DIVERSIFIED HEAT TRANSFER INC.

Installation, Operation, and Maintenance Manual

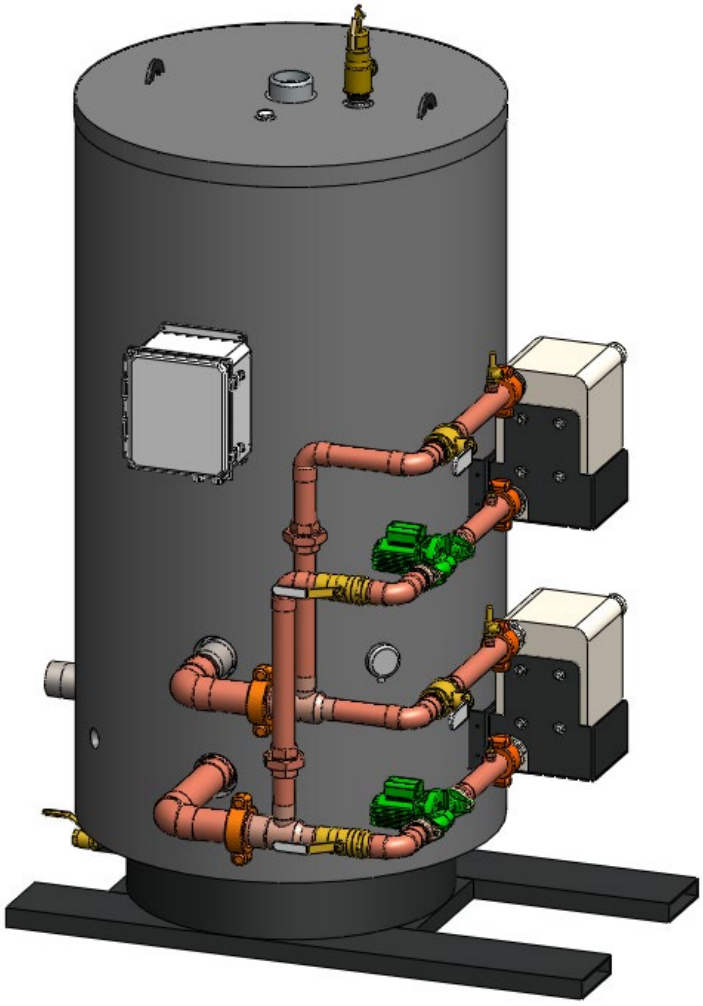
STP Series

Indirect Fired, Storage, Boiler Water Heater

(Brazed Plate Double Wall Heat Exchangers and Storage Tank)

This manual applies to the following units:

- Simplex STP units
- Duplex STP units



DHT STP SERIES WATER HEATER
(Duplex Version Shown)

CONTRACTOR / FACILITY DATA

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

Model #: _____

Serial #: _____

Install Date: _____

Latest Update: 9/11/2024

TABLE OF CONTENTS:

SECTION 1: GENERAL INFORMATION

1.1 INTRODUCTION

The purpose of this manual is to provide an installation, operation, and maintenance procedural guide for the STP Series water heaters, which includes the following model options:

- STP Simplex Double Wall Brazed Plate
- STP Duplex Double Wall Brazed Plate

These are boiler water or HTHW to domestic storage water heating units. Storage tanks are available in both double glass lined carbon steel or duplex stainless steel materials. Units are available in wide range of standard storage tank and heat exchanger capacities.

1.2 DESCRIPTION

The Diversified Heat Transfer STP Series water heaters are engineered solutions for facility owners/managers who need fully packaged storage type water-to-water heat transfer solution for quick and easy single point connections. Storage tanks are constructed of either optional carbon steel with double glass lining or duplex stainless steel materials. Heat exchangers are standard brazed plate double wall stainless steel material and available in modular design with simplex and duplex options for built in redundancy or extra capacity. Each water heater is equipped with a control panel, wiring, circulation pumps(s), piping and fittings etc., which makes them ideal for new and retrofit installations.

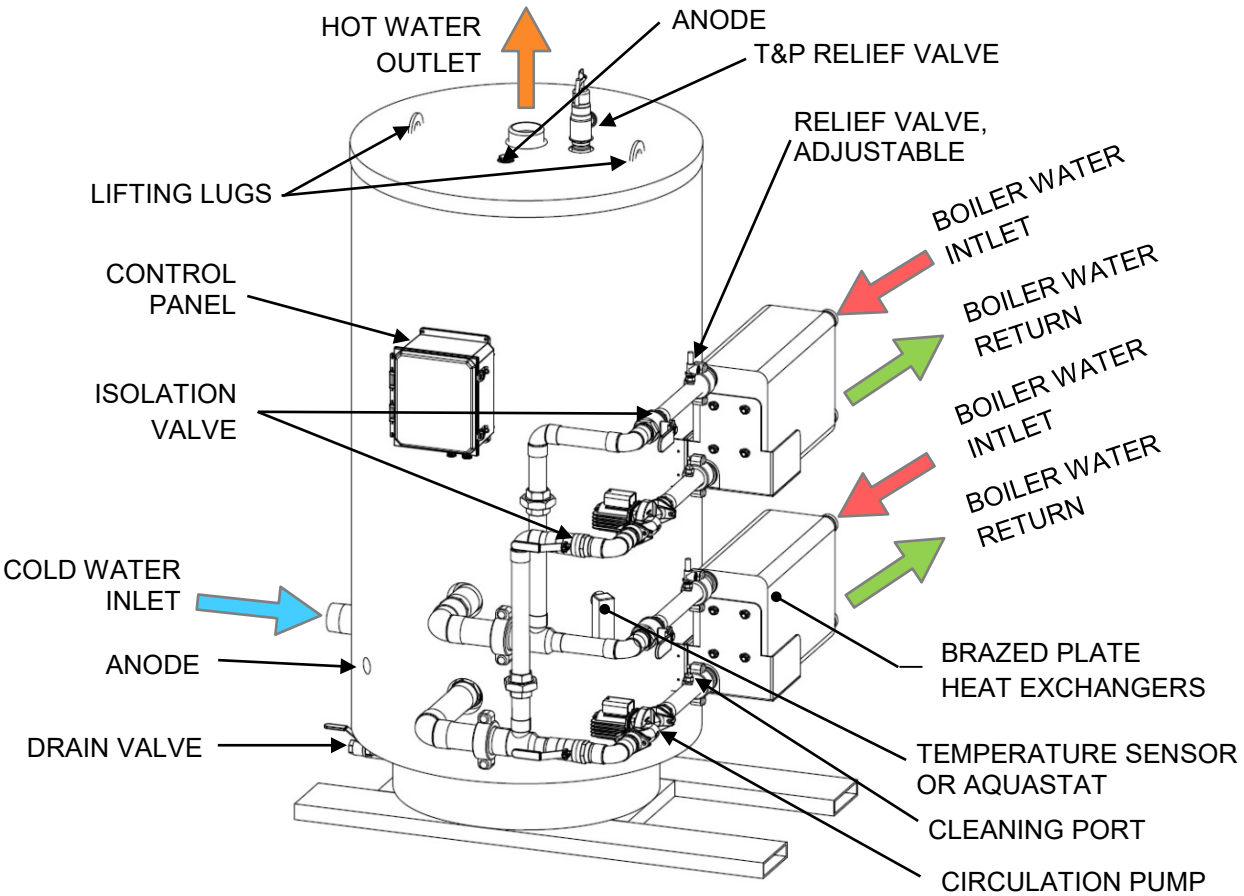


FIGURE 1.2: STP Series Component and Function Diagram (Duplex Unit Shown)

The units are engineered using boiler water as the heating medium. Piping assembly components are similar between simplex and duplex Brazed Plate Double Wall heat exchangers with Storage tank. Because the water heating 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

- Available in Simplex and Duplex heat exchanger options
- Available in variety of storage tank and heat exchanger capacities
- Compact design to fit in small mechanical rooms
- Complete packaged system with components engineered to standard application requirements for single point connections
- Energy efficient
- High recovery
- Double Wall Brazed Plate stainless steel construction heat exchanger
- ASME compliance heat exchanger and storage tank

1.4 APPLICATIONS

STP Series units are used in wide range of domestic water heating applications including either new construction or replacement of existing units. Most common application examples include:

- Apartment complexes
- Prisons/correctional facilities
- Hospitals/medical centers/nursing homes
- Hotels/casinos/entertainment
- Schools/colleges/universities/dormitories
- Government buildings
- Commercial office buildings
- Factories/industrial facilities
- Fitness centers/health clubs etc.

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

1.5 ENERGY SOURCES

DHT STP Series Hot Water Heaters are engineered and manufactured to use boiler water as energy source to produce domestic hot water.

1.6 DESIGN CONDITIONS

DHT has design, engineering, and manufacturing capabilities to produce products to satisfy a wide range of our customer requirements. Standard tank sizes range from 175 to 500 gallons. DHT standard design conditions for STP Series units are:

Design Pressure, PSIG	**150**
Design Temperature, °F	**210**

NOTES:

1. Units are also available in larger storage tank capacities. Consult with DHT sales representative if larger storage capacity unit is required.
2. Consult the design specifications for the unit or the name plate attached to the unit and a tag on T&P Relief valve for maximum pressure of the unit.

1.7 CONSTRUCTION

All DHT STP Series units are designed and manufactured from superior materials of highest quality. Each heat exchanger meets or exceeds requirements of ASME Section VIII, Div.1 Code and storage tank meets or exceeds requirements of ASME Section IV HLW Code.

Heat exchangers: Heat exchangers are available in both simplex and duplex configurations depending upon customer requirement. Plates are stainless steel construction brazed together and available in standard double-wall plate's arrangement to prevent mixing of hot and cold fluids.

Storage tank: Storage tanks are available in standard carbon steel with double glass lining and optional duplex stainless steel material construction depending upon customer requirement. Carbon steel tank configuration also includes consumable anodes. Optional powered anodes are also available for maintenance free operation by preventing corrosion of the tank and anodes are not consumed. Dispersion tubes are installed inside storage tank on brazed plate heat exchangers inlet and outlet connections which helps to prevent mixing of hot and cold domestic water.

Controls and trim: DHT Standard STP Series units are equipped with electronically activated fully modulating optional control valves or VFD pumps which ships loose with the unit for field installation. Installation is easy hook-up, plug-and-play with wiring harness. 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. Controls offer tight temperature control performance in water heating applications.

Standard package also includes ASME Temperature and Pressure Relief valve in domestic water piping and recirculating water line with circulator(s).

Fabricated skid package includes single point inlet and outlet piping connections to produce domestic hot water using heating hot water. Copper construction domestic water piping manifolds including necessary fittings and combination of unions, victaulic couplings and wiring harness, etc. which makes it easy to remove and assemble the components together.

Optional simple control solution also available which includes aquastat to enable/disable pump(s) to maintain domestic water storage temperature set point.

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 specifications 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 heating and heated fluids should be free from any debris.
- The unit should operate only with fluid that it was designed for.
- The system should be designed to prevent the unit from encountering pressure shocks.
- All strainers installed 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 STP Series water heater 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 STP Series storage water heater 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 water heater.**
- **Feel water before bathing or showering.**
- **Contact DHT technical support at 800-221-1522 for more information.**

WARNING!

- Fluids 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 water heater itself.

CAUTION!

DO NOT use this water heater 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 STP Series water heater, 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 STP 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

STP Series water heater base frame is designed in such a way that unit can be carried from both sides using forklifts or pallet jacks provided proper care must be taken to prevent any damages to the unit and its components. Lifting lugs are also available on top of the tank. The unit must be properly supported over the forks, as indicated by the arrows in Figure 2-1.

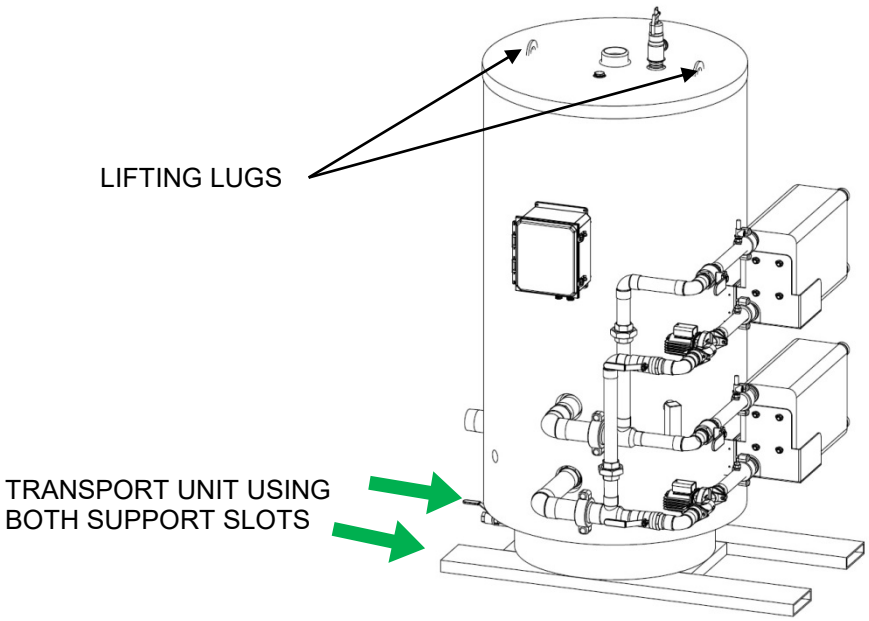


FIGURE 2-1: Support Slots for Transport

2.1.1 Examining the Unit

STP Series water heaters are thoroughly inspected and tested prior to shipment. Upon receipt of the STP Series water heater, 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.

CAUTION!
Unit piping connections can become loose during transportation, handling and installation. Therefore, you must check all connections to ensure they are tight before filling the unit with water.

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.

CAUTION!
Pay attention to following label on the unit and do not step on the components where it is present:

2.1.2 Compliance with Codes

The STP Series water heater is constructed and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII – Division 1 for heat exchanger(s) and ASME Section IV part HLW Code for storage tank. Other codes or approvals which apply will be labeled on the STP Series water heater.

The STP Series water heater 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 STP Series water heater to the building floor or mounting pad. For attachment to the foundation, use the four holes in the base.

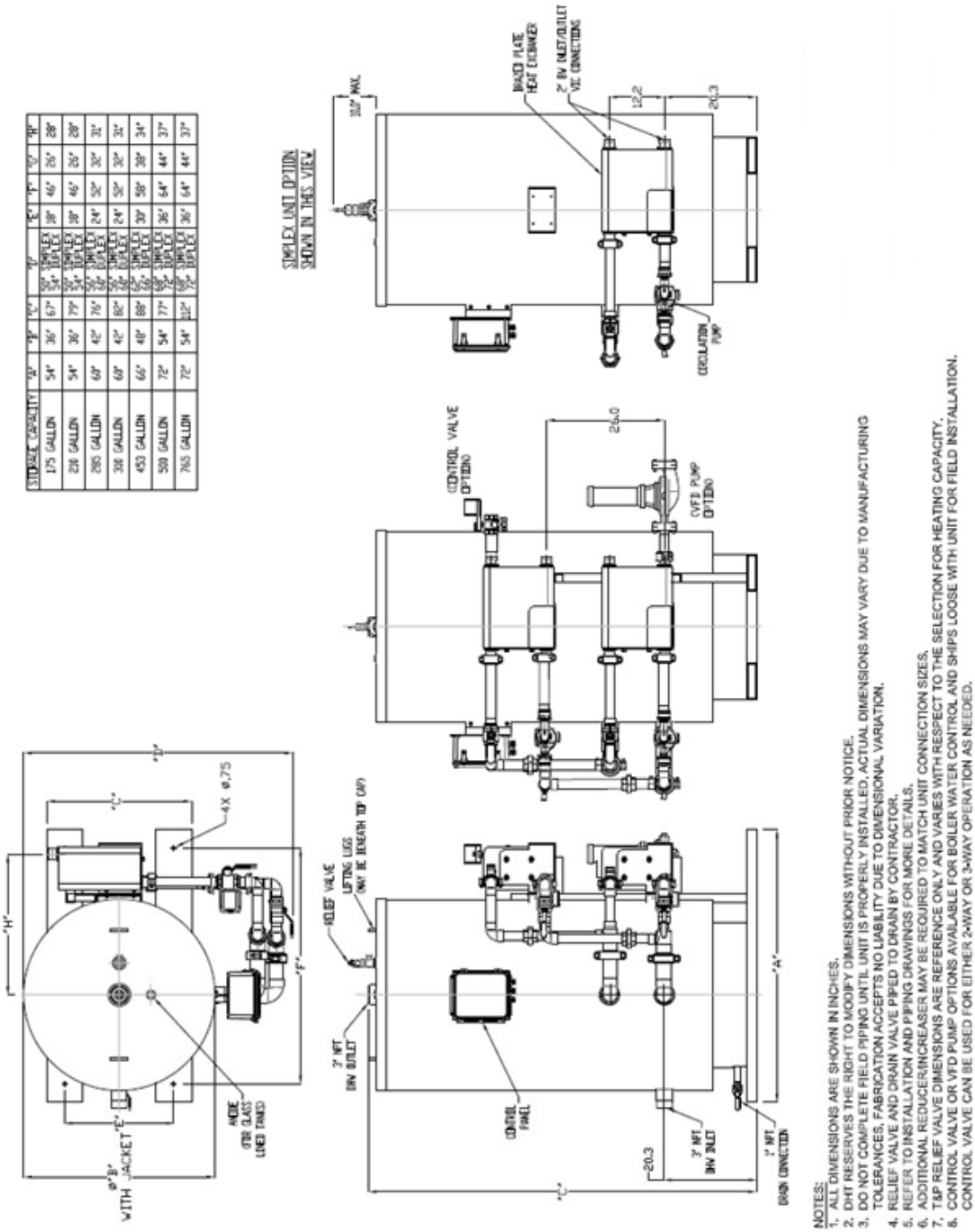
NOTE:
Seismic anchorage information is available upon request. Contact your DHT sales representative for more information.

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

2.3 INSTALLATION CLEARANCES AND UNIT DIMENSIONS

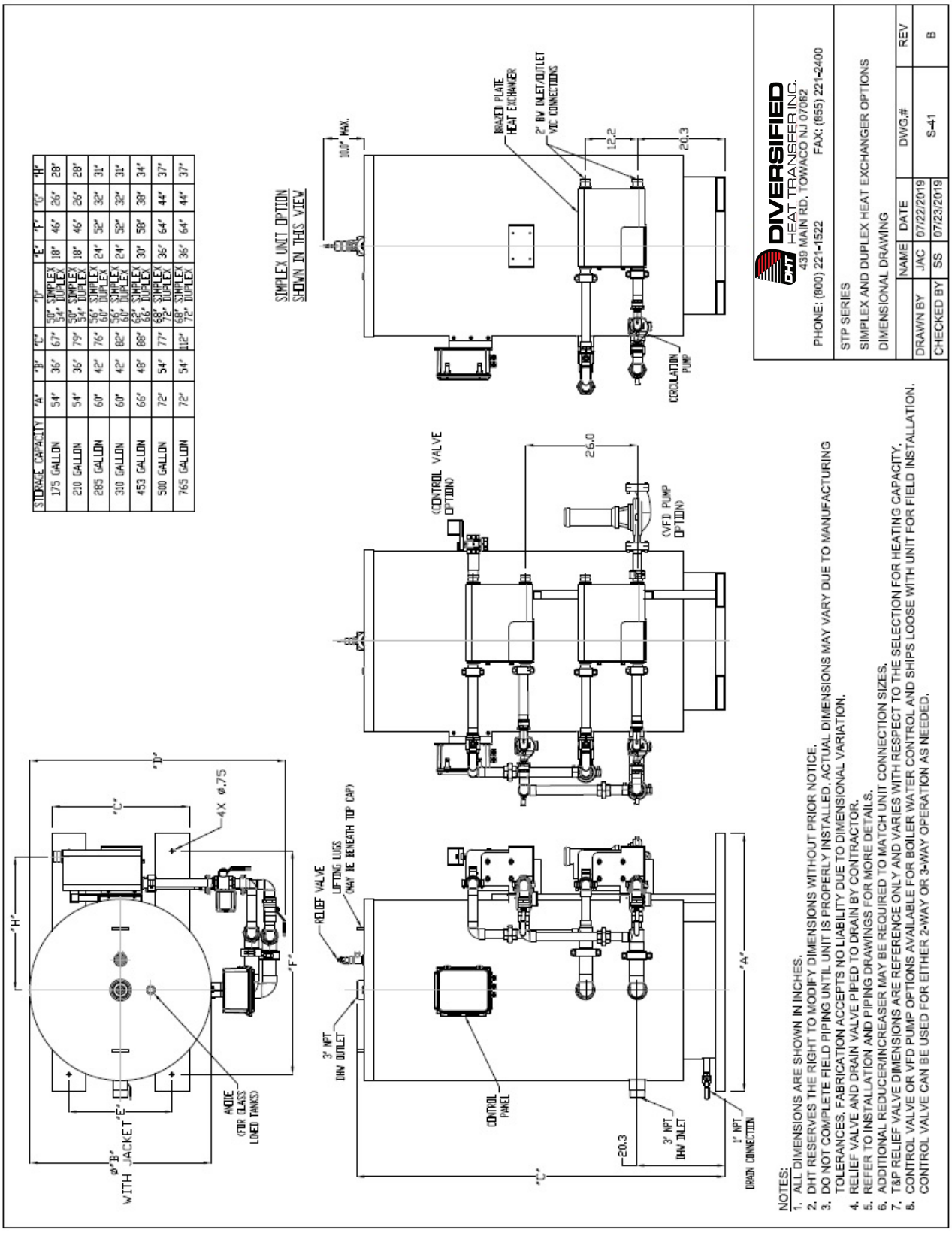
The STP Series minimum acceptable clearances are shown in Figure 2-1 and dimensions are shown in Figure 2-2. The minimum clearance dimensions are indicated in the drawings. However, if local building codes require additional clearances, the local building codes shall supersede these requirements. Consult factory for any specific questions.

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.



STORAGE CAPACITY	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"
175 GALLON	54"	36"	67"	54"	36"	46"	26"	28"
238 GALLON	54"	36"	79"	54"	36"	46"	26"	28"
285 GALLON	69"	42"	76"	54" DUPLEX	38" DUPLEX	46" DUPLEX	26" DUPLEX	28" DUPLEX
316 GALLON	69"	42"	82"	54" DUPLEX	38" DUPLEX	52" DUPLEX	32" DUPLEX	32" DUPLEX
453 GALLON	66"	48"	88"	54" DUPLEX	38" DUPLEX	52" DUPLEX	32" DUPLEX	32" DUPLEX
500 GALLON	72"	54"	77"	54" DUPLEX	38" DUPLEX	58" DUPLEX	38" DUPLEX	34" DUPLEX
765 GALLON	72"	54"	112"	54" DUPLEX	38" DUPLEX	64" DUPLEX	44" DUPLEX	37" DUPLEX

FIGURE 2-1: STP Series Installation Clearance Drawing



STORAGE CAPACITY	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"
175 GALLON	54"	36"	67"	50" SIMPLEX 54" DUPLEX	18"	46"	26"	28"
210 GALLON	54"	36"	79"	50" SIMPLEX 54" DUPLEX	18"	46"	26"	28"
285 GALLON	60"	42"	76"	56" SIMPLEX 60" DUPLEX	24"	52"	32"	31"
310 GALLON	60"	42"	82"	56" SIMPLEX 60" DUPLEX	24"	52"	32"	31"
453 GALLON	66"	48"	88"	62" SIMPLEX 66" DUPLEX	30"	58"	38"	34"
500 GALLON	72"	54"	77"	68" SIMPLEX 72" DUPLEX	36"	64"	44"	37"
765 GALLON	72"	54"	112"	68" SIMPLEX 72" DUPLEX	36"	64"	44"	37"

FIGURE 2-2: STP Series 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 drawings.

CAUTION!

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

2.5 PIPING INSTALLATION AND UNIT CONNECTIONS

STP Series units can be installed in various domestic water 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.

- **Domestic water piping:** The exact location of domestic 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.

  NOTE:
  Building recirculation piping shall be properly sized to provide sufficient capacity to dissipate residual heat within the water heaters during the periods of low demand.

- **Boiler water piping:** Boiler water inlet and return piping to be sized per given flow rates to the control valve or VFD pump options.

  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 STP Series units are equipped with pressure and temperature relief valves on top of storage tank, adjustable relief valves in domestic water piping of heat exchangers and drain connections towards bottom of storage tank. 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.

WARNING!
Make sure that the pressure and temperature relief valve is piped to a proper drain per instructions and codes. Scalding injury and/or water damage can occur from either the manual lifting of the lever or the normal operation of the valve if it is not piped to a proper drain. Ensure that the piping is of the proper material and rating for the temperature and pressure of the system and that it is secured to prevent possible injury. If the valve fails to flow water or reseat, consult the factory.

2.6 ELECTRICAL CONNECTIONS

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

Connect the system to the correct voltage. The STP Series water heater 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 capacity of relay outputs (24V 50/60HZ 8A/250VAC).

WARNING!

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

CAUTION!

Do not operate the pumps 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 heater, tank or piping must be repaired at once. Leakage of boiler water into domestic water side is unsafe and needs to be repaired immediately.
- Air elimination is extremely important from the domestic hot 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 unit components and may lead to their premature failure. Water hardness should not exceed 6 grains per gallon or 100 ppm. Water softening may be required if hardness is high.
- **Do NOT use artificially softened water** since artificial softening agents generally use salt, which causes corrosion of the heat exchanger, tank and piping components. Do NOT use deionized water.
- Elevated **chloride** levels in water accelerate corrosion of the unit and piping system materials. Concentrations of chlorides in system water should be less than 100 ppm.
- **pH** must always be between 6.5 to 7.5 for carbon steel double glass lined tank units and 6.5 to 9.0 for duplex stainless steel tank units. However, it is recommended to keep it higher than 6.8 for copper materials.

NOTE:
Consult DHT factory before using STP Series units for any other non-standard applications and in case of any additional information.

SECTION 3: OPERATION AND CONTROLS

3.1 INTRODUCTION

This chapter provides information and instructions for following topics:

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

3.2 STP SERIES FUNCTIONAL DESCRIPTION

DHT's STP Series units are engineered using boiler water as the heating medium. Heat exchangers are available in standard brazed plate double wall construction with both simplex and duplex configuration, depending upon customer requirement for larger capacity or built in redundancy. STP Series incorporates the proven DHT controls coupled with the high efficiency brazed plate double wall heat exchangers and variety of storage tank sizes. The DHT STP Series water heater is designed to satisfy potable water heating 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 STP Series can be coupled with both condensing and non-condensing type boilers with wide range of operating temperature ranges to achieve high efficiency within an optimized space. Stored hot water inside the STP tank help to meet the large instantaneous demand within short period and provide thermal mass for applications requiring storage. It also helps to reduce the number of cycles on boilers under the periods of no load to low load conditions and hence eliminate the need for external buffer tank in boiler water piping. The control system features temperature sensor installed on the storage tank, transmitting a millivolt signal to PID controller which, in turn sends a 4-20 MA signal to the optional electrically activated control valves or VFD pumps to achieve accurate temperature control over various demand situations.

The STP Series can efficiently produce higher flow domestic hot water, depending upon the temperature rise and available boiler water temperature and flow rate. Skid mounted for single point connections with a state-of-the-art PID control panel with touchscreen user interface, brazed plate double wall simplex or duplex heat exchanger configuration, optional electrically activated two-way control valve or VFD pump and non-ferrous circulator pump.

Easy removal and assembly of heat exchanger and piping via victaulic or union connections allow the complete removal of the heat exchanger and other pipe components for ease of service and also help to carry the unit through tight spaces. Isolation valves and backflush connections provided in heat exchangers piping manifolds for scheduled maintenance.

Cold domestic water enters the storage tank through cold water inlet connection, and hot water is supplied through connection on top (as shown in Figures 3-1a and 3-1b). If the tank temperature falls below the set point, water is pumped through the brazed plate heat exchangers where it is heated with higher temperature boiler water and heated domestic water then exits the heat exchanger back into the tank. Unit includes constant speed circulation pump(s) which continuously circulates water through the heat exchanger(s) until tank stored water temperature is satisfied to ensure there is always hot water present in case of demand. Domestic hot water temperature is maintained by electronic operated optional straight through 2-way control valve(s) or VFD pump(s).

Boiler water enters the heat exchanger through the inlet connection located on top of the heat exchanger and flows downwards to have counter flow arrangement for effective heat transfer. Optional control valve or VFD pump which is modulated by the 4-20 mA output from the controller, depending upon the reading from the temperature sensor on the domestic hot water outlet of the heat exchanger. Unit employs closed loop feedback control system to maintain

target temperature set point in tight range. Boiler or HTHW exits through the outlet connection on the bottom of the heat exchanger as shown. Flow rate of heating medium is modulated to maintain the desired set point in varying load conditions.

Variety of heat exchanger and storage tank sizes are available to satisfy wide range of domestic hot water application requirements. Standard storage tanks are available in carbon steel with double glass lining or optional duplex stainless steel materials of construction. Carbon steel tank configuration also includes consumable anodes or optional powered anodes for maintenance free operation by preventing corrosion of the tank. Diverter tubes (also called dispersion tubes) are installed inside storage tank on both cold and hot water inlet connections which helps to prevent mixing of hot and cold domestic water. STP Series units can be used with both condensing and non-condensing boilers for combination space and domestic water heating.

STP series units are also available with optional simple Aquastat controls which enable/disable the constant speed domestic circulators and boiler through relay panel in order to maintain the domestic hot water temperature inside storage tank.

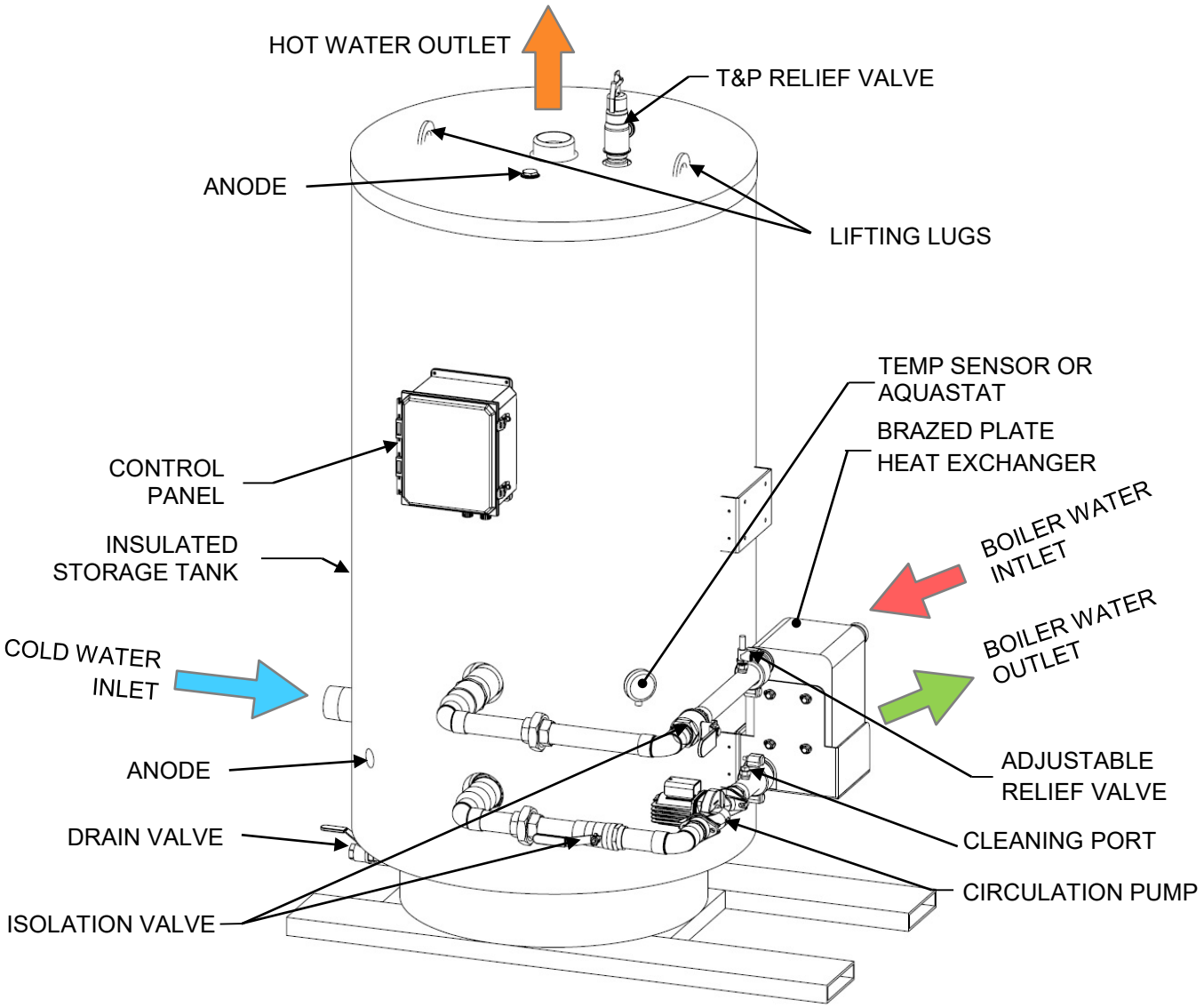


FIGURE 3-1a: STP Series with Simplex Heat Exchanger Configuration

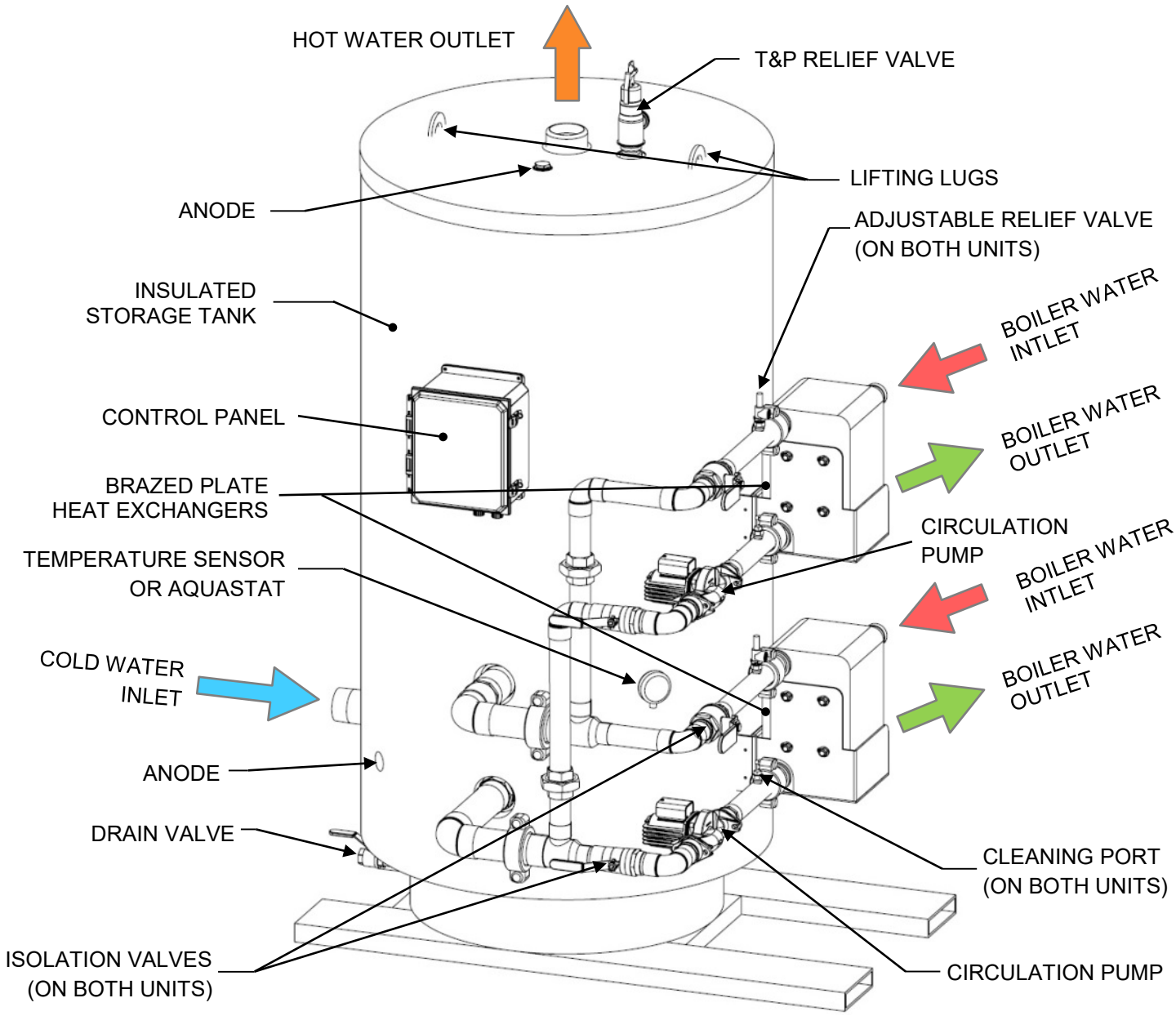
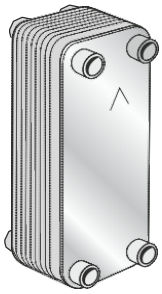


FIG 3-1b: STP Series with Duplex Heat Exchanger Configuration

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.



3.3 PLATE OPTIONS

STP Series units' heat exchangers are available in standard double-wall brazed plate construction. Double-wall construction features boiler and domestic water separated by an air gap between two walls, rather than being separated by only a single wall. This greatly enhances protection against leakage of the boiler water into the domestic water. If there is leakage in a wall, the water is collected within the air gap which is vented to atmosphere for leak detection. Similarly, if the domestic water leaks through a wall, it is collected within the air gap and is vented to atmosphere for leak detection.

3.3.1 Double Wall Construction and Protection Performance

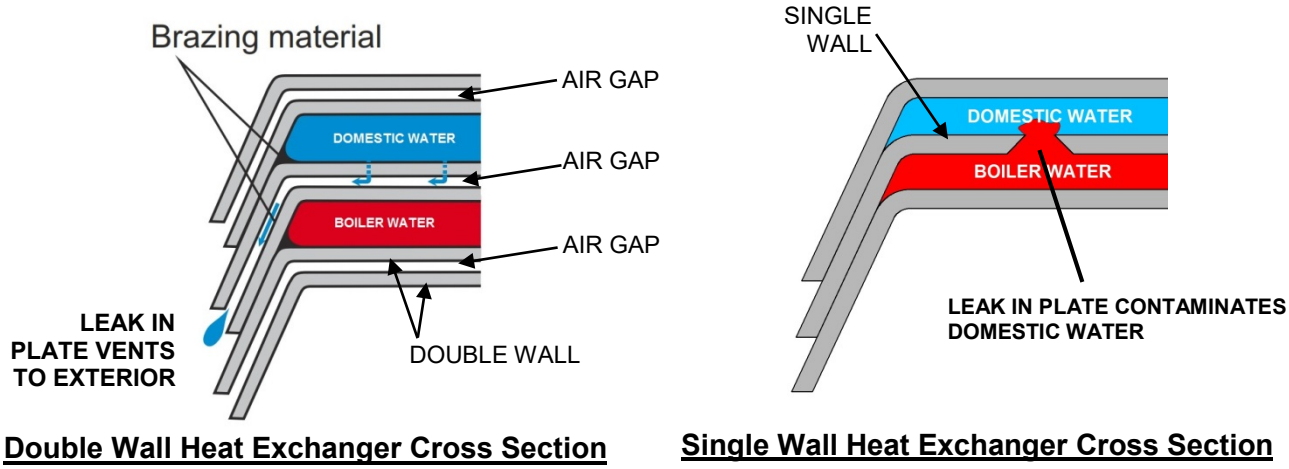
The advantages of double-wall construction include:

- Prevention of cross-contamination
- Easy inspections and low maintenance
- Fully visible and vented leak detection between plates
- Potable water and heating medium are completely separated.

Leakage can be caused by corrosion, erosion, and vibration, and can result in the domestic water system being contaminated by a heating medium, such as hydronic water, glycol solution, etc.

There is no practical way to have the heating medium sterile or free from harmful treatment compounds or corrosion by-products. A low pressure/temperature heating medium circuit does not ensure contamination protection of indirect, single-wall water heaters. Whether they are shell and tube, shell and coil, plate and frame, or any other type, all consist of relatively thin wall heat transfer surfaces separating the heating medium from the domestic water system. Therefore, the potential for cross contamination is real and in some instances contamination has occurred.

Several states and cities are now insisting on double-wall vented construction in all indirect type domestic water heaters. Plumbing codes have also been re-written to include double-wall protection. See Figure 3-2 for an illustration of how a single wall and double wall differ in construction, and how both function in the event of a hole, allowing fluid to leak through a plate.



Double Wall Heat Exchanger Cross Section **Single Wall Heat Exchanger Cross Section**

FIGURE 3-2: Double-Wall and Single-Wall Heat Exchanger Leakage Comparison

3.4 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 then alarm starts sounding. 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, a green light turns on, but the siren continues until the owner manually presses the alarm silence button to turn it off. Power to the control valve is restored, and the unit goes back into normal operation.

3.5 CONTROL VALVE OPTION

Control Valves are available, standard 2 inches NPT connections size in 3-way operation and shown in Figure 3-3 below:

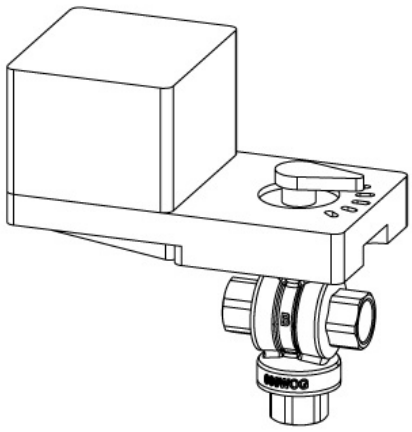


FIGURE 3-3: Control Valve with 2” NPT

3.5.1 Performance Data (Control Valve)

- STP Series water heaters include Electronic Control Valve actuators.
- Control valve modulates the flow of boiler/HTHW through the heat exchanger based upon the signal from the controller to maintain domestic supply temperature to target setpoint.
- Fluid enters through one inlet (AB) and exits through two outlets (A, B)
- Valve is fast positioning: < 3 seconds
- Low leakage rates: A Port: ANSI Class IV; B: Port: Class III
- Temperature of medium = 34°F to 250°F
- UL, ULC and CE
- Before shipment, every unit is inspected to make sure the valve is opening and closing with respect to signal from the controller.
- Control Valve is factory set to “Automatic” mode of operation.
- Control Valve is powered by 24VAC electricity.
- Control Valve is characterized 3-way ball valve.
- Control Valve is actuated by 4 to 20 mA signal from the controller.
    - 4mA means valve is in fully closed position. Means flow path from port A to AB is closed when valve is de-energized (fail safe feature).
    - 20mA means valve is in full open position (full flow from port direction A to AB)

3.5.2 Calibration Instructions (Control Valve)

3-WAY CONTROL VALVE DIPSWITCH FUNCTIONS			
Switch #	**Switch Function**	**OFF (down)**	**ON (up)**
1	Rotation	CW	CCW*
2	Fail safe return	At 0°*	at 90°
3	Input signal	Vdc	mA*
4	Feedback	mA*	Vdc

* Default factory setting (do not change)

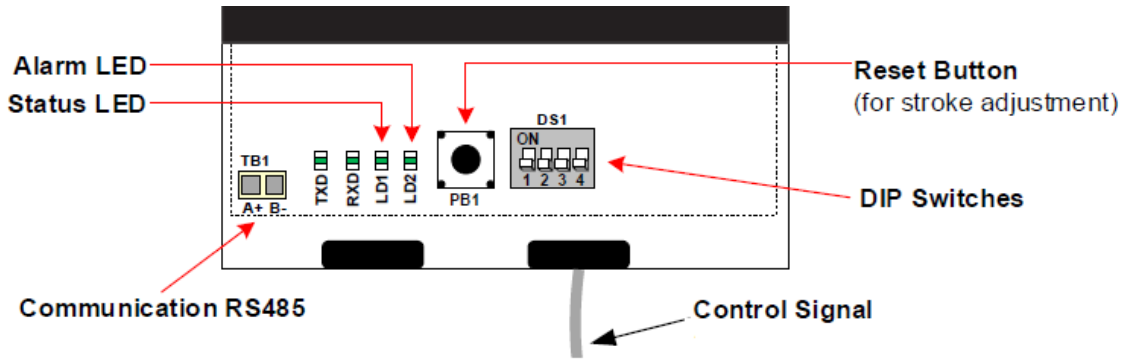


FIGURE 3-4: Control Valve DIP Switch Functions

The Control Valves are factory-calibrated for the standard operation.

3.6 VARIABLE FREQUENCY DRIVE (VFD) PUMP OPTION

The optional VFD pump consists of two main parts: the centrifugal pump and electronic control module on top. It is a self-sensing, close coupled, mechanically sealed, in-line pump that exceeds industry and efficiency standards with an advanced hydraulic design. It features a high-efficiency volute, permanent magnet motor with ECM technology and integrated frequency drive. It has simple yet versatile control options. These standard features combined with the intuitive user interface allow for quick start-ups achieving optimum system efficiency and maximum comfort. It is available in standard Cast Iron material construction for closed loop boiler water flow control through heat exchanger(s).

FIGURE 3-8: VFD Pump with Flange Connections

3.6.1 Performance Data

- STP Series water heaters include optional VFD pumps which are simple to install and easy interface
- VFD pump modulates the flow of boiler/HTHW through the heat exchanger based upon the signal from the controller to maintain domestic temperature to target set point inside tank
- Standard 1-1/2 inches 2-bolt flange connections (flange gaskets included)
- Max flow: 120USGM
- Max shut-off head: 65 feet
- Temperature of medium = 36°F to 230°F (2°C to 110°C)
- Ambient temperature range: 32°F to 104°F (0°C to 40°C)
- Max Operating Pressure = 175PSI (12bar)
- UL listed
- Minimum static inlet pressure at pump suction to avoid cavitation and mechanical seal damage (NPSHR)

Fluid Temperatures	PSI / bar
112°F (50°C)	7.3 / 0.5
176°F (80°C)	11.6 / 0.8
230°F (110°C)	20.3 / 1.4

- Before shipment, every unit is inspected to make sure the pump speed is varying with respect to signal from the controller.

- Pump is powered by 200-240V/1ph/60Hz electricity (field supplied) and power consumption is 0.027-0.75HP (20 – 650 W).
- Flow is controlled through pump by 4 to 20 mA signal from the controller.
  - 4mA means pump is in fully closed position and no flow through pump (fail safe feature).
  - 20mA means pump is in full speed operation (full flow through pump)

3.6.2 Operating modes

Includes following easy to set operating mode options:

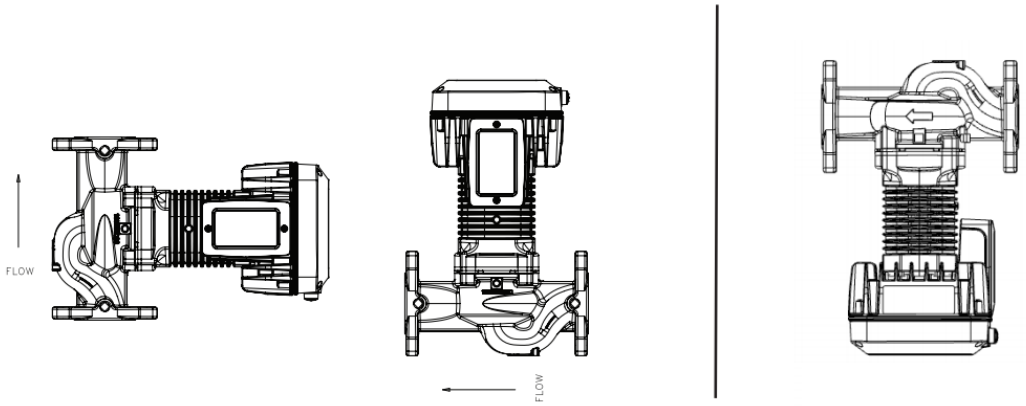
- Constant speed – 3 modes
- Constant pressure – 4 modes
- Proportional Pressure
- 0-10V
- 2-Pump Alteration

WARNING!
The pump is factory set to 0-10V operation and should remain in this mode for proper operation of the unit. Unit controls include conversion from 4-20mA signal to 0-10V mode operation for this option.

3.6.3 Pump Installation

Piping assembly spool piece is included with the unit to make connection with heat exchanger and pump. Use nuts and bolts to attach companion flanges to the pump flange for field side piping connection. Gaskets are included with the pumps. Ensure flange bolts are adequately torqued.

NOTE:
Pump can be installed with the motor shaft in the horizontal or vertical position with the control module facing up. Cover can be rotated independent of the pump to adjust orientation of the user interface.



ACCEPTABLE **UNAUTHORIZED**

FIGURE 3-9: VFD Pump with Flange Connections

WARNING!
The pump should never be installed in unauthorized positions which can cause damage.

CAUTION!

Electrical power wiring must be in accordance with all local, state, and national codes that apply.

WARNING!

Misconnection or overload of electrical or signal connections could cause pump to shut down or cause permanent damage. Carefully follow all installation and operations instructions in pump manufacturer's instruction sheet.

CAUTION!

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

WARNING!

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

3.6.4 Controller Status LED Indication and Error Codes

LED Status monitors Pump On (solid green) for normal operation and Standby (flashing green). The pump Status LED will flash red during errors and overload conditions. The sequence of the flash is determined by the type of error as shown in following table:

Error Codes		
Blinks in 1/2 second intervals	**Description**	**Probable Cause(s)**
1 blink	Locked Rotor	Impeller is unable to turn – debris in system
2 blinks	Over Current	High Motor Load
3 blinks	Over Temperature	Motor might be faulty or viscous medium is present. High Motor Load, Water Temperature too hot, Pump running dry.
4 blinks	Over Voltage	Line voltage is too high.
5 blinks	Under Voltage	Line voltage is too low for proper operation.
6 blinks	Communication Fault	
7 blinks	Motor Temperature Fault	Control temperature near maximum limit. Control reduces rpm to reduce heat.
8 blinks	Staging Fault	

The LED will typically assume only the conditions in this table.

3.7 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.

3.8 UNIT STARTUP PROCEDURES

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

➢ UNIT STARTUP PROCEDURE INSTRUCTIONS

1) Assure that all manual shutoff valves on boiler water/high temperature hot water and domestic water main lines on tank are closed.

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

CAUTION!
Do not leave the unit(s) unattended during the filling process until fully pressurized and show no signs of leakage.

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 boiler water/ HTHW return valve.

6) If no leaks are found, slowly open the manual shutoff valves on the energy source inlet.

NOTE:
This procedure is similar for both boiler water and high temperature water energy sources.

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

7) As the unit is initially heating the water, carefully re-inspect the water inlet, water outlet, energy source inlet (boiler water or high temperature water), and boiler water return lines and joints for signs of leakage.

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

9) 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.

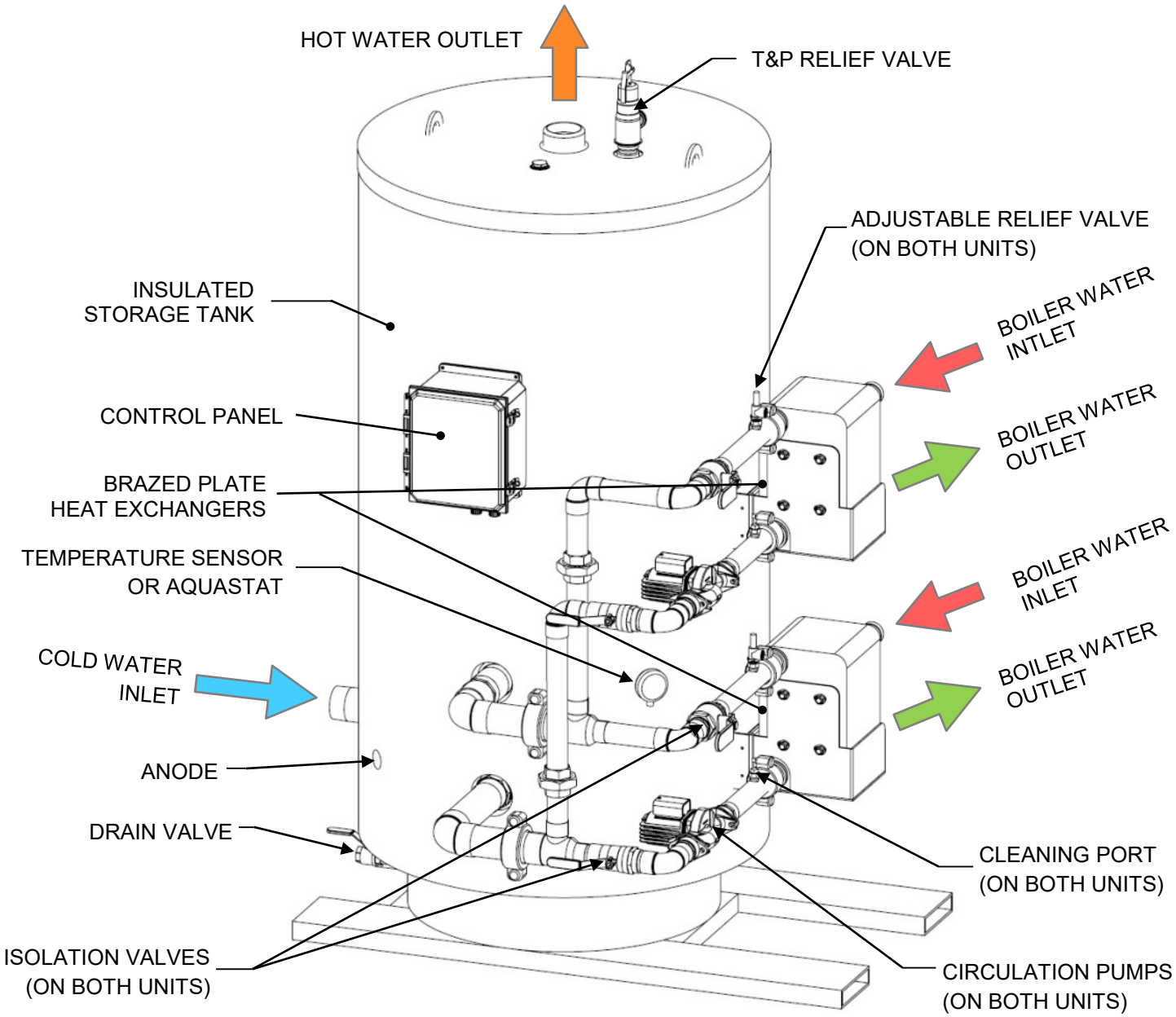
10) The unit is now ready for normal operation. Proceed to Section 3.11 for setting the temperature and other initial startup parameters using the controller.

3.9 UNIT SHUTDOWN PROCEDURES

All maintenance procedures require the water heater to be properly shut down. Follow the instructions below in order to shut down the STP Series unit:

➢ UNIT SHUTDOWN PROCEDURE INSTRUCTIONS

1. Close all valves in the energy source inlet line (boiler water or high temperature water).
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. Hot water outlet line
    b. Cold water inlet line
    c. Boiler/high 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 3.8.



STP SERIES STARTUP / SHUTDOWN COMPONENTS

NOTE:
Also refer to appropriate drawings in Section 6 for more installation instructions and other field installed component location details.

3.10 CONTROLLER INTRODUCTION

The DHT Water Heater Controller is a microprocessor based, state-of-the-art, device offering unmatched performance and full user configurability through HMI interface for water heating 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.

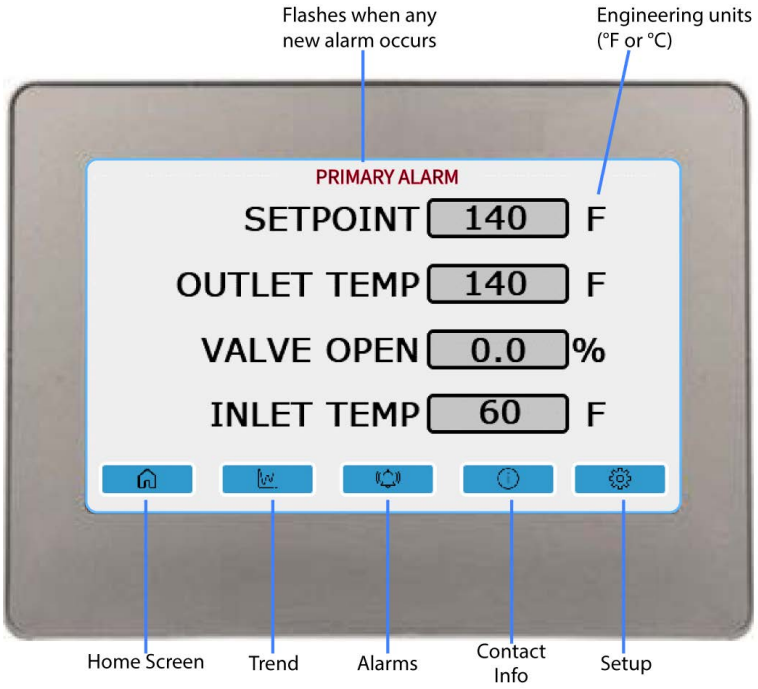
Utilizes 1/8 DIN advanced programmable PID temperature controller factory configured for full range of math, logic, totalizer and specialized functions required for single loop process and temperature control of water heating applications.

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 is also available for connections with other protocols.

3.10.1 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 STP Series water heater 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 domestic 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 0 "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 domestic hot water set point. The display returns back to life quickly with a single click on the touchscreen.

NOTE:
USB memory drive kit is installed standard inside the control panel. Contact your DHT sales representative or DHT factory for more information about data logging.

3.10.2 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

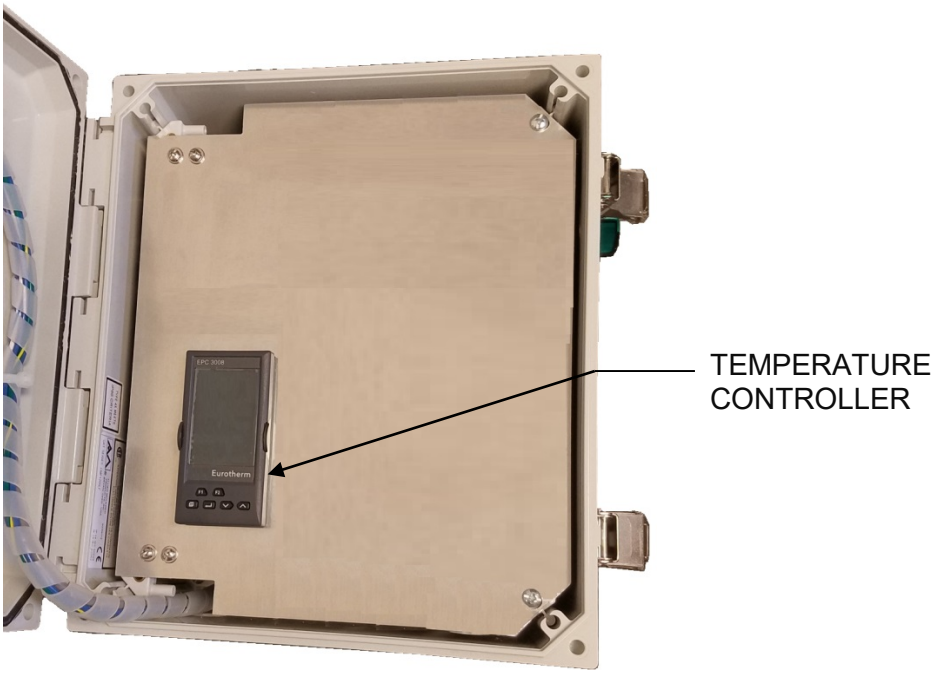
NOTE:
A time-out applies to all displays. If no button presses are detected within a timeout period (default is 30 min.), the display will revert back to the “HOME screen.”

3.11 CONTROLS STARTUP

Location of controls main touchscreen display is shown below.

STP SERIES CONTROL PANEL FRONT

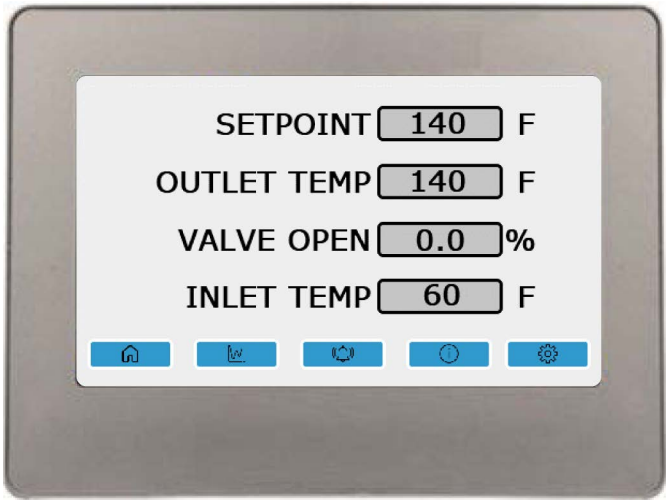
Location of temperature controller is shown below, which can be used as a backup interface when front HMI screen interface is down.



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.



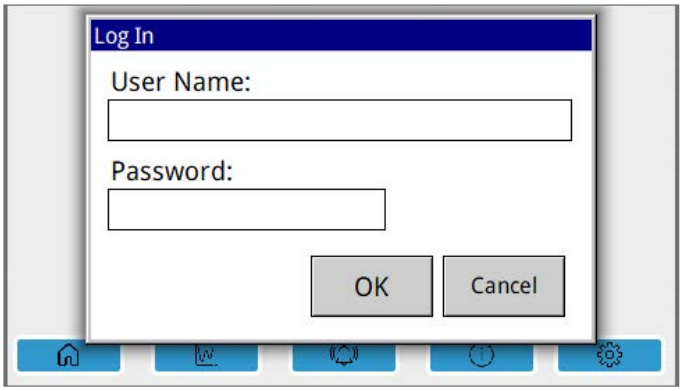
DEFAULT STP SERIES HOME SCREEN

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

3.12 PROGRAMMING SEQUENCE

➢ ENTERING THE PASSWORD

1. Some of the display screens have password protection for proper operation of the water heater. 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:

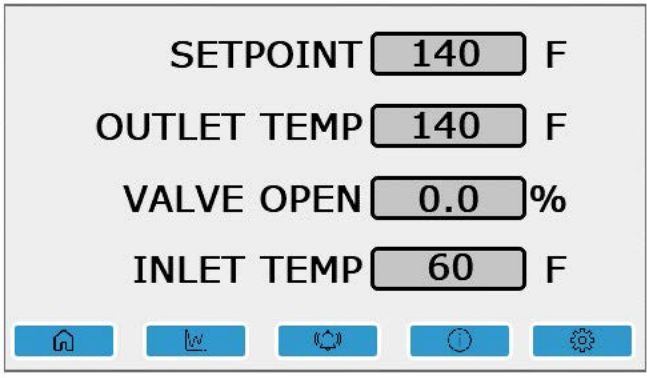


2. Click on required empty box inside the touchscreen display and a keypad appears on the screen. Use this keypad to enter the access login name and password.

NOTES:
1. Use default operator level User Name “L1” and password “0439” to gain access.
2. 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

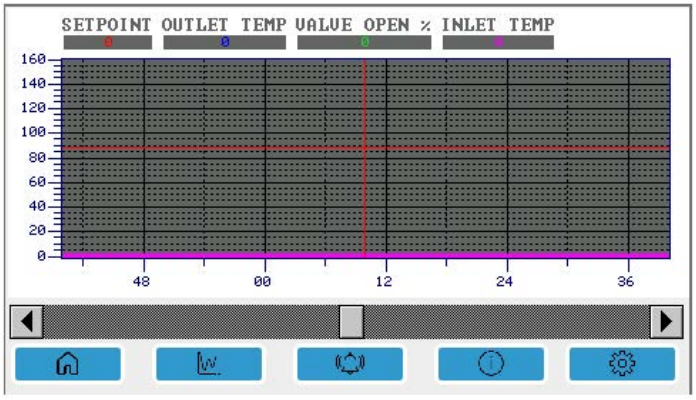
3. The STP Series default “HOME screen” as explained in Section 3.9.1. Factory default domestic hot water set point is 140°F. This screen shows the adjustable domestic water set point as well as currently measured domestic outlet temperature, domestic inlet water temperature and control valve output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



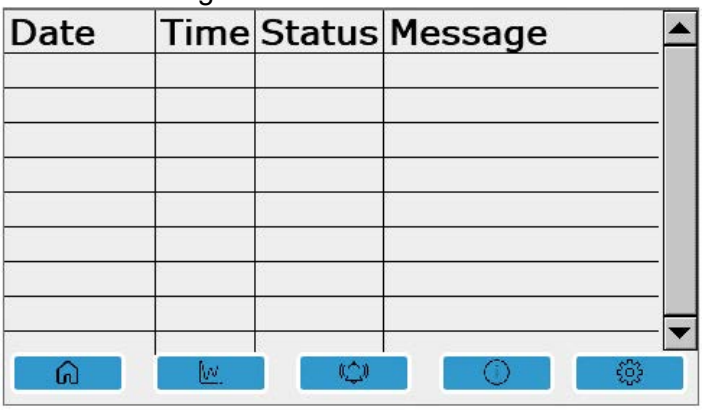
4. The domestic hot water set point can be adjusted anywhere within the range of 35-180°F by entering the operator level password as shown in steps 1 and 2 above.
5. The high temperature alarms are default set to 20°F above the set point. If domestic water outlet temperature reading is equal to or higher 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 active sound alarm. 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, but the siren continues until alarm silence pushbutton is pressed manually.

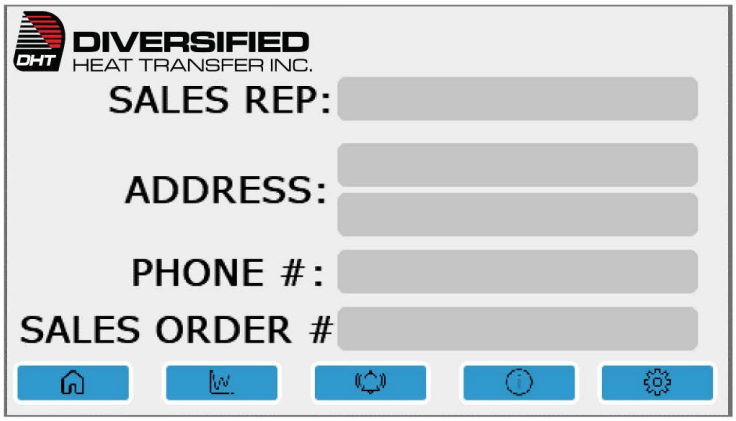
6. The low temperature alarms are default set to 20°F below the set point. If domestic water outlet temperature reading is equal to or lower than this number, the unit status changes from green to red in color and “LOW TEMP ALARM” message starts flashing in red color on the center top side of the HOME 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 domestic 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.



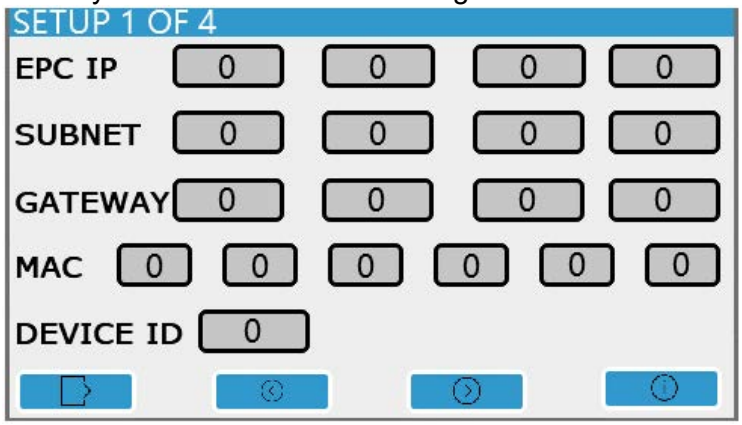
9. The “Contact Information screen” shown below displays the DHT factory and local sales representative company contact information as well as the serial number information of controller and water heater, which are preconfigured before unit is shipped from factory. Each unit is factory configured to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

1. Not recommended to use manual positioning when unit is in operation. Always leave the unit in AUTO (Automatic) setting.
2. Valve % shows the live output percentage signal to the control valve.
3. 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.

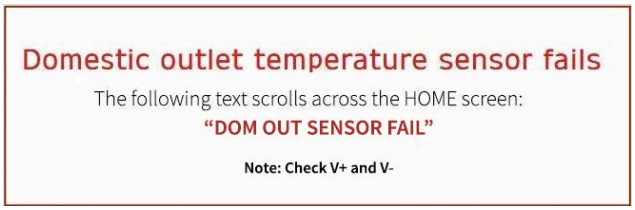
CAUTION!

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

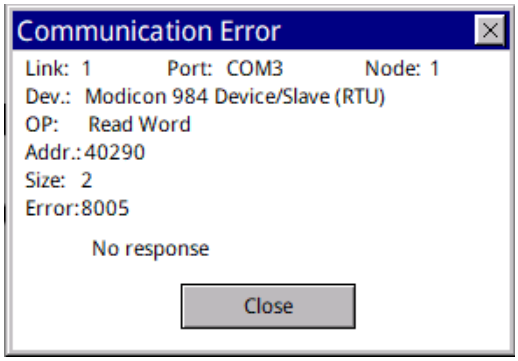
➢ SYSTEM DIAGNOSTICS

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:



Pop Up Items:



Note: Check HD, HE, HF

NOTES:

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

3.13 DATA COMMUNICATIONS

DHT STP Series Water heater control system allows the controller to communicate with external Building Automation System (BAS) or Energy Management System (EMS). It is compatible with standard Modbus TCP/IP and BACnet UDP/IP 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.

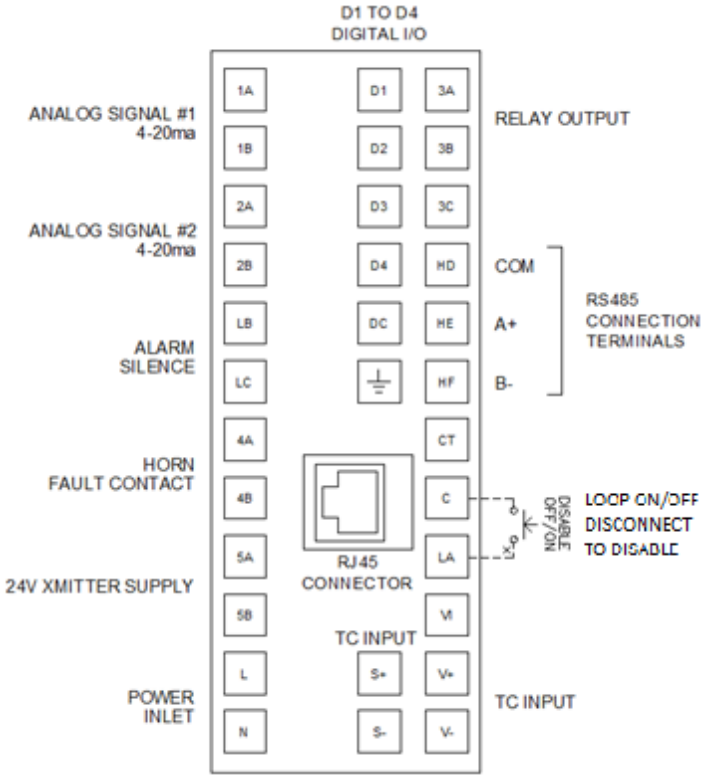
WARNING!

- 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:

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

3.13.1 Temperature Controller Terminals Layout



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

3.13.2 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.

3.13.3 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

3.13.4 Modbus/BACnet Data Addresses and Points

Item Description	Type	Modbus Address	BACnet Address	Register	Comments
Remote/Local Setpoint	float32	2	Analog Value #38	RW	40-180°F Range (140°F Default)
Unit Remote On/Off	float32	277	Analog Value #53	RW	0: Off 1: On
Outlet Water Temperature	float32	289	Analog Input #1	RO	40-205°F Range
Control Valve Open %age	float32	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:
   RO – Read Only
   RW – Read/Write

3.13.5 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 water heater.
- 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:

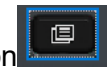
3. Now release the button. Again press and hold page button  until following screen appears:

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 14 through 26. Ignore steps 12 and 13 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.

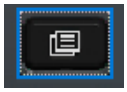
13. Use arrow buttons  to select the O.Com:

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.

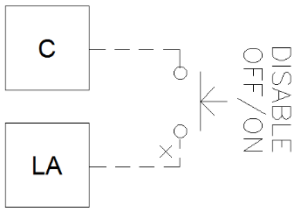
26. Now the controller is ready for normal operation.

3.14 DRY CONTACTS

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

3.14.1 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.



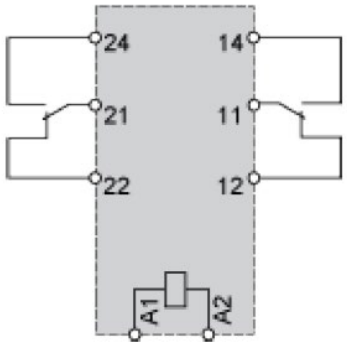
This input is supplied with the current transformer. Contact closure on the remote switch enable (start) the unit.

NOTE:
When using this feature, remove the factory installed jumper between contacts C and LA behind PID controller and connect remote start/stop switch wiring to these terminals instead.

3.14.2 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. Fault can be cleared by pressing the Alarm Silence button.

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 STP Series water heaters must be performed by trained and experienced technicians from appropriate service agencies.

This section covers the service and maintenance for STP Series water heaters 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 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 3.9) and unit startup (Section 3.8).

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 STP Series water heaters are equipped with circulating pump(s) to assist in the even heating 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 AND REPLACEMENT INSTRUCTIONS

a) Take the unit offline (Steps: 1 through 5 of the shutdown procedure, Sec. 3.9) before attempting to service the circulating pump.

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

b) 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:

c) After assuring that the power has been turned off, disconnect the electric leads to the circulating pump.

d) Drain the unit by opening the drain valves (See Figures 3-1a and 3-1b).

e) Break the flanged joint between the pump and the inlet and outlet piping.

f) Remove the pump.

g) 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.

h) Reconnect the electric leads to the pump (reference wiring diagram provided with the unit to assure proper wiring).

i) Follow the startup procedures (Section 3.8) to put the unit back online. Carefully check all connections for any sign of leakage.

WARNING!
DO NOT RUN THE PUMP WITHOUT WATER AND FAILURE TO DO SO CAN CAUSE DAMAGE TO THE PUMP.

NOTE:
Follow inspection, repair, maintenance and replacement instructions etc. contained in the pump manufacturer's documentation shipped with the unit.

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 HEAT EXCHANGER MAINTENANCE

This section describes how to clean and maintain the STP Series heat exchangers, including inspection instructions.

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. They have high turbulent flows which helps with self-cleaning and makes them less susceptible to fouling and scaling depending upon operating conditions and water quality.

4.3.1 General Heat Exchanger Maintenance Procedures

- Every 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 surfaces and check surfaces for signs of damage.

4.3.2 Clean-In-Place (CIP) Cleaning of Brazed Plate Heat Exchanger(s)

CIP cleaning is preferable when the scaling deposits on the plates are soluble. When CIP cleaning is used routinely, intervals between heavier maintenance are extended and heat exchanger life is improved. Information for cleaning solutions is listed below:

FLUID TYPE	INFORMATION
Mineral Acids	They have highest ability to dissolve scale (limestone and other minerals) but are also extremely hazardous. Examples include hydrochloric (HCl), sulfamic, nitric, phosphoric and sulfuric acids. Hydrochloric acid and nitric acid cause corrosion of stainless steel and copper materials respectively which is not recommended choice. Corrosion inhibitors are also required.
Organic Acids	These are less hazardous and lower ability to dissolve scale in comparison with mineral acids. They have less risk of corrosion for heat exchanger materials which makes them good choice cleaning agents. They are used in concentrations between 1-5% of volume and include formic, acetic, and citric acids.
Bases	They are able to remove organic, oil and grease deposits from material surfaces. They are commonly used to supplement cleaning afterwards in order to neutralize any acids remaining on the heat transfer surfaces. Concentrations of 1-2% sodium hydroxide or sodium bicarbonate are used before rinsing with water.

CAUTION!

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

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

➢ CIP CLEANING INSTRUCTIONS (PLATE and FRAME and BRAZED PLATE)

NOTES:

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

1) Isolate the heat exchanger from the system, empty the heat exchanger 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 water heater 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.

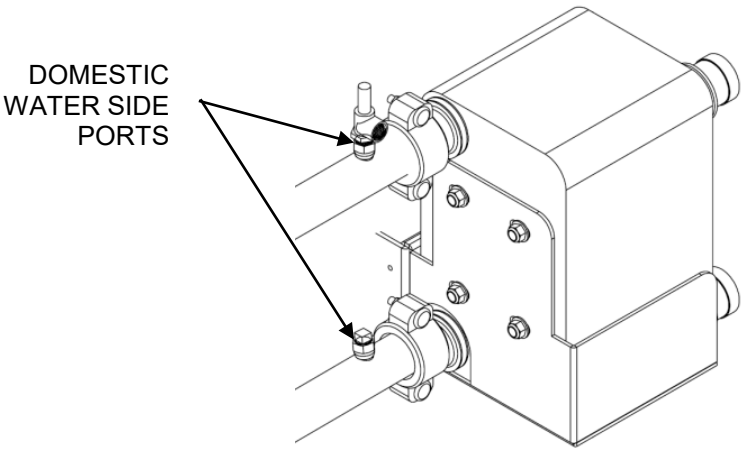


FIGURE 4-1: CIP Port Connection Locations

NOTE:
Boiler water side CIP connections are field provided.

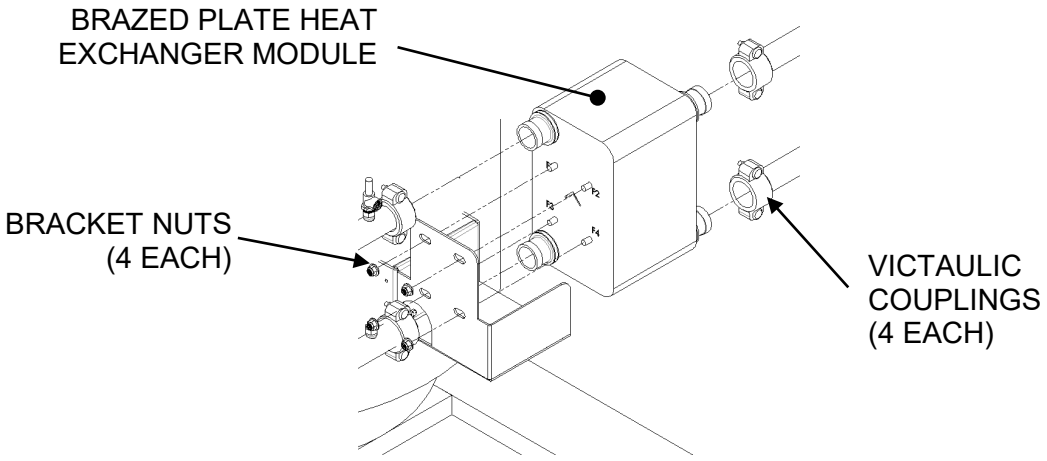
4.3.3 Brazed Plate Heat Exchanger Module Replacement

➢ REPLACING THE BRAZED PLATE HEAT EXCHANGER

1. Shut down the heat exchanger as described in Section 3.9.
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 safe temperatures.
5. Remove the four bolts that affix the module to the support plate.
6. Decouple the all the four water connections to the heat exchanger module.



7. Replace the module, recouple to the four water heater connections, and affix the four bracket 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 3.8: 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 T&P OR ADJUSTABLE RELIEF VALVE REPLACEMENT

If either of the T&P or adjustable relief valves mounted on the unit is not functioning correctly and must be replaced, follow the procedures outlined below.

➢ T&P RELIEF VALVE REPLACEMENT INSTRUCTIONS

1. Before performing this maintenance procedure, follow the shutdown procedure in Section 3.9 to take the unit offline.

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

2. Carefully disconnect the drain line from the relief valve to the drain.
3. Unscrew and remove the relief valve from its mounting location (Fig. 4-4).
4. Install the new relief valve in place. Tighten until sealed and facing proper orientation for reconnection to the drain line.

NOTE:
Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor. Reconnect the drain line from the relief valve to the drain per local codes.

5. Reference the manufacturer's documentation for the T & P relief valve that was supplied with your unit for additional installation/setup instructions.
6. Follow the startup procedures to put the unit back online. Carefully check all connections for any sign of leakage.

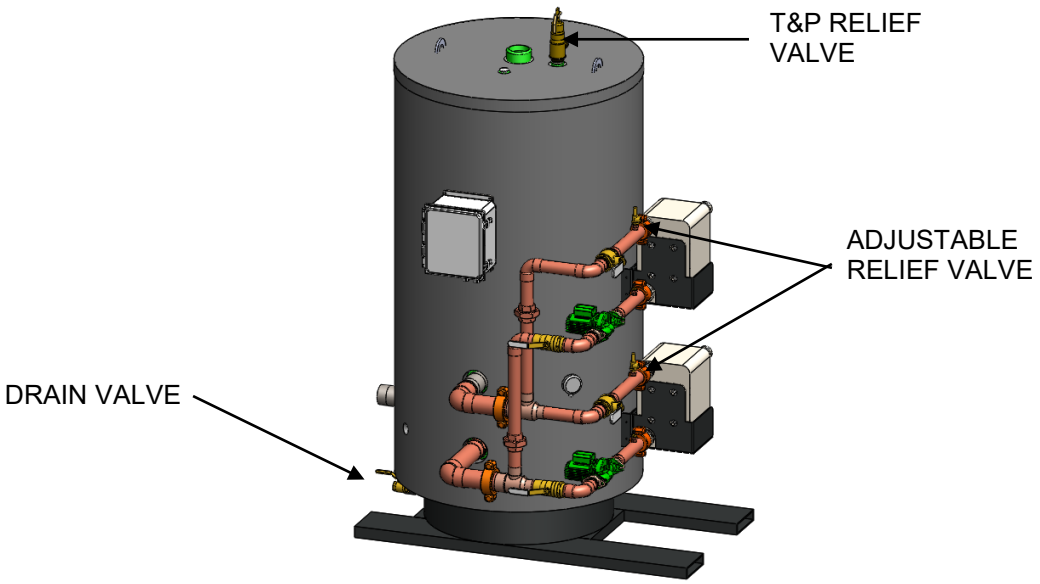


FIGURE 4-4: T&P or Adjustable Relief Valve Installation Locations

4.5 BOILER WATER CONTROL VALVE OPTION MAINTENANCE

The manufacturer documentation included with the unit gives specifics for operation and maintenance of the boiler water control valve option. 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 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 status 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	**State**	**Description**
Status LED	ON	During discharging of Supercapacitors. Autostroke
	Slow Flash (1Hz)	Normal Operation Programming Mode
Alarm LED	ON	Autostroke
	Rapid Flash (5Hz)	Error
TXD and RXD LEDs	TXD	Flashes when transmitting data
	RXD	Flashes when receiving data

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 Control Valve Replacement

Mounting and operating instructions are supplied with the replacement actuator and the electronics module.

The valve is suitable for 3-way arrangement and the strict observance of the direction of flow is essential.

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

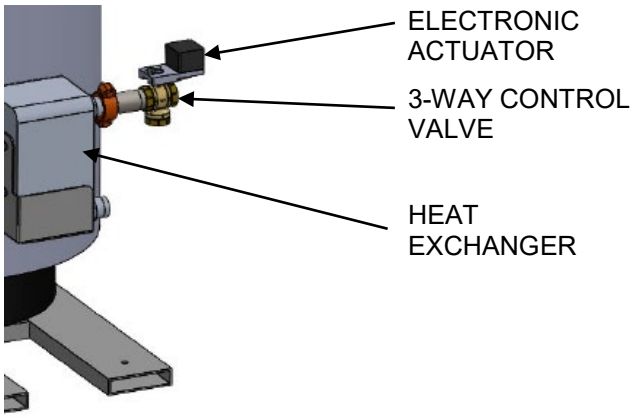


FIGURE 4-5: 3-Way Control Valve Component Locations

4.5.3 Stroke Adjustment

An auto-stroke adjustment must be performed the first time the unit is powered on.
An auto-stroke process can be initiated while the unit is in normal operating mode (status LED flashes slowly 1Hz). Press and release the reset button to start the auto-stroke process. The status (green) and alarm (red) LEDs will remain on.

The actuator travels in both directions to find its limit and position itself according to the demand. The LEDs will extinguish when the process is complete. The status LED will then continue flashing slowly (1Hz).

➢ 3-WAY CONTROL VALVE REPLACEMENT INSTRUCTIONS

1) Follow Steps 1 through 6 of the shutdown procedure in Section 3.9 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 the energy source hot water system; 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.

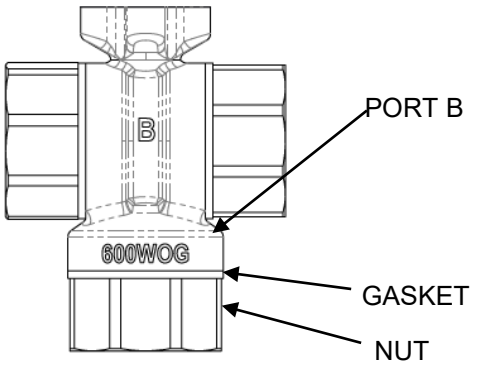


FIGURE 4-6: 3-Way Control Valve NPT Connection Components

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 BOILER WATER VFD PUMP OPTION MAINTENANCE

DHT STP Series water heaters are equipped with optional heating source boiler water VFD pump(s) to assist in the even heating of the water in lieu of Control Valve(s) depending upon customer preference. If the unit is equipped with this option, the following procedure should be followed to replace the pump.

NOTE:
Also follow inspection, repair, maintenance and replacement instructions etc. contained in the pump manufacturer's documentation shipped with the unit.

➢ VFD PUMP INSPECTION AND REPLACEMENT INSTRUCTIONS

a) Take the unit offline (Steps: 1 through 5 of the shutdown procedure, Sec. 3.9) before attempting to service the circulating pump.

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

b) Test the pump according to manufacturer's instructions supplied with the unit. If found to be defective or worn, replace the pump per the following steps:
c) After assuring that the power has been turned off, disconnect the electric and control signal leads to the pump.
d) Close the isolation valves and drain the boiler water loop.
e) Break the flanged joint between the pump and the inlet and outlet piping.
f) Remove the pump.
g) 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.
h) Reconnect the electrical and control signal wiring to the pump (reference wiring diagram provided with the unit to assure proper wiring).
i) Follow the startup procedures (Section 3.8) to put the unit back online. Carefully check all connections for any sign of leakage.

WARNING!
DO NOT RUN THE PUMP WITHOUT WATER AND FAILURE TO DO SO CAN CAUSE DAMAGE TO THE PUMP.

4.7 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.

4.8 REPLACEABLE PARTS LIST

The following is a list of typical parts that are generally replaceable by personnel trained/certified on DHT, Inc., STP water heaters. 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.

- Control Valve(s) if used
- VFD Pump(s) if used
- Heat Exchangers
- Relief Valves
- Circulation Pump(s)
- Temperature sensor or aquastat
- Isolation Valves and other pipe fittings etc.
- Control Panel and its components including HMI, Temperature Controller, etc.
- Support Frames/Brackets
- Hardware
- Anodes(s) for carbon steel tank option

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

4.9 RECOMMENDED SPARE PARTS:

TABLE 4-3: RECOMMENDED SPARE PARTS

REFERENCE	ITEM NO.	QUANTITY PER UNIT	PART NAME
SEC 4.12		1 or 2	Circulation pump
SEC 4.12		1 or 2	Control Valve or VFD Pump electronic module
SEC 4.13		1	PID Controller (if used)
SEC 4.12		1	Thermocouple or Aquastat
SEC 4.12		1	T&P Relief Valve
SEC 4.12		1 or 2	Adjustable Relief Valve
SEC 4.12		1 or 2	Anode(s) only with carbon steel tank

4.10 ORDERING INFORMATION

All replacement parts for DHT STP 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. All orders must be submitted via PO and sent to sales@dhtnet.com.

4.11 INSPECTION SCHEDULE

Table 4-4, below, summarizes the recommended time intervals for inspection of the water heater, 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
Circulation Pumps	X					
Control Valve or VFD Pump	X					
Temperature and Pressure Gauges				X		
Heat Exchanger (measure performance)					X	
All Inlet, Outlet and Return Connections				X		
Power and Ground Connections				X		
Relief Valves	X					
Isolation and Check Valves		X				
Strainers				X		
Control Panel and Thermocouples					X	

4.12 PARTS AND ACCESSORIES

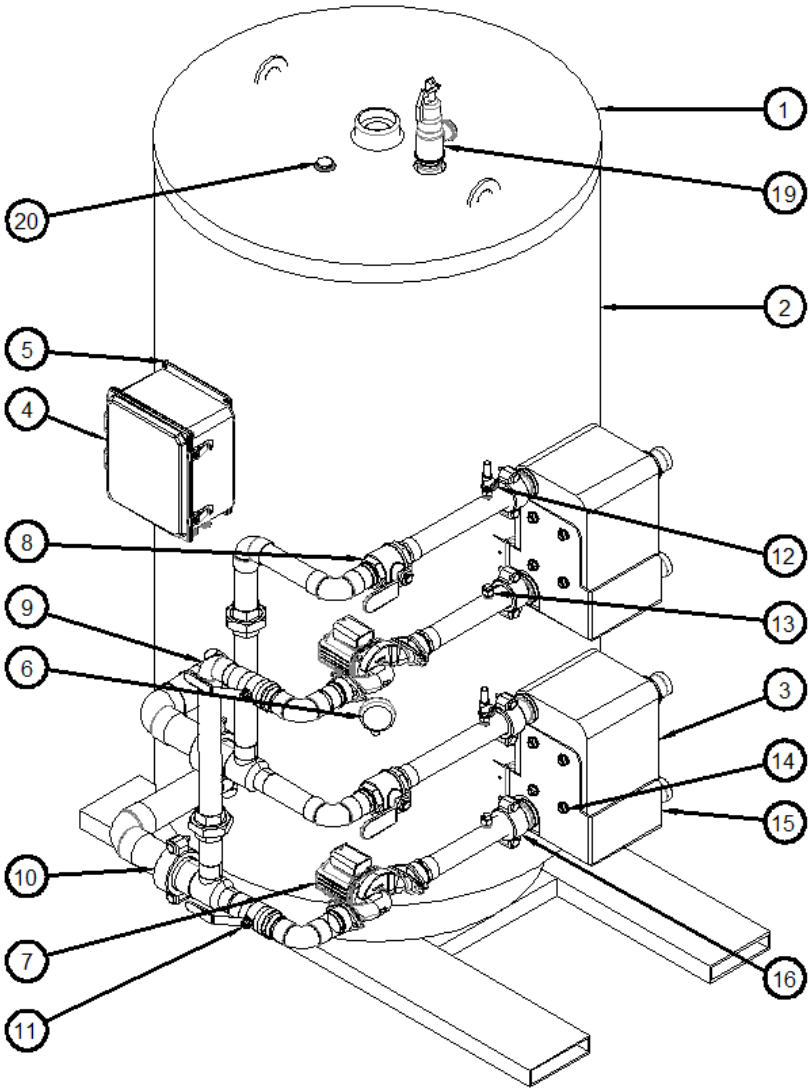


TABLE 4-5: PLATE AND FRAME/BRAZED PLATE UNITS			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
1	SEE TABLE 4-6	1	STORAGE TANK
2	SEE TABLE 4-7	1	INSULATION JACKET
3	SEE TABLE 4-8	1 - SIMPLEX 2 - DUPLEX	BRAZED PLATE HEAT EXCHANGER
4	64002-2	1	CONTROL PANEL (OPTIONAL)
	64003-1		RELAY CONTROL BOX (OPTIONAL WITH AQUASTAT CONTROL)
	10042-0.75	4	HEX BOLT - 1/4”-20 X 0.75"LG FULL THREAD - UNC 2A
	11001-.25		FLAT WASHER – 1/4” – TYPE A
	11003-.25		FLANGED LOCK NUT - 1/4”-20 - UNC 2B

5	40010	1	CONTROL BRACKET
	10043-1.25	3	HEX BOLT - 3/8”-16 X 1.25 LG FULL THREAD – UNC 2A
	11003-.38		FLANGED LOCK NUT – 3/8”-16 UNC 2B
	11001-.375		WASHER – 3/8” TYPE A
6a	22005-1	1	THERMOCOUPLE, TYPE J (OPTIONAL)
	22004-6		THERMOWELL FOR THERMOCOUPLE (OPTIONAL)
6b	62001	1	AQUASTAT (OPTIONAL)
	22006-1		THERMOWELL FOR AQUASTAT (OPTIONAL)
7	22029	1 - SIMPLEX 2 - DUPLEX	CIRCULATION PUMP WITH COMPANION FLANGES
8	22018-2	1 - SIMPLEX 2 - DUPLEX	BALL VALVE (FULL PORT) – 2” FNPT – LEAD FREE
9	22001	2	DIVERTER TUBE
10	72030-3	2 – DUPLEX ONLY	3” VICTAULIC COUPLING
11	22032-2	1 - SIMPLEX 2 - DUPLEX	BALL VALVE (FULL PORT) – 2” SWEAT – LEAD FREE
12	22003	1 - SIMPLEX 2 - DUPLEX	PRESSURE RELIEF VALVE, 1/2" NPT
13	72005-.5	1 - SIMPLEX 2 - DUPLEX	BRASS PLUG, 1/2" NPT
14	11003-.5	4	FLANGED LOCKNUT, 1/2"-13 UNC GRADE 5
15	40008-2	1 - SIMPLEX 2 - DUPLEX	HEAT EXCHANGER BRACKET (FOR SMALL SIZE)
	40008-1		HEAT EXCHANGER BRACKET (FOR LARGE SIZE)
	10043-1.25	1 OR 2*	HEX BOLT – 3/8”-16 X 1.25” LG FULL THREAD UNC2A
16	72030-2	2 - SIMPEX 4 - DUPLEX	2” VICTAULIC COUPLING
17	22018-1	1	DRAIN VALVE – 1” NPT – LEAD FREE (NOT SHOWN HERE
18**	21001	1	SECONDARY SUPPORT BRACKET
	10043-2.5	4	HEX BOLT - 3/8”-16 X 2.50 LG FULL THREAD – UNC 2A
	11001-.375		FLAT WASHERS – 3/8” SIZE
19	22007	1*	T&P RELIEF VALVE – 1-1/2” NPT - LEAD FREE
20	22002	1 OR 2*	SACRIFICIAL ANODES
	29001		POWER ANODE KIT

*Quantity vary depending upon unit capacity requirement

**Item number 18 (not shown here) and used with large heat exchangers

TABLE 4-6: STORAGE TANK ASSEMBLY			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
1	85002-175DS	1	TANK 175 GALLON, DUPLEX STAINLESS STEEL
	85002-210DS		TANK 210 GALLON, DUPLEX STAINLESS STEEL
	85002-285DS		TANK 285 GALLON, DUPLEX STAINLESS STEEL
	85002-453DS		TANK 453 GALLON, DUPLEX STAINLESS STEEL
	85002-500DS		TANK 500 GALLON, DUPLEX STAINLESS STEEL
	85002-765DS		TANK 765 GALLON, DUPLEX STAINLESS STEEL
	85002-175GL		TANK 175 GALLON, DOUBLE GLASS LINED C.S.
	85002-210GL		TANK 210 GALLON, DOUBLE GLASS LINED C.S.
	85002-285GL		TANK 285 GALLON, DOUBLE GLASS LINED C.S.
	85002-453GL		TANK 453 GALLON, DOUBLE GLASS LINED C.S.
	85002-500GL		TANK 500 GALLON, DOUBLE GLASS LINED C.S.
	85002-765GL		TANK 765 GALLON, DOUBLE GLASS LINED C.S.

TABLE 4-7: INSULATION JACKET			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
2	20001-175	1	INSULATION JACKET, 175 GALLONS TANK
	20001-210		INSULATION JACKET, 210 GALLONS TANK
	20001-285		INSULATION JACKET, 285 GALLONS TANK
	20001-453		INSULATION JACKET, 453 GALLONS TANK
	20001-500		INSULATION JACKET, 500 GALLONS TANK
	20001-765		INSULATION JACKET, 765 GALLONS TANK

TABLE 4-8: BRAZED PLATE DOUBLE WALL HEAT EXCHANGER			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
3	80002-62	1 - SIMPLEX 2 - DUPLEX	HEAT EXCHANGER – B35TDWM4X62
	80002-90		HEAT EXCHANGER – B35TDWM4X90
	80002-118		HEAT EXCHANGER – B35TDWM4X118
	80002-174		HEAT EXCHANGER – B35TDWM4X174
	80002-222		HEAT EXCHANGER – B35TDWM4X222

CONTROL VALVE OPTION PARTS:

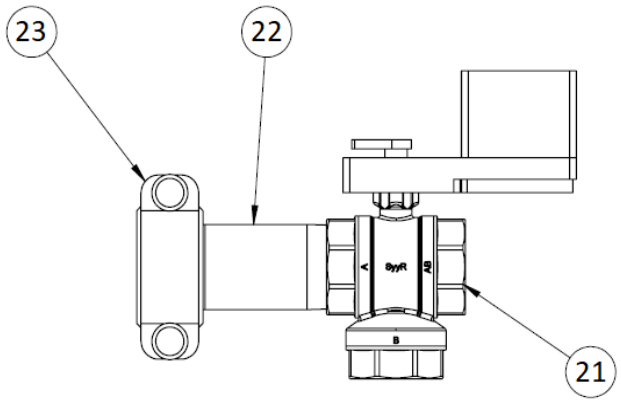


TABLE 4-10: CONTROL VALVE MODULE PARTS			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
21	22046-2	1 - SIMPLEX 2 - DUPLEX	CONTROL VALVE – 2” NPT
21a	65020		ELECTRONIC ACTUATOR ONLY
21b	22031-2		2” SIZE 3-WAY VALVE BODY ONLY
22	70038-2-6		2” PIPE SPOOL
23	72034-2		2” VICTAULIC COUPLING

VFD PUMP OPTION PARTS:

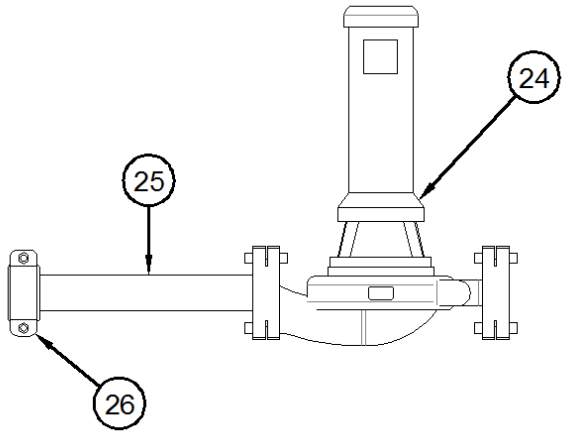
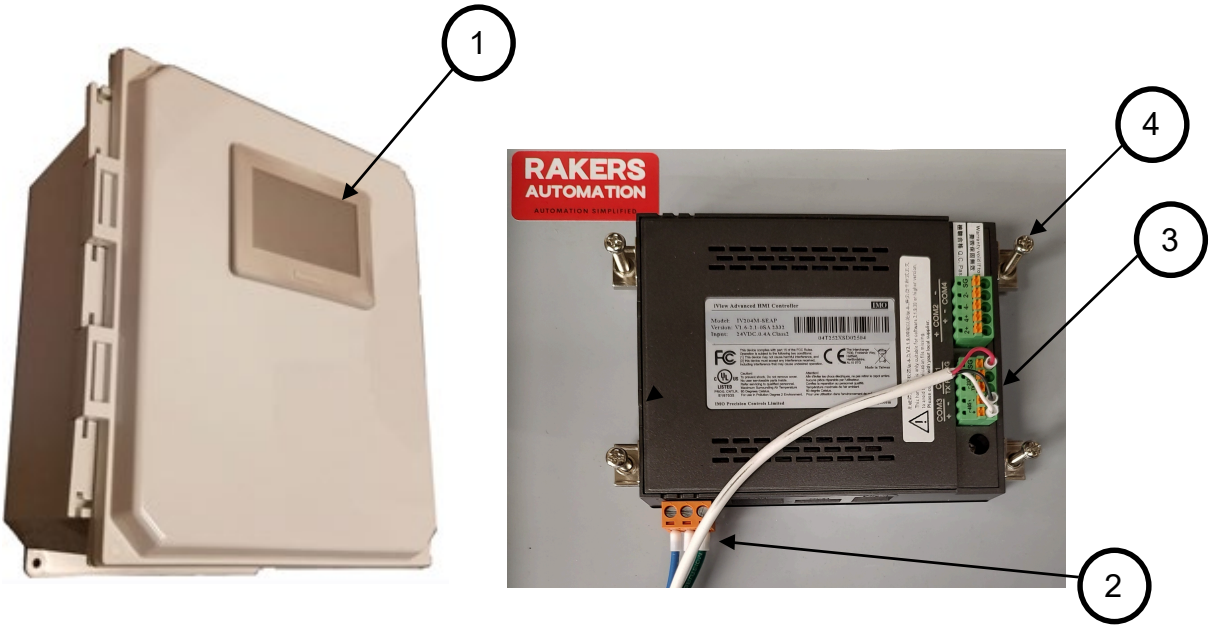
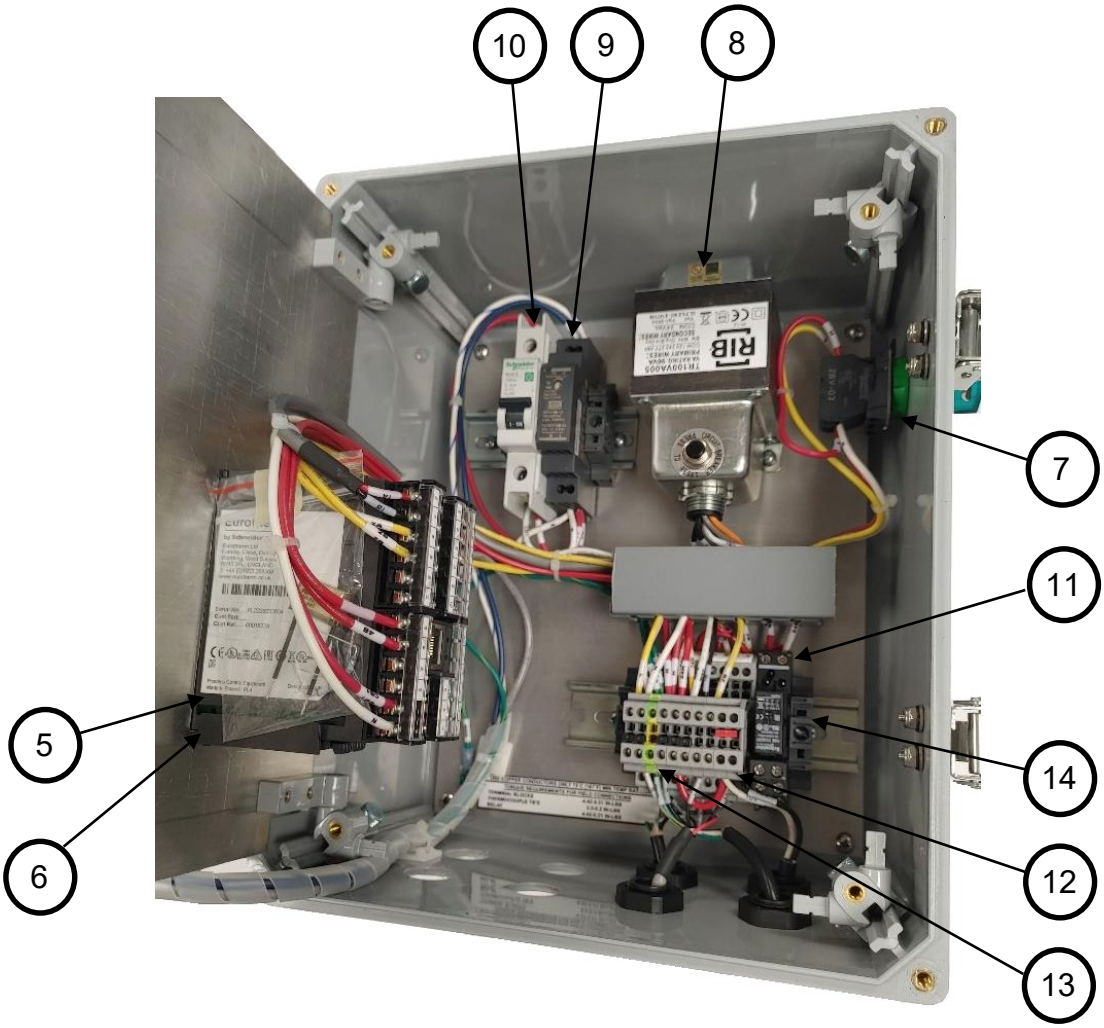


TABLE 4-11: VFD PUMP MODULE PARTS			
ITEM NO.	**PART NO.**	**QUANTITY**	**PART DESCRIPTION**
24	22045	1 - SIMPLEX 2 - DUPLEX	VFD PUMP WITH STAINLESS COMPANION FLANGES
25	70038-1.5-6		1.50” SIZE STRAIGHT PIPE
26	72035-2-1.5		REDUCING VICTAULIC COUPLING

4.13 CONTROL BOX PARTS





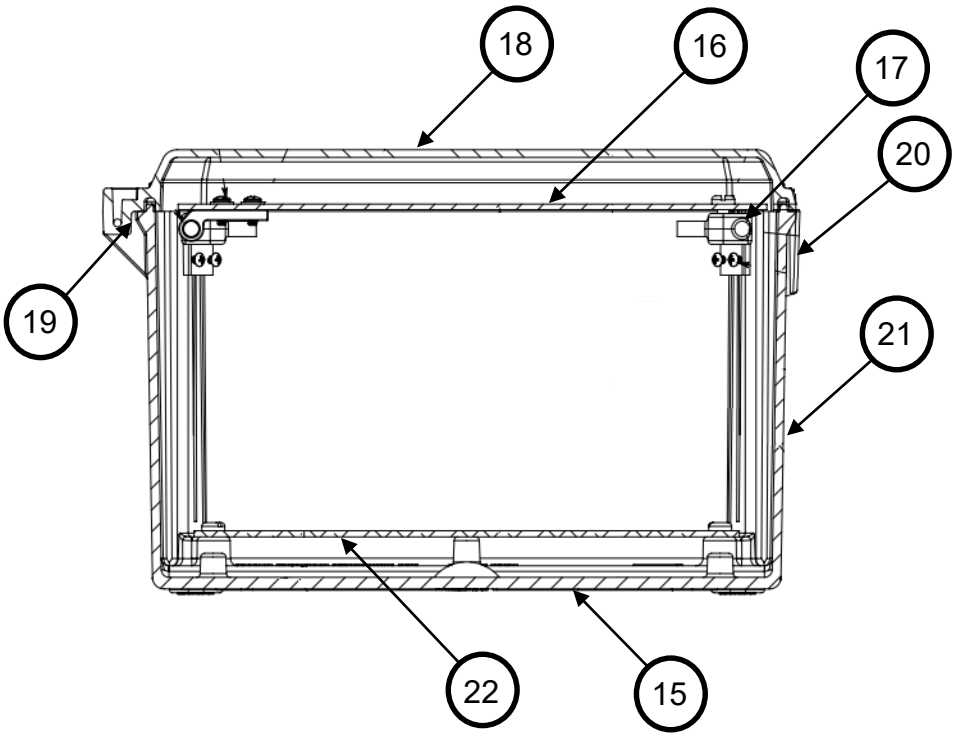


TABLE 4-13: CONTROL PANEL PART NUMBERS

ITEM	PART NO.	QTY.	DESCRIPTION
1	65016	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 STP 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
Water heater is not able to maintain the required temperature at the rated capacity or slow recovery.	1. The water heater temperature controls or Aquastat not set properly.	1. Check the set point settings on the controller or aquastat. Readjust the set point settings if below the required temperature. Refer to programming sequence in section 3.12 for complete settings information.
	2. Control valve or VFD pump 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 4.5 for Control Valve and Sections 3.6 and 4.6 for VFD Pump Technical Information if hard copy is not available. Make sure is is set in Automatic mode.
	3. Boiler water supply temperature is low.	3. Check to make sure the boiler water inlet temperature gauge reading is equal to the design conditions. Readjust the boiler supply water temperature if necessary.
	4. Boiler water flow rate is low.	4. Measure the boiler water supply flowrate using flowmeter and check the pump to make sure the flowrate is not lower than the design conditions.
	5. Boiler water or cold water inlet strainer clogged.	5. Blowdown and clean the strainer.
	6. The heat exchanger is scaled on boiler 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. Water heater 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 signal from control panel.	9. Open the control valve or pump cover and check 4-20mA (or 2-10VDC 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 water heater temperature control system/valve or VFD pump is not operating properly.	1. See the adjustment and testing instructions contained in Section 3.10 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple or Aquastat is installed and functioning correctly. Repair or replace thermocouple or Aquastat if needed. Replace the control valve and/or actuator (or optional VFD pump) if necessary. Refer to Section 4 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 domestic 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.
	6. Pump(s) does not deactivate.	6. Check the pump(s) on/off and high/low temperature settings. Inspect and replace the relay switch if not functioning properly.
DHW supply outlet temperature fluctuates significantly.	1. Control Valve or VFD pump 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. Water heater 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. Circulating pump malfunctions/failed.	3. Inspect the circulation pump for proper operation and repair or replace if not functioning properly.
	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 water heater temperature control system or Aquastat is not operating properly.	5. Refer to the control settings adjustment and testing instructions contained in Section 3.12 for the specific temperature control system installed on the unit. Also, check to ensure that the

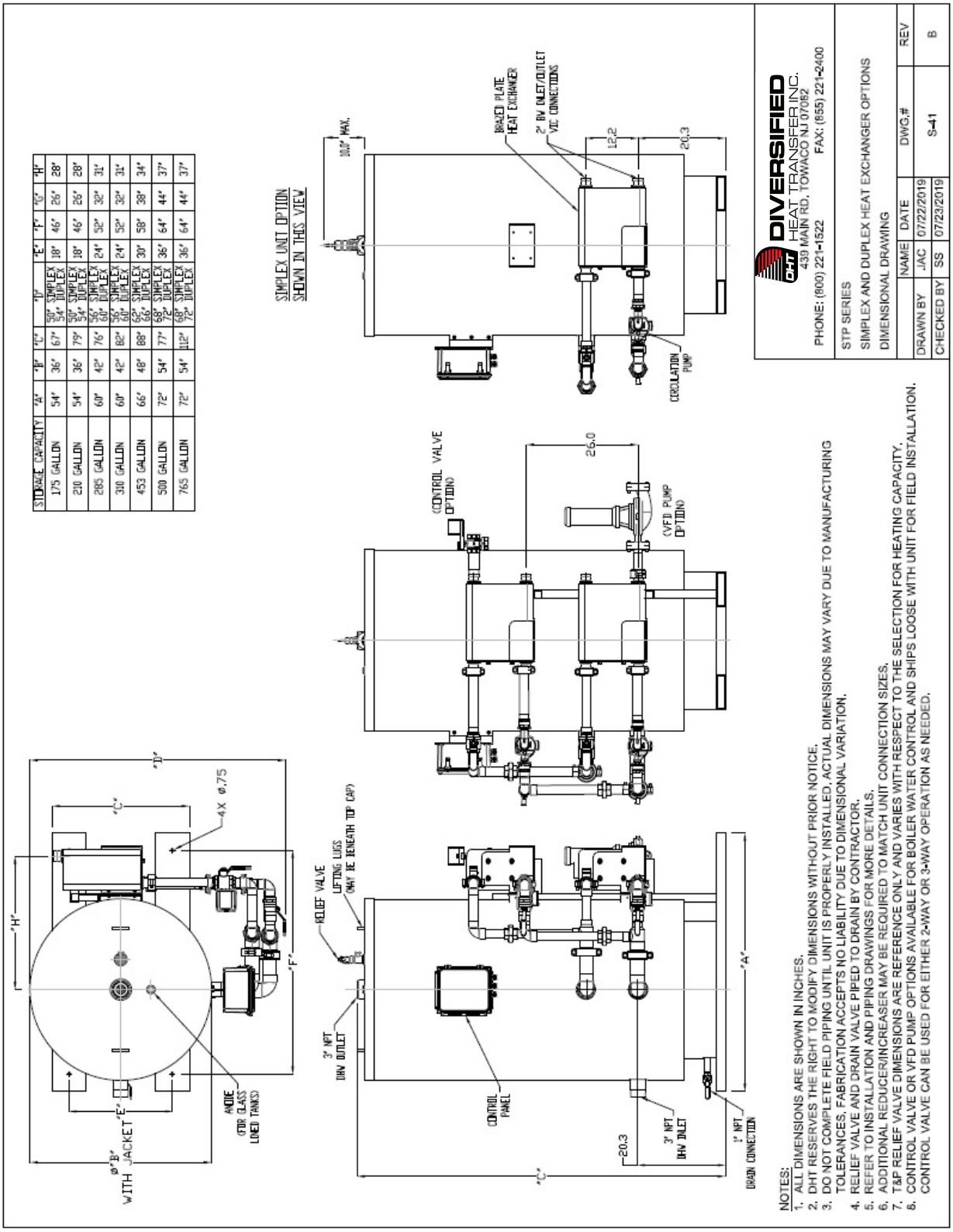
		thermocouple or Aquastat is installed and functioning correctly. Repair or replace it if needed.
Excessive or insufficient boiler water being returned from the unit.	1. The water return piping has not been installed properly to allow the water return; boiler water return line is restricted; or the return check valve is leaking or has failed. 2. There is 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 heating the domestic water and control valve(s) or VFD pump(s) is closed.	1. There is no power supply to control valve or optional VFD pump. 2. There is no signal from controller to valve or VFD pump.	1. Open the valve or pump 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 or pump cover, and check 4-20mA control signal is present at terminals (4-20mA converted to 2-10VDC for pump). Troubleshoot panel to restore proper signal to control valve or VFD pump if it malfunctions. Also check control valve dip switches or pump controller settings as shown in Section 6.4.
Temperature and Pressure or pressure only relief valve “pops.”	1. Control Valve or VFD pump does not close properly. 2. Improperly sized or disconnected expansion tank in closed loop piping system. 3. Inadequate water hammer arrestors. 4. System/incoming water pressure is too high. 5. Relief valve is faulty.	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. 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. 4. Bring the system water pressure below the relief valve setting. 5. Inspect and adjust or replace the relief valve if it has failed. Contact DHT representative for replacement.

	6. Over temperature settings in PID controller or Aquastat not properly set or defective.	6. Check and readjust as necessary. Replace the defective parts as necessary. Refer to adjustment instructions contained in Section 3.12.
Water heater shuts down at or too close to (above or below) the design outlet water temperature.	1. Over temperature limit settings or Aquastat not properly set or defective.	1. Refer to adjustment instructions contained in Section 3.12. Replace the defective parts as necessary.
A loud banging noise in the water heater 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 domestic 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 3.12. Replace the defective parts or thermocouple if defective.
Unable to clear Over-temperature sound alarm condition.	1. Automatic over temperature settings not properly set or defective parts. 2. Defective thermocouple. 3. Control valve or VFD pump requires calibration.	1. Check and readjust the over-temperature settings as necessary. Refer to adjustment instructions contained in Section 3.12. Replace the defective parts. 2. Replace the thermocouple if shorted. 3. Recalibrate the Control valve or VFD pump per instructions in Section 3.5 or 3.6.

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.

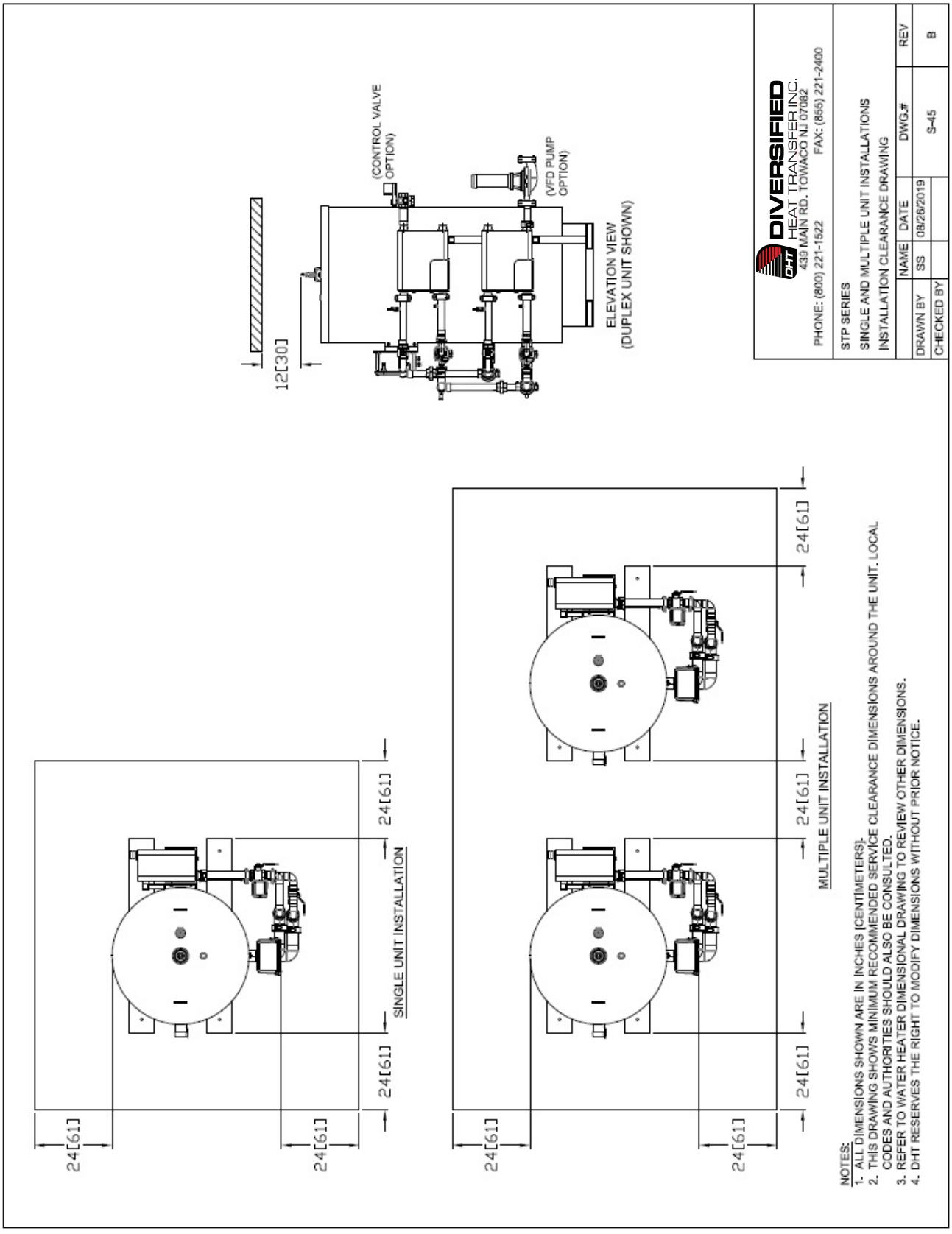
SECTION 6: TECHNICAL DRAWINGS & FORMS

6.1 DIMENSIONAL DRAWINGS

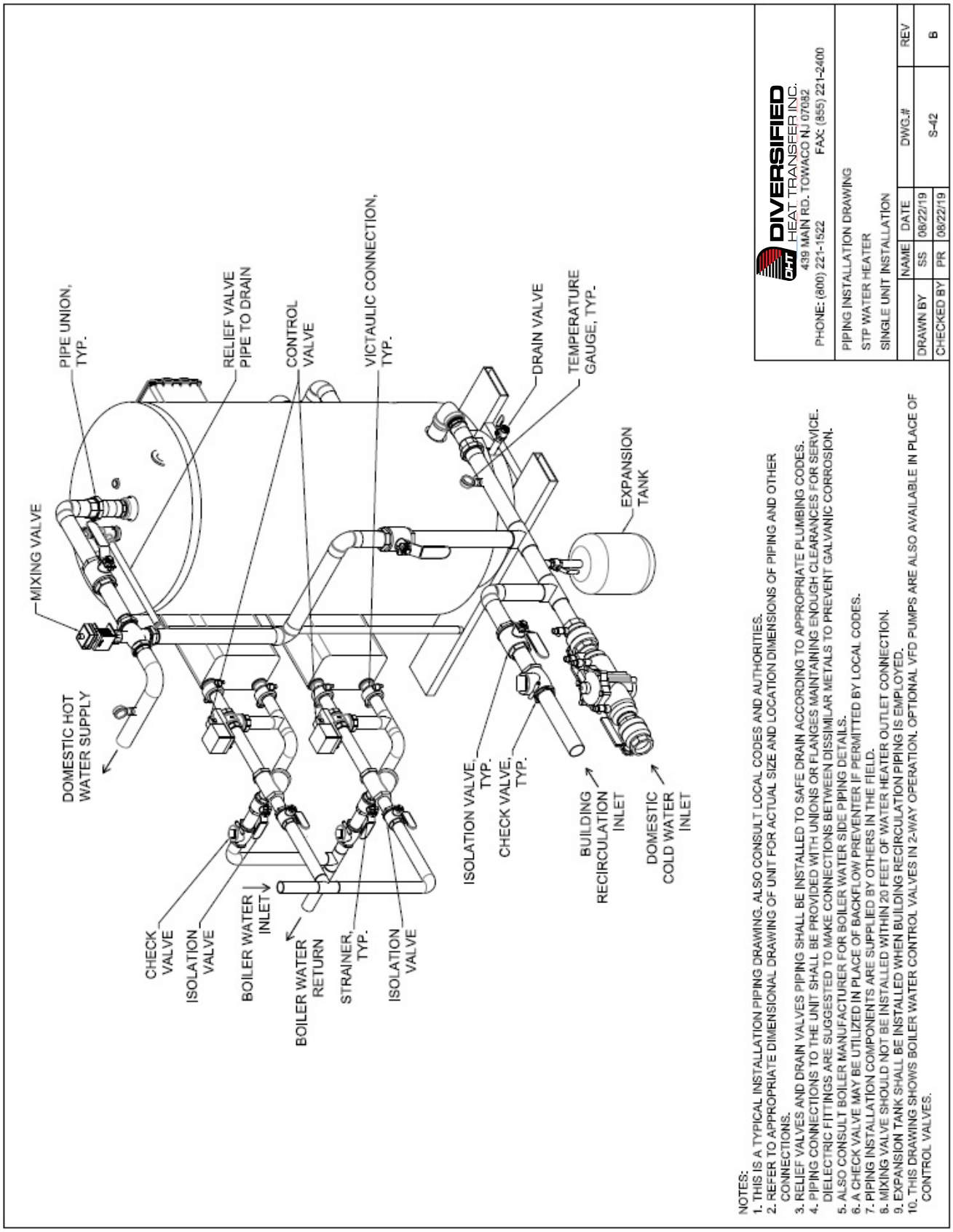


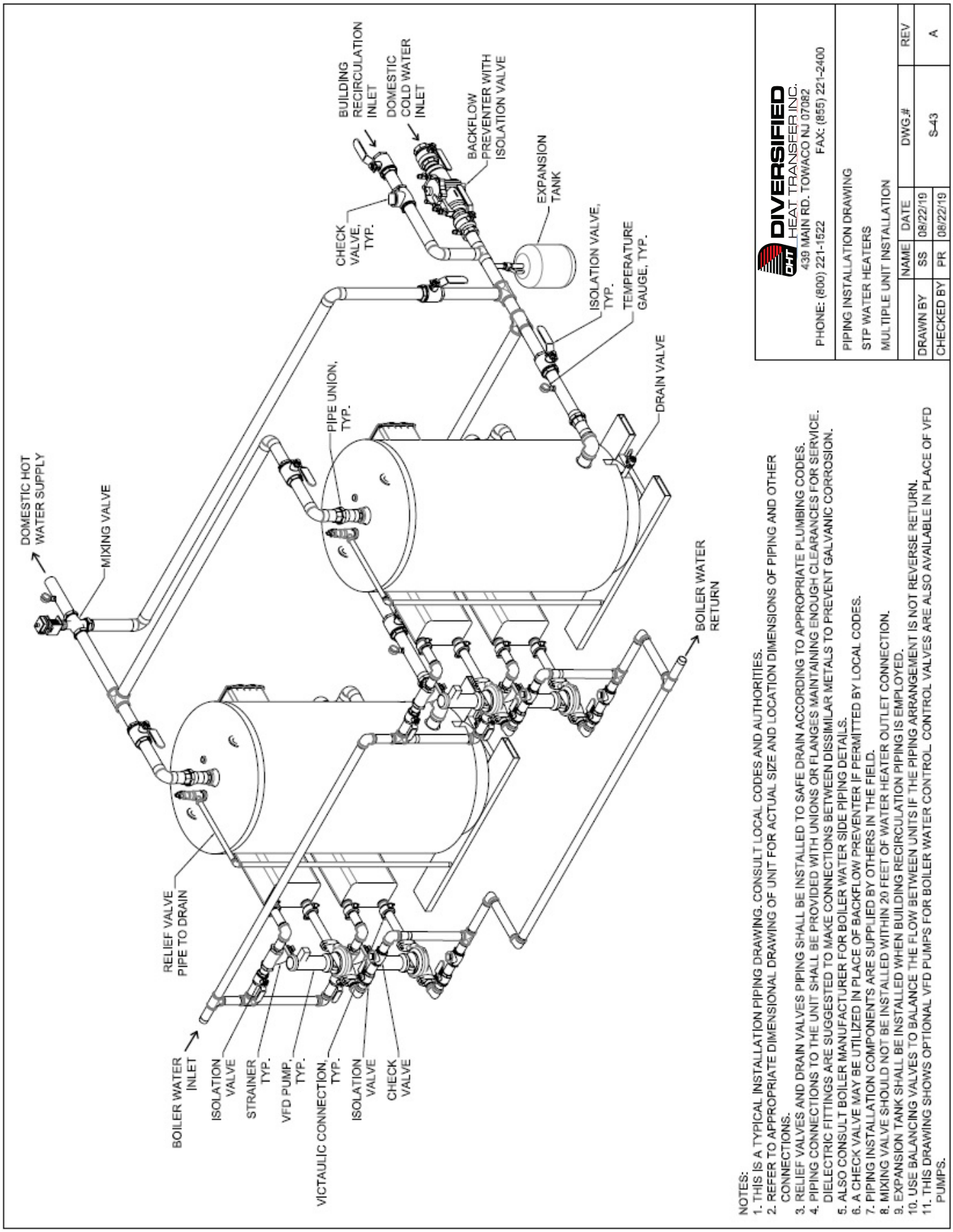
STORAGE CAPACITY	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"
175 GALLON	54"	36"	67"	30" SIMPLEX 54" DUPLEX	18"	46"	26"	28"
210 GALLON	54"	36"	79"	30" SIMPLEX 54" DUPLEX	18"	46"	26"	28"
285 GALLON	60"	42"	76"	36" SIMPLEX 60" DUPLEX	24"	52"	32"	31"
310 GALLON	60"	42"	82"	36" SIMPLEX 60" DUPLEX	24"	52"	32"	31"
453 GALLON	66"	48"	88"	42" SIMPLEX 66" DUPLEX	30"	58"	38"	34"
500 GALLON	72"	54"	77"	48" SIMPLEX 72" DUPLEX	36"	64"	44"	37"
765 GALLON	72"	54"	112"	48" SIMPLEX 72" DUPLEX	36"	64"	44"	37"

6.2 CLEARANCE DRAWINGS



6.3 PIPING AND INSTALLATION DRAWINGS





NOTES:
1. THIS IS A TYPICAL INSTALLATION PIPING DRAWING. CONSULT LOCAL CODES AND AUTHORITIES.
2. REFER TO APPROPRIATE DIMENSIONAL DRAWING OF UNIT FOR ACTUAL SIZE AND LOCATION DIMENSIONS OF PIPING AND OTHER CONNECTIONS.
3. RELIEF VALVES AND DRAIN VALVES PIPING SHALL BE INSTALLED TO SAFE DRAIN ACCORDING TO APPROPRIATE PLUMBING CODES.
4. PIPING CONNECTIONS TO THE UNIT SHALL BE PROVIDED WITH UNIONS OR FLANGES MAINTAINING ENOUGH CLEARANCES FOR SERVICE. DIELECTRIC FITTINGS ARE SUGGESTED TO MAKE CONNECTIONS BETWEEN DISSIMILAR METALS TO PREVENT GALVANIC CORROSION.
5. ALSO CONSULT BOILER MANUFACTURER FOR BOILER WATER SIDE PIPING DETAILS.
6. A CHECK VALVE MAY BE UTILIZED IN PLACE OF BACKFLOW PREVENTER IF PERMITTED BY LOCAL CODES.
7. PIPING INSTALLATION COMPONENTS ARE SUPPLIED BY OTHERS IN THE FIELD.
8. MIXING VALVE SHOULD NOT BE INSTALLED WITHIN 20 FEET OF WATER HEATER OUTLET CONNECTION.
9. EXPANSION TANK SHALL BE INSTALLED WHEN BUILDING RECIRCULATION PIPING IS EMPLOYED.
10. USE BALANCING VALVES TO BALANCE THE FLOW BETWEEN UNITS IF THE PIPING ARRANGEMENT IS NOT REVERSE RETURN.
11. THIS DRAWING SHOWS OPTIONAL VFD PUMPS FOR BOILER WATER CONTROL. CONTROL VALVES ARE ALSO AVAILABLE IN PLACE OF VFD PUMPS.

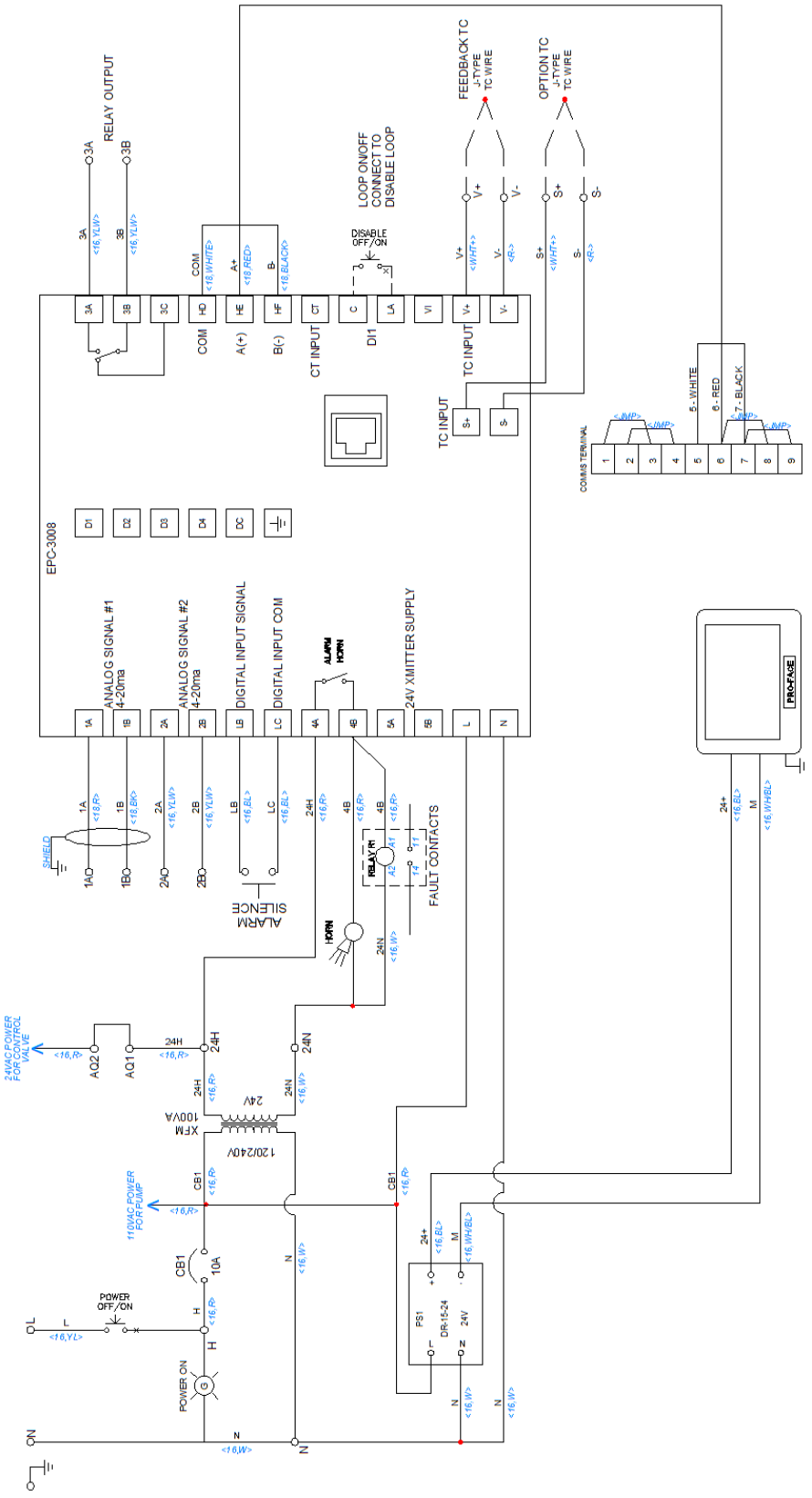
DIVERSIFIED HEAT TRANSFER INC.
439 MAIN RD. TOWACO NJ 07082
PHONE: (800) 221-1522 FAX: (855) 221-2400

PIPING INSTALLATION DRAWING
STP WATER HEATERS
MULTIPLE UNIT INSTALLATION

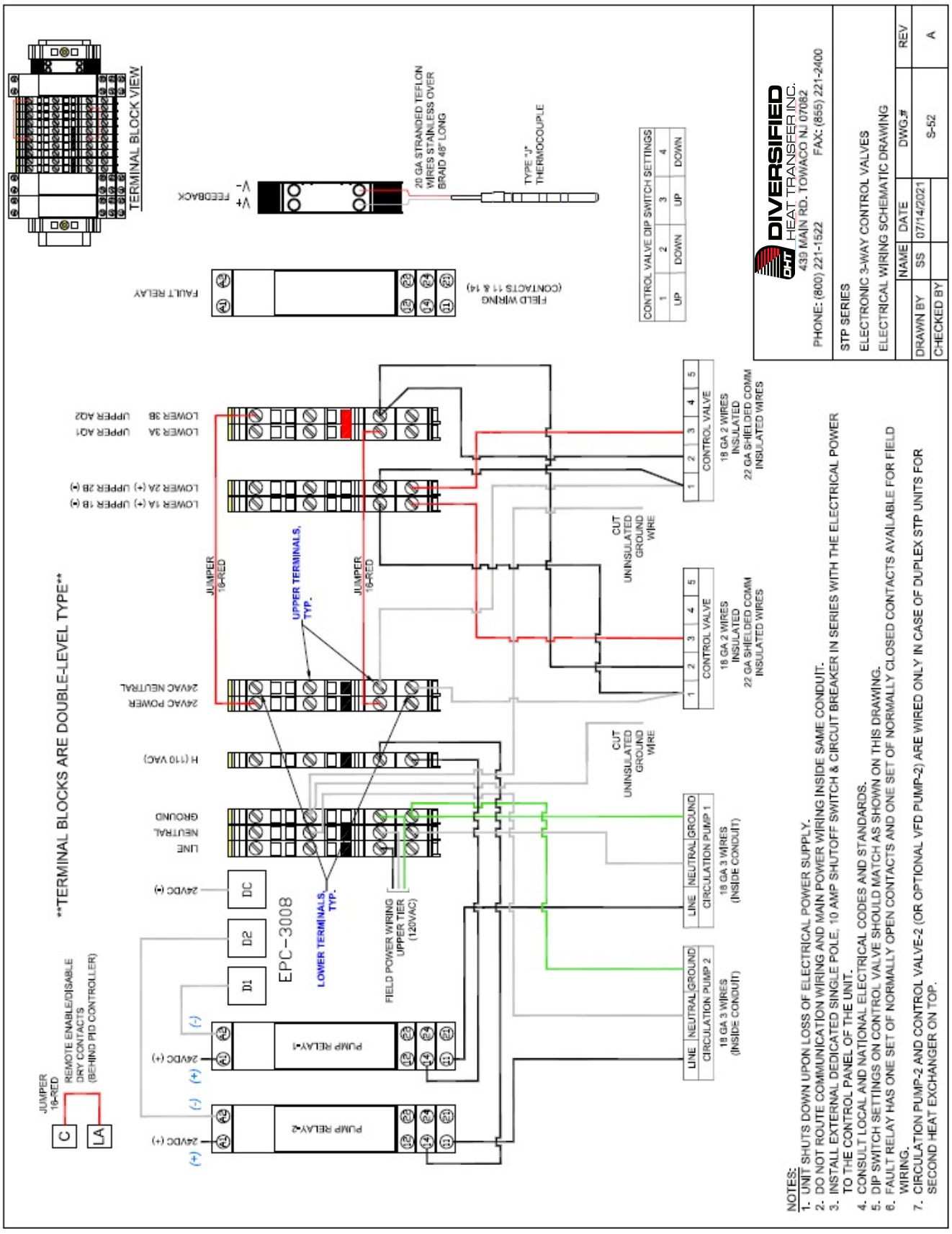
	NAME	DATE	DWG.#	REV
DRAWN BY	SS	08/22/19	S-43	A
CHECKED BY	PR	08/22/19		

6.4 ELECTRICAL WIRING DIAGRAMS/SCHEMATICS

Control Box Internal Electrical Wiring Diagram:

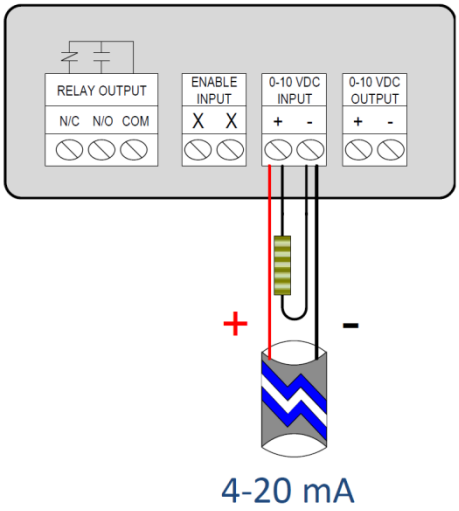


Terminal Block Wiring Connections:



VFD Pump Specific Wiring Connections:

Electrical Signal Wiring Connections: Open the cover on top of the VFD pump user interface module using screw driver and low voltage wiring terminals as shown below are available on circuit board attached to the cover:



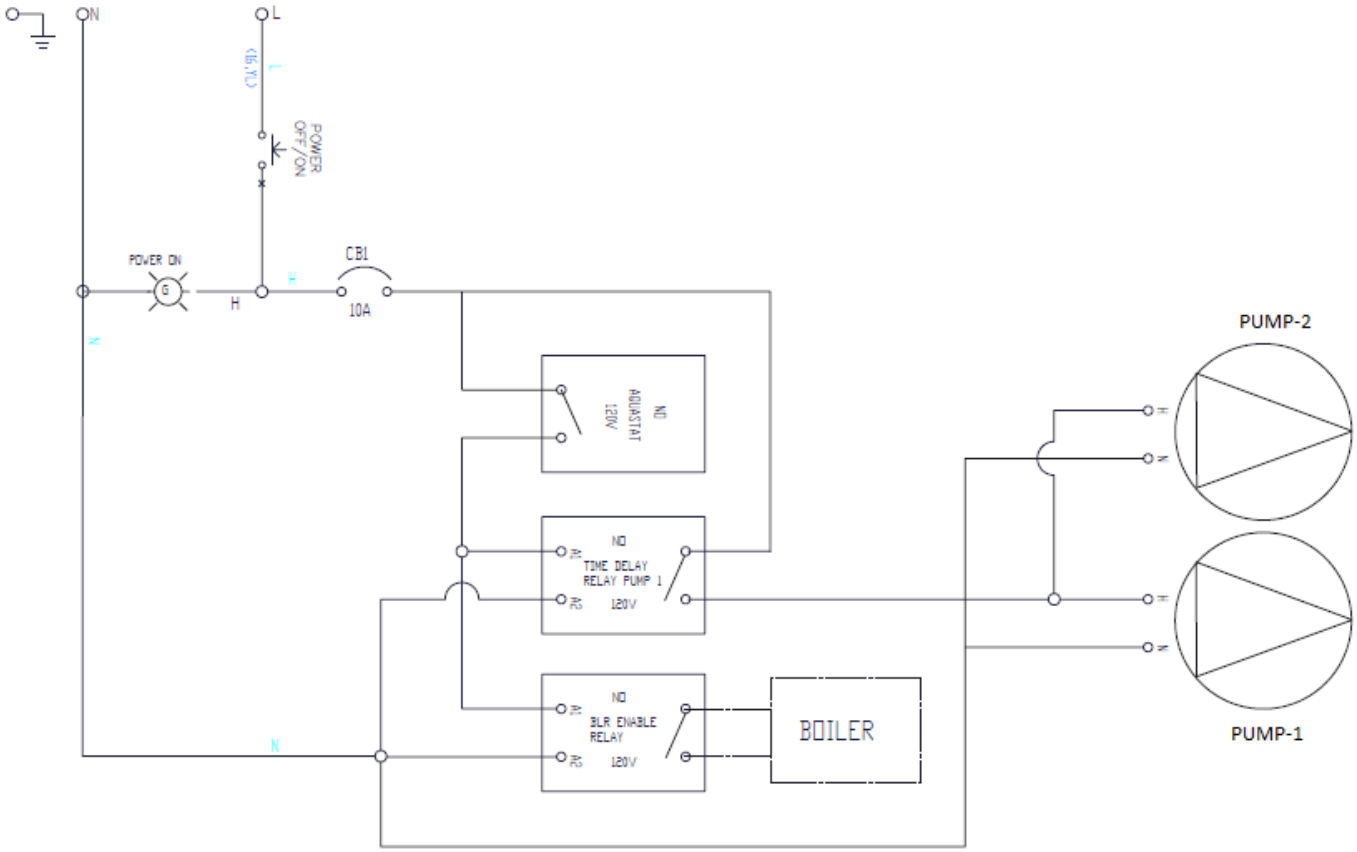
4-20 mA to 2-10vdc signal conversion with 500 ohm resistor

Electrical Power Supply Connections: Open the electrical module cover on side of the pump to make 200-240V/1ph/60Hz wiring connections:

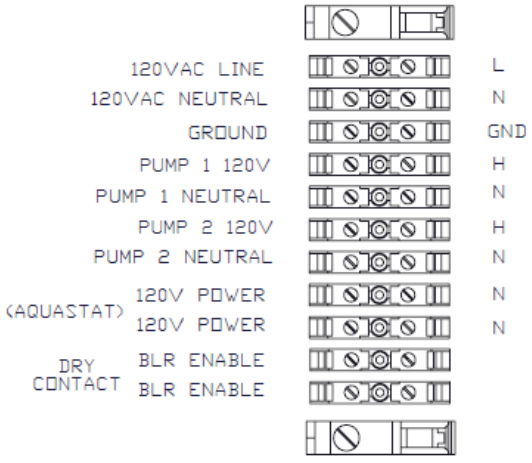
NOTES:

- Connect the black wire of the pump to the hot/live wire and white wire to neutral. Ground wire is connected to the green color screw as shown above.
- Power supply cabling should be capable of carrying rated power and be properly fused. Install external electrical disconnect complying with electrical codes.
- The pump has built-in over current protection, temperature protection, and basic overvoltage protection.
- National or local electrical codes supersede the instructions.
- Also follow instructions in pump manufacturer manual shipped with the unit.

Relay Panel Wiring Schematic with Aquastat Control Option:



Field Wiring Connections for Relay Panel:



NOTES:

- Unit shuts down upon loss of electrical Power supply cabling should be capable of carrying rated power and be properly fused. Install external electrical disconnect complying with electrical codes.
- National or local electrical codes supersede the instructions.

6.5 FORMS AND RECORDS

6.5.1 DHT Water Heater Controller Programming Record Sheet

DHT Water Heater 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 STP Series Installation Form

DIVERSIFIED HEAT TRANSFER INC.

STP SERIES INSTALLATION FORM

Please complete ONE (1) form for each SITE at which DHT STP 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: ◻ Storage Tank ◻ Other: _____			
8. Are all units installed in accordance with the clearances defined in the STP Series OM? If no, why? _____	◻ Yes	◻ No	
9. Are all piping connections tight on unit(s)?	◻ Yes	◻ No	
10. If multiple units are installed in parallel, are they piped reversed return as per the STP Series OM? If no, why?	◻ NA	◻ Yes	◻ No

STP SERIES 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

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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?	_____ ^{O} F	
11. Is there a buffer tank used with the STP Series Unit?	◻ 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

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 ^{O}F	
Control Valve Open	Automatic	
Primary Alarm On/ Off	+ Δ 20 ^{O}F	
Secondary Alarm On/ Off	+ Δ 30 ^{O}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 ^{O}F	
Pump Dev. High	2 ^{O}F	
Pump Dev. Low	5 ^{O}F	

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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
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.		

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Other Notes:

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

6.5.3 STP Series Startup Form

DIVERSIFIED HEAT TRANSFER INC.

STP SERIES START-UP FORM

Please complete ONE (1) form for each SITE at which DHT STP 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 maxium 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	

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Additional Notes:

DHT INTERNAL APPROVAL	
DHT Engineering 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 STP SERIES WATER HEATER. The STP SERIES Water Heater must be operated in accordance with the conditions stated herein, against the indicated failures. The STP 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.
- **TANK** shall carry a non-prorated warranty:
  - (10) year limited warranty on steel tank with double glass lining
  - (25) year limited warranty on duplex steel tank.
- **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, heating 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 heating 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 STP SERIES Water Heater;
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 STP SERIES Water Heater 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
09/11/2019	Initial release	SS
06/21/2021	Add cautions in section 2.1.1 and 3.8 Update section 3.14.2, 4.13, 6.5.2 and 6.4 electrical wiring drawing	SS
07/08/2021	Update section 2.3, 3.13, 3.5, 4.12, 4.13, 4.5 and 6	SS