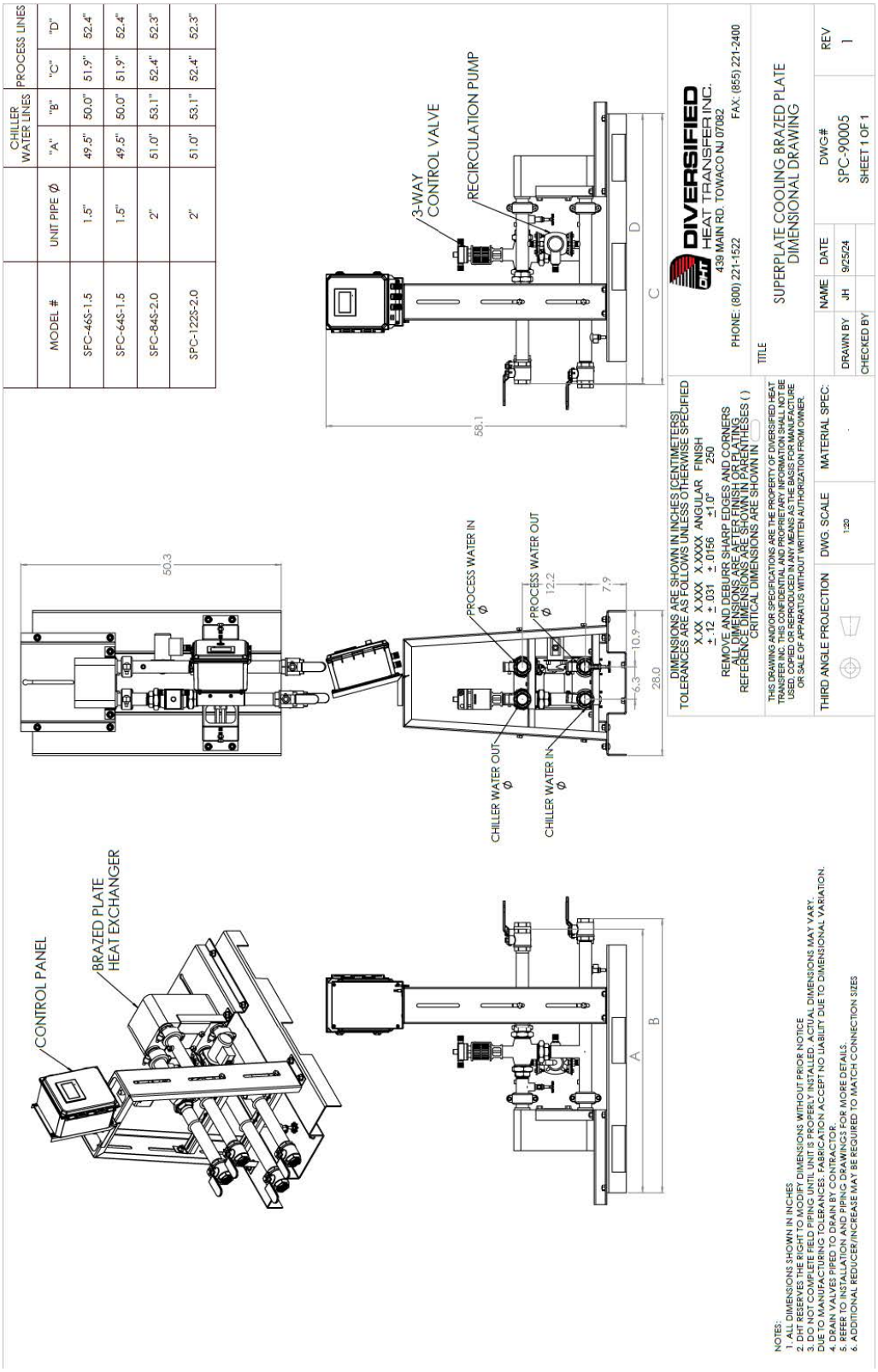
Excessive or insufficient boiler water being returned from the unit.	1. The water return piping has not been installed properly to allow the water return; boiler water return line is restricted; or the return check valve is leaking or has failed. 2. There is ~~a~~ water leakage in the heat exchanger.	1. Rearrange the boiler water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the water return line. Replace the check valve if it is leaking or has failed. 2. Shut off the isolation valves on inlet and outlet of the unit and check to verify the presence of leakage. Disassemble, inspect, repair (if possible), or replace the heat exchanger and reassemble the unit.
Unit is not cooling the water and control valve is closed.	1. There is no power supply to control valve. 2. There is no signal from controller to valve.	1. Open the valve cover and check to make sure 24VAC power is present at valve terminals. Troubleshoot panel to restore power if it is not present. 2. Open the valve cover, and check 4-20mA control signal is present at valve terminals. Troubleshoot panel to restore proper signal to control valve if it malfunctions.
Temperature and Pressure or pressure only relief valve “pops.”	1. Water 3-Way Control Valve does not close properly. 2. Incoming water is preheated too much. 3. Improperly sized or disconnected expansion tank in closed loop piping system. 4. Inadequate water hammer arrestors. 5. System/incoming water pressure is too high. 6. Relief valve is faulty. 7. Over temperature settings in PID controller not properly set or defective.	1. See the adjustment and testing instructions contained in Section 3.11 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace it if needed. Replace the control valve and/or actuator if necessary. Refer to Section 4.6 for replacement instructions. 2. Maintain incoming cold water at least 10°F below the hot water supply temperature. 3. Install the properly sized expansion tank in the closed loop piping system as shown in Installation and Piping drawings in Section 6.3. 4. In order to avoid any shock waves, install water hammer arrestors/shock absorbers in the hot and cold water systems as needed. 5. Bring the system water pressure below the relief valve setting. 6. Inspect and adjust or replace the relief valve if it has failed. Contact DHT representative for replacement. 7. Check and readjust as necessary. Replace the defective parts as necessary. Refer to adjustment instructions contained in Section 3.11.

Liquid cooler shuts down at or too close to (above or below) the design outlet water temperature.	1. Over temperature limit settings not properly set or defective.	1. Refer to adjustment instructions contained in Section 3.11. Replace the defective parts as necessary.
A loud banging noise in the liquid cooler or water piping (not to be confused with a normal clicking noise made during operation).	1. Water return piping has not been installed properly to allow the water return circulation; the water return line is restricted; or the water return check valve is leaking or has failed. 2. Improperly sized or disconnected expansion tank in closed loop piping system. 3. Inadequate water hammer arrestors.	1. Rearrange the water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the water return line. Replace the check valve if it is leaking or has failed. 2. Install the properly sized expansion tank in the closed loop piping system as shown in Installation and Piping drawings in Section 6.3. 3. In order to avoid any shock waves, install water hammer arrestors/shock absorbers in the hot and cold water systems as needed. Also check for any trapped air in the water system.
Over-temperature sound alarm occurs frequently.	1. Automatic over temperature settings not properly set or defective parts.	1. Check and readjust the over-temperature setting as necessary. Refer to adjustment instructions contained in Section 3.11. Replace the defective parts or thermocouple if defective.
Unable to clear Over-temperature alarm condition.	1. Automatic over temperature settings not properly set or defective parts. 2. Defective thermocouple. 3. Recirculating pump malfunctions/failed. Flow is stagnant through the heat exchanger. 4. Control valve requires calibration.	1. Check and readjust the over-temperature setting as necessary. Refer to adjustment instructions contained in Section 3.11. Replace the defective parts. 2. Replace the thermocouple if shorted. 3. Check to make sure pump is functioning properly. Also, check for any blockage in the piping to ensure proper flow through heat exchanger. 4. Recalibrate the Control valve per instructions in Section 3.5.2.

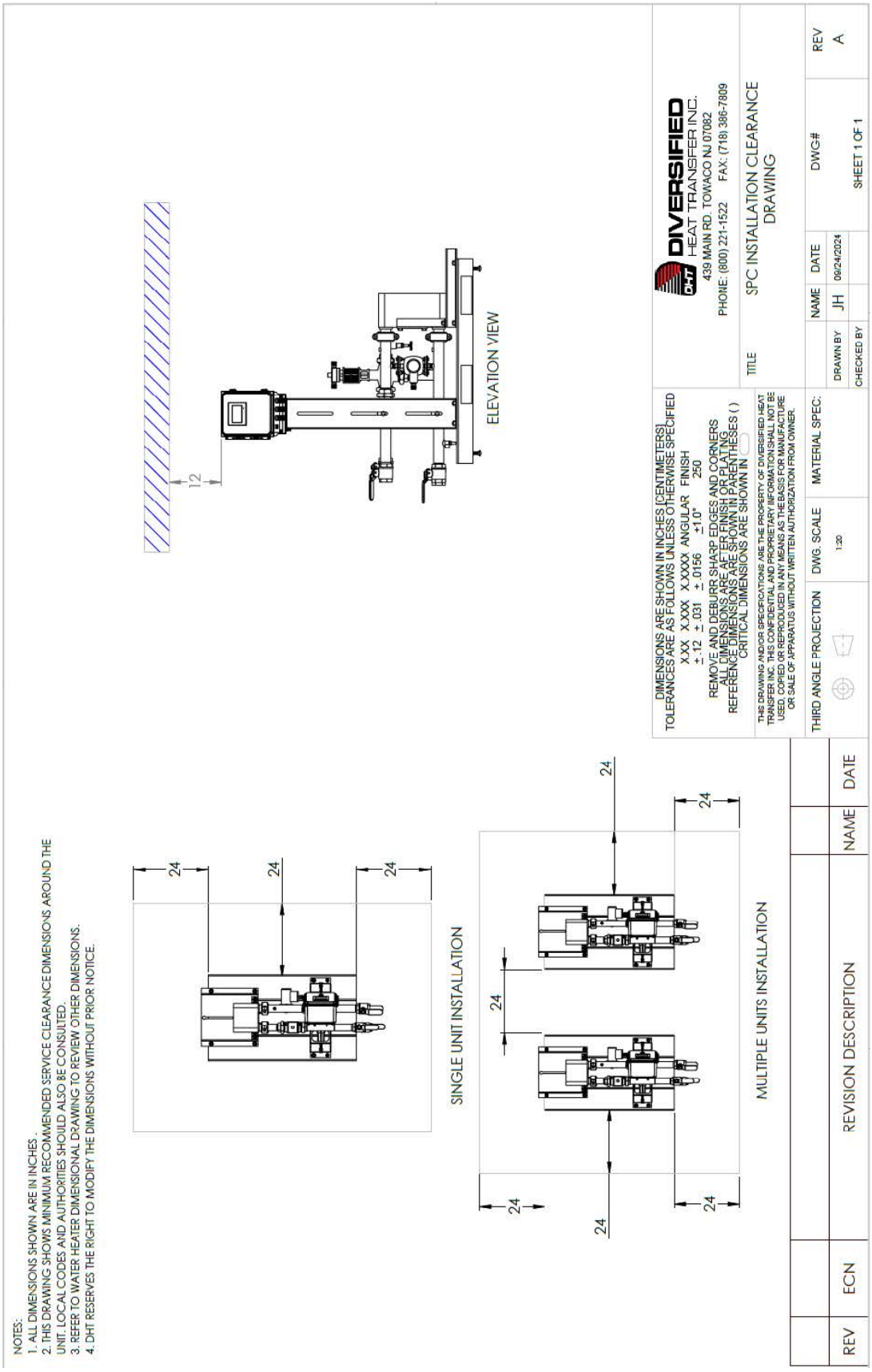
Controller unit 'Locks Up.'	1. Controller 'Locks Up.'	1. Recycle power to the unit by removing AC power, waiting 10 seconds and reconnecting power. **DANGER!** **This should be done by using the user provided circuit breaker or fuse, not by removing the power wires at the terminal block. Serious injury or death can occur if contact is made with the incoming AC power.**
HMI and/or Controller display remains at zero or shows no change.	1. Display remains at zero or shows no change, but the process is changing.	1. Recycle power to the unit by removing AC power, waiting 10 seconds and reconnecting power. If the problem persists, contact the local DHT representative.
Entire System is OFF.	2. External 120V AC power disconnected or ON/OFF switch on control panel failed/OFF.	2. Check to make sure external circuit breaker is ON and there is power supply available. Replace the ON/OFF switch on the control panel if faulty.

SECTION 6: TECHNICAL DRAWINGS & FORMS

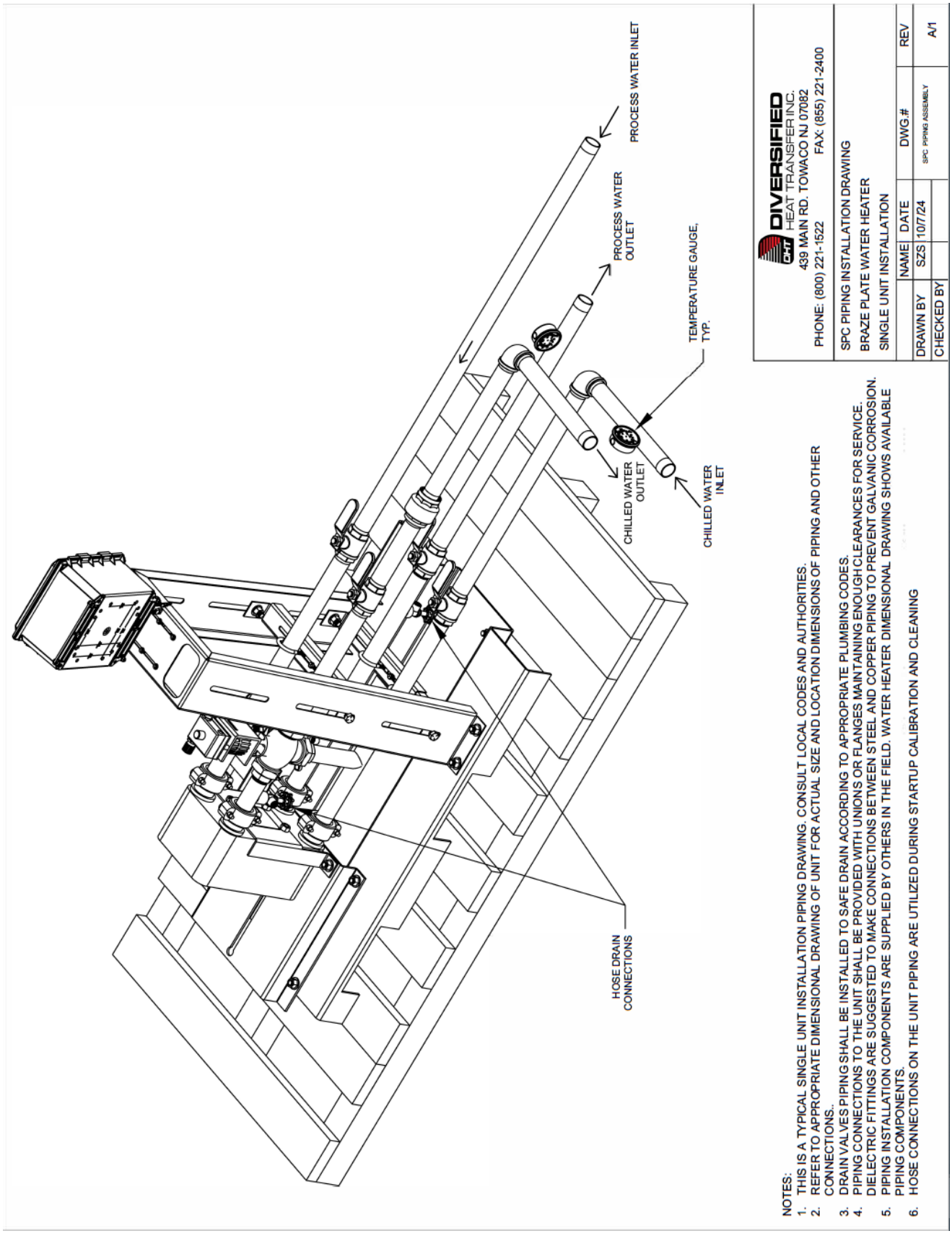
6.1 DIMENSIONAL DRAWINGS



6.2 CLEARANCE DRAWINGS

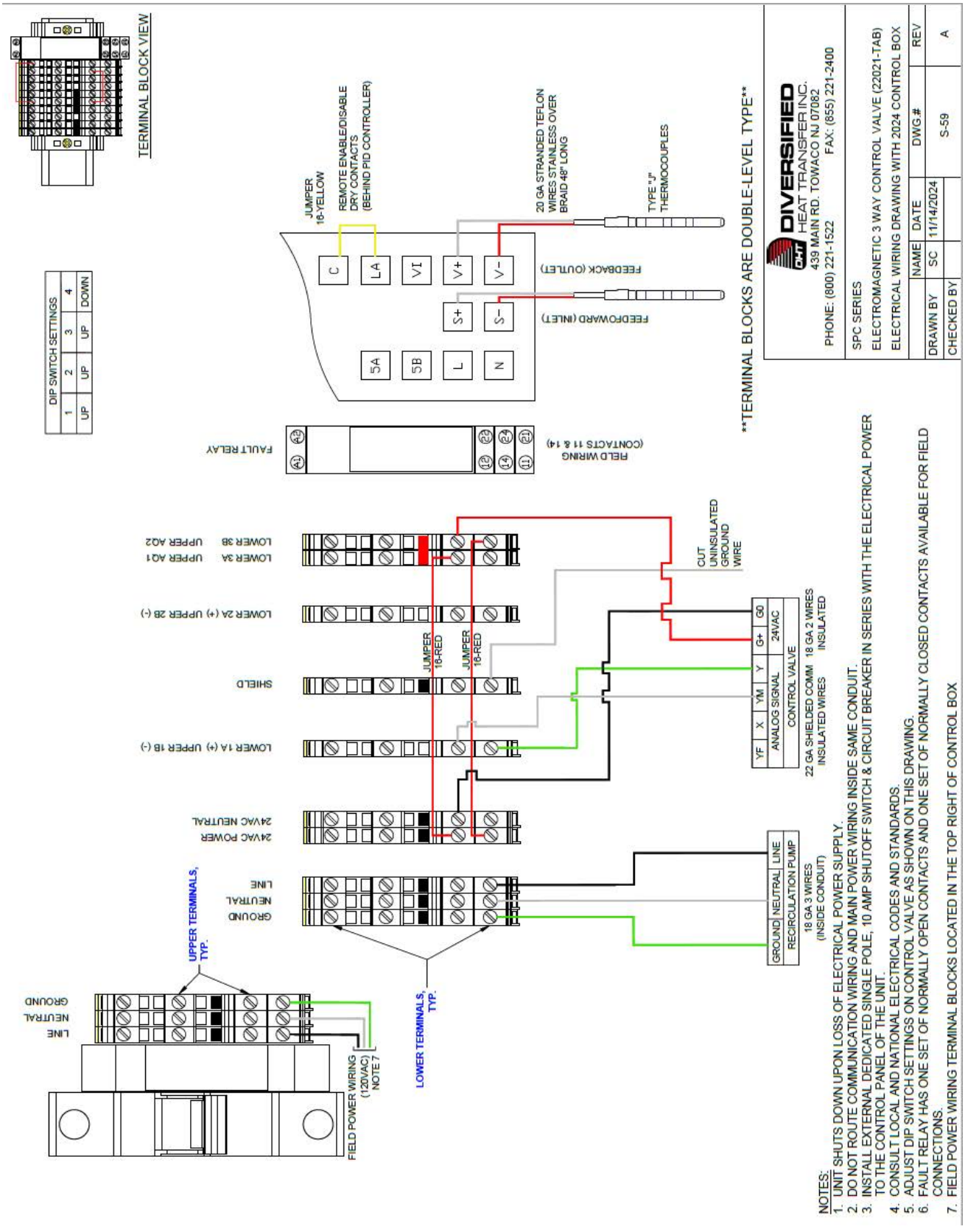


6.3 PIPING AND INSTALLATION DRAWINGS



6.4 ELECTRICAL WIRING DIAGRAMS/SCHEMATICS

Terminal Block Wiring Connections:



6.5 FORMS AND RECORDS

6.5.1 DHT Liquid cooler Controller Programming Record Sheet

DHT Liquid cooler Controller Programming Record Sheet

MODEL NUMBER:_____ SERIAL NUMBER: _____

VERSION:_____ PASSWORD: _____

SETPOINTS **SETPOINT**

PRIMARY ALARM ON AT _____

PRIMARY ALARM OFF AT _____

SECONDARY ALARM ON AT _____

SECONDARY ALARM OFF AT _____

PASSWORD:

INPUT FILTER _____

UNIT TEXT _____

SCALING

DECIMAL POINT _____

ANALOG INPUT LOW _____

ANALOG INPUT HIGH _____

6.5.2 SPC Series Installation Form

DIVERSIFIED HEAT TRANSFER INC.

SP SERIES INSTALLATION FORM

Please complete ONE (1) form for each SITE at which DHT SP Series Units are installed and return it to DHT for warranty validation within 30 days of start-up. After completion, e-mail this form to: WARRANTY@DHTNET.COM or fax to 718-386-7809.

Completed by: _____ Date: _____

UNIT AND LOCATION		
Installation Name:	Technician:	
Street Address:	Company:	
City, State, Zip:		
Phone#:	Fax#:	Email:
DHT Sales Rep:		

EQUIPMENT CLASSIFICATION
Choose the unit type and enter the serial number for each unit. Add additional in ADDITIONAL NOTES if needed.
Model #:
Serial #:

GENERAL INSTALLATION			
1. Is the relief valve piped to drain or within 12" of floor?	□ Yes	□ No	
2. Is there an electrical service switch at or near the unit?	□ Yes	□ No	
3. Does any electrical conduit, ductwork or piping impede the serviceability of the unit or the ability to remove the sheet metal covers?	□ Yes	□ No	
4. Have all electrical components been verified for proper grounding?	□ Yes	□ No	
5. Has all communication wire been properly shielded?	□ Yes	□ No	
6. What is the system pressure?	□ Yes	□ No	
7. The system application is: □ Potable Water □ Process □ Storage Tank □ Other: _____			
8. Are all units installed in accordance with the clearances defined in the SUPERPLATE OM? If no, why? _____	□ Yes	□ No	
9. If multiple units are installed in parallel, are they piped reversed return as per the SUPERPLATE OM? If no, why? _____	□ NA	□ Yes	□ No

FOR HEATERS USING A STORAGE TANK		
1. Storage tank is:	□ Stratified	□ Accumulator
2. The tank has:	□ Baffle	□ Dispersion Tube
3. What is the storage tanks volume?	_____ Gallons	
4. What is the heater outlet temperature?	_____ ^{o}F	

DIVERSIFIED HEAT TRANSFER INC.

5. Position of aquastat:	□ Upper 1/3	□ Middle 1/3	□ Lower 1/3	□ No aquastat
6. What is the aquastat temperature setting?	_____ °F			
7. Does the aquastat control the pump between the tank & heater?	□ Yes		□ No	
8. Is a throttling valve installed between the pump and heater?	□ Yes		□ No	
9. Is there a bypass loop around the pump?	□ Yes		□ No	
10. What is the capacity of pump between the tank and heater?	_____ GPM			

WATER HEATER INSTALLATION		
1. Are isolation valves installed in the inlet piping?	□ Yes	□ No
2. Are isolation valves installed in the outlet piping?	□ Yes	□ No
3. Is a hose bib installed in the outlet piping?	□ Yes	□ No
4. Are check valves installed in the cold water inlet?	□ Yes	□ No
5. Are check valves installed in the recirculation line?	□ Yes	□ No
6. Building recirculation is piped to:	□ Inlet Side of Heater	□ None
7. Record distance of building connections (ft)_____ & cold water feed _____ to the bank of unit (s)		
8. What are the maximum/ minimum design flow rates through the unit?	MAX_____GPM	MIN_____GPM
8a. Were the maximum/ minimum flow rates verified?	□ Yes	□ No
9. What is the design system flow rate?	_____ GPM	
10. What is the design boiler plant delta T?	_____ °F	
11. Is there a buffer tank used with the SUPERPLATE Heater?	□ Yes	□ No
11a. If yes, is the buffer tank supplied by DHT?	□ Yes	□ No
11b. Number of buffer tank ports?	□ 2 Ports	□ 4 Ports
11c. Buffer tank volume:	_____ Gallons	
12. What is the setpoint?		
13. What is the high limit set to?		
14. What boiler water temp is being supplied?		
15. What is the boiler water pressure?		
16. Does the SuperPlate have a dedicated boiler pump?	□ Yes	□ No
17. What is flow rate of the pump?		
18. Has the flow been verified?	□ Yes	□ No

DIVERSIFIED HEAT TRANSFER INC.

CONTROL BOX CONFIGURATION Please indicate if any changes have been made to the Factory Settings.					
Factory Settings	Factory Value	Field Value (Changes)	Factory Settings	Factory Value	Field Value (Changes)
Set Point	140 °F		Feed forward Gain	1	
Control Valve Open	Automatic		Feed forward Lead Time	5	
Primary Alarm On/ Off	+ Δ 20 °F		Feed forward Lag Time	3	
Secondary Alarm On/ Off	+ Δ 30 °F		Aquastat (if used)	180 °F	
Gain	20		Pump Dev. High	2 °F	
Integral	360		Pump Dev. Low	5 °F	
Derivative	0				

WATER QUALITY DHT recommends that a sample of the unit's input water supply be tested to determine if it will have an adverse effect on the unit. Testing can be via a standard water quality test kit, widely available at retail hardware and home improvement stores. The following questions can be answered by such test kits.				
1. What is the pH of the water? *(a pH between 6.5 to 9.5 is recommended)*				
2. What is the hardness of the water? *Grains per Gallon (1-10 is recommended)*				
3. Is there a water softening or treatment system installed?	□ Yes		□ No	
3a. If yes, what kind?	□ Salt	□ No Salt	□ Chemical Injection	□ Other: _____

SUMMARY		
1. Are all the units installed in accordance with DHT guidelines & industry best practices?	□ Yes	□ No
1a. If no, please describe the issues.		
1b. Who has been contacted? Please provide name & Number for each person contacted. (Check all that apply) □ DHT Engineer: □ Mechanical Contractor: □ Design Engineer: □ Controls Engineer: □ General Contractor: □ Building Owner: □ Plumber: □ Electrician:		
2. Is there any conflicts between the Installation & the Engineer's Specification or Design Plans?	□ Yes	□ No
2a. If no, please describe the issues.		
3. Are there any conflicts or physical restrictions that will prevent the boiler plant from receiving proper preventative maintenance in the future?	□ Yes	□ No

DIVERSIFIED HEAT TRANSFER INC.

3a. If no, please describe the issues.	

3b. Who has been contacted? Please provide name & Number for each person contacted. (Check all that apply)

□ DHT Engineer:	□ Mechanical Contractor:	□ Design Engineer:
□ Controls Engineer:	□ General Contractor:	□ Building Owner:
□ Plumber:	□ Electrician:	

4. Please outline any exceptions that have granted by a DHT Engineer for this installation if necessary.

Other Notes:

DHT INTERNAL APPROVAL	
DHT Engineering Sign-off:	Date:
Notes:	

6.5.3 SPC Series Startup Form

DIVERSIFIED HEAT TRANSFER INC.

SP SERIES START-UP FORM

Please complete ONE (1) form for each SITE at which DHT SP Series Units are installed and return it to DHT for warranty validation within 30 days of start-up. After completion, e-mail this form to: WARRANTY@DHTNET.COM or fax to 718-386-7809.

Completed by: _____ Date: _____

UNIT AND LOCATION		
Installation Name:	Technician:	
Street Address:	Company:	
City, State, Zip:		
Phone#:	Fax#:	Email:
DHT Sales Rep:		

EQUIPMENT CLASSIFICATION
Choose the unit type and enter the serial number for each unit. Add additional in ADDITIONAL NOTES if needed.
Model #:
Serial #:

TEMPERATURE CALIBRATION Consult SUPERPLATE OM for temperature calibration procedure.	
1. What is the water heater setpoint?	_____ °F
2. What is the integral setting?	_____ °F
3. What is the gain setting?	_____ °F
4. What is the valve maximum percentage	_____ %
5. If used, what is the aquastat setting? *(Typically set 20 °F above unit setpoint)*	_____ °F

CONTROL BOX CONFIGURATION
Please indicate if any changes have been made to the Factory Settings.

Factory Settings	Factory Value	Field Value (Changes)
Set Point	140 °F	
Control Valve Open	Automatic	
Primary Alarm On/ Off	+ Δ 20 °F	
Secondary Alarm On/ Off	+ Δ 30 °F	
Gain	20	
Integral	360	
Derivative	0	

Factory Settings	Factory Value	Field Value (Changes)
Feed forward Gain	1	
Feed forward Lead Time	5	
Feed forward Lag Time	3	
Aquastat (if used)	180 °F	
Pump Dev. High	2 °F	
Pump Dev. Low	5 °F	

DIVERSIFIED HEAT TRANSFER INC.

Additional Notes:

DHT INTERNAL APPROVAL	
DHT Engineer Sign-off:	Date:
DHT Notes:	

SECTION 7: WARRANTY

Subject to the terms and conditions herein and the Terms and Conditions of Sale (as defined herein), Diversified Heat Transfer, Inc. (DHT) ("Seller") provides to the purchaser of the product ("Buyer") a non-prorated warranty for the following components of the SPC SERIES LIQUID COOLER. The SPC SERIES Liquid cooler must be operated in accordance with the conditions stated herein, against the indicated failures. The SPC SERIES Warranty commences on the date of shipment or if a start-up report is furnished to Seller, on the start-up date shown on the report furnished to Seller (the "Warranty Period"). The startup must be completed within six (6) months of shipment, and the start-up report must be furnished to Seller within thirty (30) days of the startup.

- **HEAT EXCHANGER** shall carry a non-prorated (5) year warranty.
- **ALL OTHER COMPONENTS** shall carry a non-prorated (1) year warranty.

CONDITIONS OF WARRANTY:
This Specific Product Limited Warranty is transferrable to the owner that utilizes the product(s) purchased hereunder for its intended use at the original installation site (the "Original Owner"). This Specific Product Limited Warranty is non-transferable to anyone who subsequently receives or purchases products from the Original Owner. If the Original Owner did not purchase the product directly from Seller, the Original Owner should contact the reseller from whom it purchased the product for a copy of the Terms and Conditions of Sale which can be also found on www.dhtnet.com.

Seller's obligations under this Specific Limited Warranty is limited to modify, repair, or exchange the defective item which after examination shall, to Seller's own satisfaction be determined to have been defective at the time it was shipped. In the event that a replacement is provided by Seller, the defective item will become the property of Seller. Any claims relating to this product shall be limited to the list price of the product at the time of sale. Transportation to Seller's facility or other designated facility for repairs of any products or party alleged defective shall, in all events, be at Buyer's sole risk and cost.

This warranty applies only if the Seller receives, within the Warranty Period, an immediate written notice, providing a detailed description of all claimed defects, upon discovery of such defects together with proof of purchase (invoice or Order Acknowledgment) and a copy of the start-up report for the affected product (Attention: Diversified Heat Transfer, Inc., 439 Main Rd. Rte 202, Towaco, NJ).

Seller may seek reimbursement of any costs incurred by Seller where the product is found to be in good working order, or when it has been determined that this Specific Product Limited Warranty does not apply as per the exclusions set forth below. The remedies available to Buyer set forth herein are exclusive remedies, and all other remedies, statutory or otherwise, including but not limited to the right of legal action, are waived by Buyer. Buyer shall indemnify and hold Seller harmless against, any claim due to any injury or death to any person or damage to any property resulting in whole or in part from any modification or alteration Buyer makes to any product sold hereunder.

EXCLUSIONS:
To the full extent permitted by law, Seller shall have no liability for and the warranties do not cover:

A. Any product which has been altered or repaired by other than Seller's personnel;
B. Deterioration or failure of any product due to
    a. abrasion, corrosion, erosion or fouling,
    b. misuse,
    c. modification not authorized by Seller in writing
    d. improper installation, lack of or improper maintenance or operation;
C. Equipment not furnished by Seller, either mounted or unmounted, or when contracted for by a party or parties other than Seller to be installed or handled;
D. The suitability of any product for any particular application;
E. The design or operation of owner's plant or equipment or of any facility or system of which any product may be made a part;

F. Any damage to the product due to abrasion, erosion, corrosion, deterioration, abnormal temperatures or the influence of foreign matter or energy;
G. Leakage or other malfunction caused by:
    a. defective installations in general and specifically, any installation which is made
        i. in violation of applicable state or local plumbing, housing or building codes or
        ii. contrary to the written instructions furnished with the product,
    b. adverse local conditions in general and, specifically, sediment or lime precipitation in the tubes, headers and/or shells or corrosive elements in the water, cooling medium or atmosphere, or
    c. misuse in general and, specifically, operation and maintenance contrary to the written instructions furnished with the unit, disconnection, alteration or addition of components or apparatus, not approved by Seller, operation with cooling media, fuels or settings other than those set forth on the rating plate or accidental or exterior damage;
H. Discoloration or rusty water caused by piping, fittings, valves, pumps or other sources outside of the SPC SERIES Liquid cooler;
I. Damage to surrounding area or property caused by leakage or malfunction;
J. INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, SUCH AS LOSS OF THE USE OF PRODUCTS, FACILITIES OR PRODUCTION, INCONVENIENCE, LOSS OF TIME OR LABOR EXPENSE INVOLVED IN REPAIRING OR REPLACING THE ALLEGED DEFECTIVE PRODUCT;
K. Costs associated with the replacement and/or repair of the unit including: any freight, shipping or delivery charges, any removal, installation or reinstallation charges, any material and/or permits required for installation, reinstallation or repair, charges to return the SPC SERIES Liquid cooler or components;
L. Any claim due to any injury or death to any person or damage to any property resulting in whole or in part from any modification or alteration Buyer makes to any product sold hereunder; and
M. Design defects where Seller has complied with Buyer's design specifications.

No salesman or other representative of the seller has any authority to expand warranties beyond the face of the said warranty and purchaser shall not rely on any oral statement except as stated in the said warranty. An Officer of the Seller must do any modifications to this warranty in writing.

WARRANTY CLAIMS:
Warranty claims should be presented through prompt telephone notification to DHT at toll-free 1-800-221-1522 or email to warranty@dhtnet.com. In order to process a warranty claim a formal purchase order number is required prior to shipment of any warranty item. In addition, the returned item must include a Returned Goods Authorization (RGA) label, attached to the shipping carton, which identifies the item's return address, register number and factory authorized RGA number.

NOTE:
This warranty applies only to units sold to customers in North America. All other geographical areas carry a standard warranty of 18 months from date of shipment or 12 months from startup, whichever comes first.

Change Log:

Date	Description	Changed By
01/02/2019	Initial release	SS
05/20/2019	Update design and control changes	SS
08/15/2019	Update startup and installation forms	SS
01/23/2023	Update new part numbers and communication settings	SS
01/31/2023	Update part description Table 4-13	SS
10/15/24	Update to SPC	CB