DIVERSIFIED HEAT TRANSFER INC.

Installation, Operation, and Maintenance Manual

ST Series (V/H/VW/HW)

Indirect Fired, Semi-Instantaneous, Steam and Boiler Water Heater

(Vertically or Horizontally Built, Steam-to-Water, or Water-to-Water with Electronic or Pneumatic Controls)

This manual applies to the following models:

- STV Series
  Vertical Construction
  Single and Double Wall

- STH Series
  Horizontal Construction
  Single and Double Wall



DHT ST SERIES WATER HEATER

CONTRACTOR / FACILITY INFORMATION

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

Model #: _____

Serial #: _____

Install Date: _____

Latest Update: 08/28/2026

DISCLAIMER

The information contained in this document is subject to change without notice from Diversified Heat Transfer, Inc. (DHT). DHT makes no warranty of any kind in respect to this material, including but not limited to, implied warranties of merchantability and fitness for a particular application. DHT is not liable for errors appearing in this document, nor for incidental or consequential damages occurring in connection with the furnishing, performance, or use of these materials.

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SECTION 1: GENERAL INFORMATION

1.1 INTRODUCTION

The purpose of this manual is to provide an installation, operation, and maintenance procedural guide for the ST Series Water Heaters, which includes the following unit configurations and models:

- STV/STH-6_
- STV/STH-8_
- STV/STH10_
- STV/STH12_

These units are either vertically or horizontally constructed, per customer requirement and use - either steam or boiler water to heat domestic water.

1.2 DESCRIPTION

The Diversified Heat Transfer ST Series semi-instantaneous water heaters are the engineered solutions for facility owners/managers who need high recovery capacity in a small space. They are constructed of stainless steel pipe and other non-ferrous materials to ensure long leak-free operation. Designed for continuous high-peak loads, the DHT ST Series units are ideal for high-demand applications, such as hospitals and dormitories.

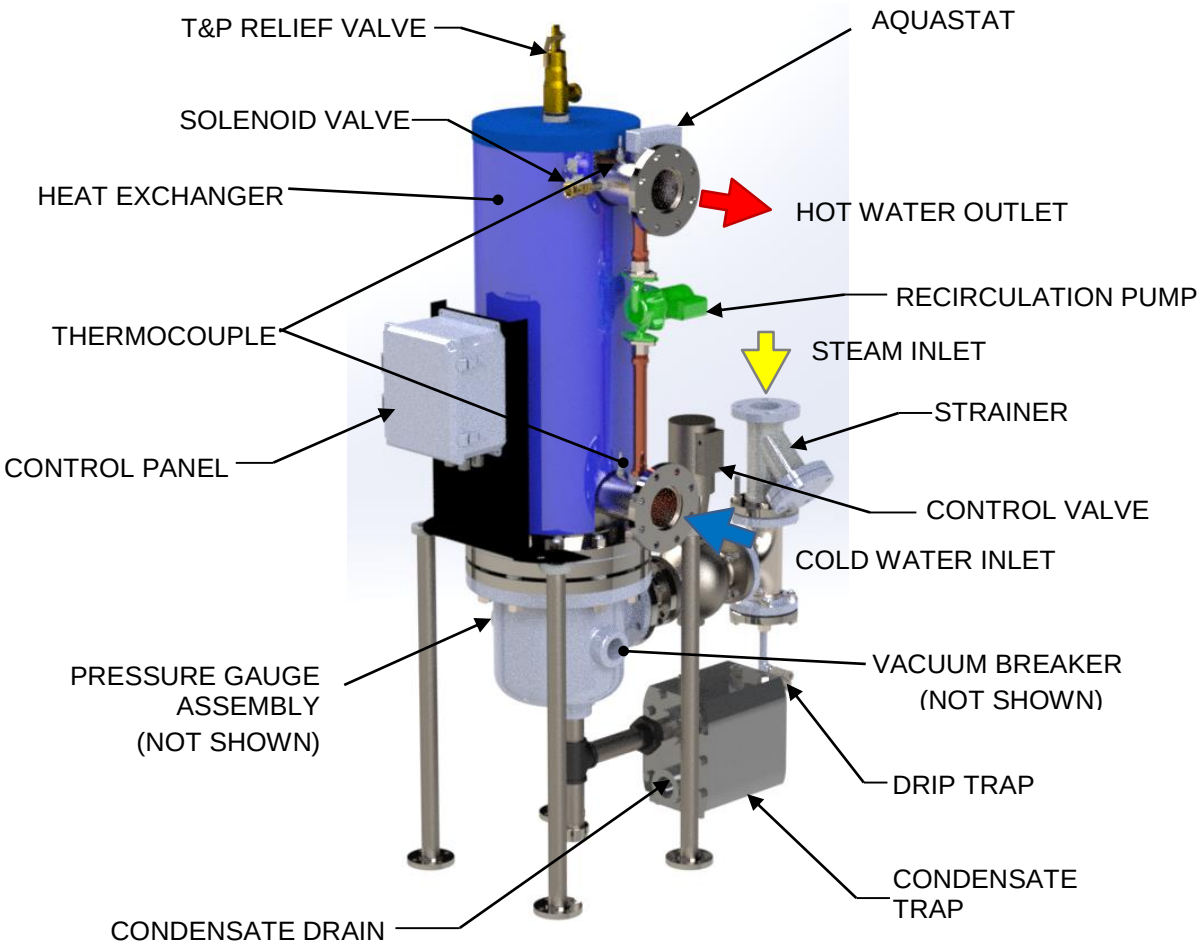


FIG 1.1: ST Series VS (Vertical/Steam) Component and Function Diagram

Units are engineered using steam, boiler water, or High Temperature Hot Water (HTHW) as the heating medium. Semi-instantaneous operation provides high output by channeling the incoming cold water directly over the heat exchanger tubes in a controlled manner to maximize the heat transfer rates compared to conventional stratified heat exchanger convection systems. Velocity of water and pressure drop are controlled by changing water flow directly across the heat exchanger, which increases heat transfer and inhibits scale formation.

Perfect for mechanical rooms where space is limited, the water heating systems feature vertical configurations so they require less than four square feet of floor space. Plus, the tube bundle can be removed straight downward from the bottom of the unit to eliminate the need for overhead space or extra clearances for service or maintenance.

HOT WATER OUTLET

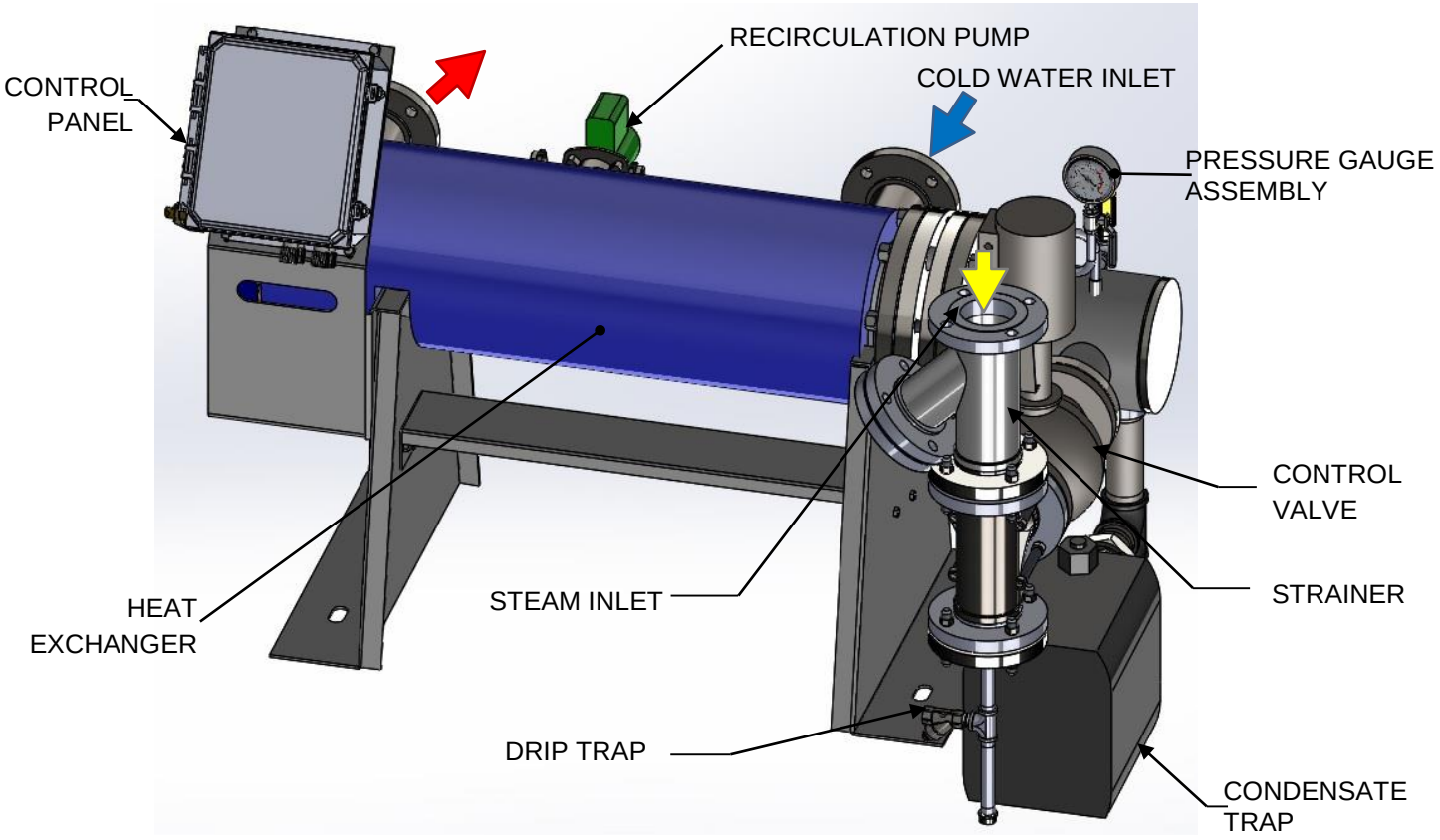


FIG 1.2: ST Series HS (Horizontal/Steam) Component and Function Diagram

1.3 FEATURES

- Compact design to fit in small mechanical rooms and standard doorways
- Complete packaged system with components engineered to specific application requirements
- Energy efficient
- High recovery
- Stainless alloy construction
- ASME Code Tested & Stamped

1.4 APPLICATIONS

ST Series units are used in wide range of domestic water heating applications including 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 in case any applications-related information is required.

1.5 ENERGY SOURCES

DHT ST Series Water Heaters are engineered and manufactured to use one the following energy sources to produce domestic hot water:

- Steam
- Boiler Water
- HTHW

**This manual includes information for steam to water units with electronic controls and pneumatic controls. Refer to separate manual or additional documentation if hot water as the heating medium or different control options are required.*

1.6 DESIGN CONDITIONS

DHT has design, engineering, and manufacturing capabilities to produce products to satisfy a wide range of our customer requirements.

DHT standard design conditions for ST Series units are:

	Shell Side	Tube Side
Design Pressure, PSIG	**200**	**150**
Design Temperature, °F	**210**	**350**

NOTE:
Consult the design specifications for the unit or the name plate attached to the unit and a tag on the T & P Relief valve for maximum pressure for the unit.

1.7 CONSTRUCTION

All DHT ST Series units are designed and manufactured from superior materials of the highest quality. Each unit meets or exceeds requirements of ASME Section VIII, Div.1 Code. All DHT Units are registered with the National Board of Boiler and Pressure Vessels Inspectors, and are U-stamped.

Heat exchangers: U-tube heat exchangers are manufactured with stainless steel tubesheet, stainless steel shell, and cast iron or fabricated carbon steel head. Tubes are available in copper, Cu-Ni 90/10, or stainless steel options depending upon customer requirement and operating conditions. If it is required the units can be built using double-wall, leak protective tubing and double tubesheets. Double wall tubes are available in copper or Cu-Ni 90/10 and steam or tube side tubesheet is available in carbon steel. Shell or water side tubesheet is stainless steel.

Controls and trim: DHT ST Series units can be equipped with electronically or pneumatically activated control valves. DHT ST Series units are equipped with a control panel that uses TFT in a color LCD touchscreen display, easy adjustable set points, solenoid valve and set points for double safety alarm system. Backup interface on PID controller display is also available behind the front door when front HMI interface is down. A data port is available for communication with the Building Management System if required.

Standard packages also includes an ASME Temperature and Pressure Relief valve and recirculating water line with circulator.

Steam fired units are equipped with condensate line: F&T steam trap, steam inlet strainer, and drip leg with thermodynamic steam trap.

Insulation and Jacketing: All standard DHT ST Series units contain fiber glass insulation between the heat exchanger and jacket. The jackets are constructed of PVC as standard.

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 in accordance with the information only 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 only be operated and serviced by qualified technical personnel in accordance with all applicable codes, laws, and regulations.
    - The unit must be used according to the specification given to DHT.
    - Pressure and temperatures should not exceed limits indicated on the DHT name plate attached to the unit.
- For initial startup refer to all instructions in **Section 3.4: 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.
    - Prevent evaporation of fluid on the shell side. Steam or vapor should only flow through the tubes.
- 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 2.7: 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 indoor spaces that are maintained between 32°F to 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 temperature limits specified by DHT.

1.8.3 Safety Features

The customer is responsible for maintainance of the safety features of the ST 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 that accompany 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 to 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 ST Series semi-instantaneous 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, and elderly are at the highest risk of being scalded.**
- **See instruction manual before setting temperature at water heater.**
- **Feel water before bathing or showering.**
- **Temperature limiting valves are available. 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 ST 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 to avoid risking loss of coverage under warranty.
- The inspection log must be maintained and up-to-date and kept in close proximity to the ST 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

2.1.1 Examining the Unit

ST Series Water Heaters are thoroughly inspected and tested prior to shipment. Upon receipt of the ST 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.

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

2.1.2 Compliance with Codes

The ST Series semi-instantaneous water heater is constructed and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII – Division 1. Other codes or approvals which apply will be labeled on the ST Series Water Heater.

The ST Series Water Heater installation must only be performed by technically qualified persons. The installation must conform to all national, state, provincial, and local code requirements established by the authorities having jurisdiction, as well as to 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 (6 to 8 inches concrete pad recommended).
- Secure the ST Series Water Heater to the building floor or mounting pad. For attachment to the foundation, use the four holes in the base.

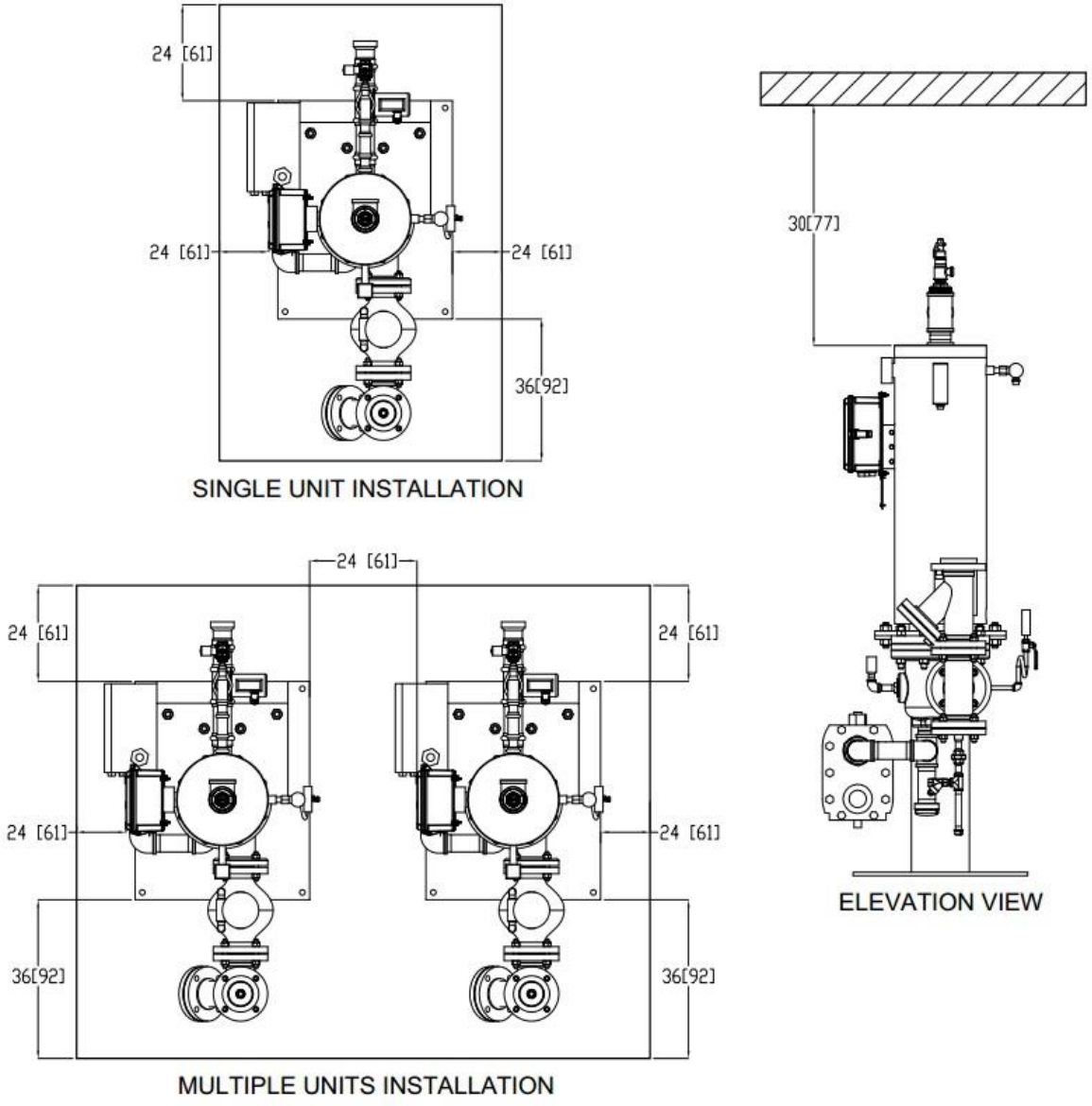
> **NOTE:**
> Seismic anchorage information is available upon request. Contact your DHT sales representative for more information.

- The ST Series Water Heater is top-heavy and proper rigging techniques should be followed while moving heavy equipment to avoid injury.
- The ST Series Water Heater must be plumb and level to function properly.
- The ST Series Water Heater should be placed with at least 10” headroom above it to permit removal of the relief valve.
- All ST Series steam water heaters should be placed to permit gravity flow of condensate to the condensate return system (see Sec. 2.6.1.3).

2.3 INSTALLATION CLEARANCES AND UNIT DIMENSIONS

The ST 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, these codes shall supersede these requirements.

All steam piping, 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.



NOTES:
1. ALL DIMENSIONS SHOWN ARE IN INCHES [CENTIMETERS].
2. 54[138] MIN. SERVICE CLEARANCE IS REQUIRED ON TOP OF HEAT EXCHANGER SHELL COVER IF RELIEF VALVE AND TEE ARE NOT TO BE DISASSEMBLED IN THE FIELD DURING SERVICE.
3. THIS DRAWING SHOWS MINIMUM RECOMMENDED SERVICE CLEARANCE DIMENSIONS.
4. REFER TO WATER HEATER DIMENSIONAL DRAWING TO REVIEW OTHER DIMENSIONS.
5. DHT RESERVES THE RIGHT TO MODIFY THE DIMENSIONS WITHOUT PRIOR NOTICE.
6. ALSO CONSULT LOCAL CODES AND AUTHORITIES.

FIG 2-1: ST SERIES VERTICAL UNIT INSTALLATION CLEARANCE DRAWING

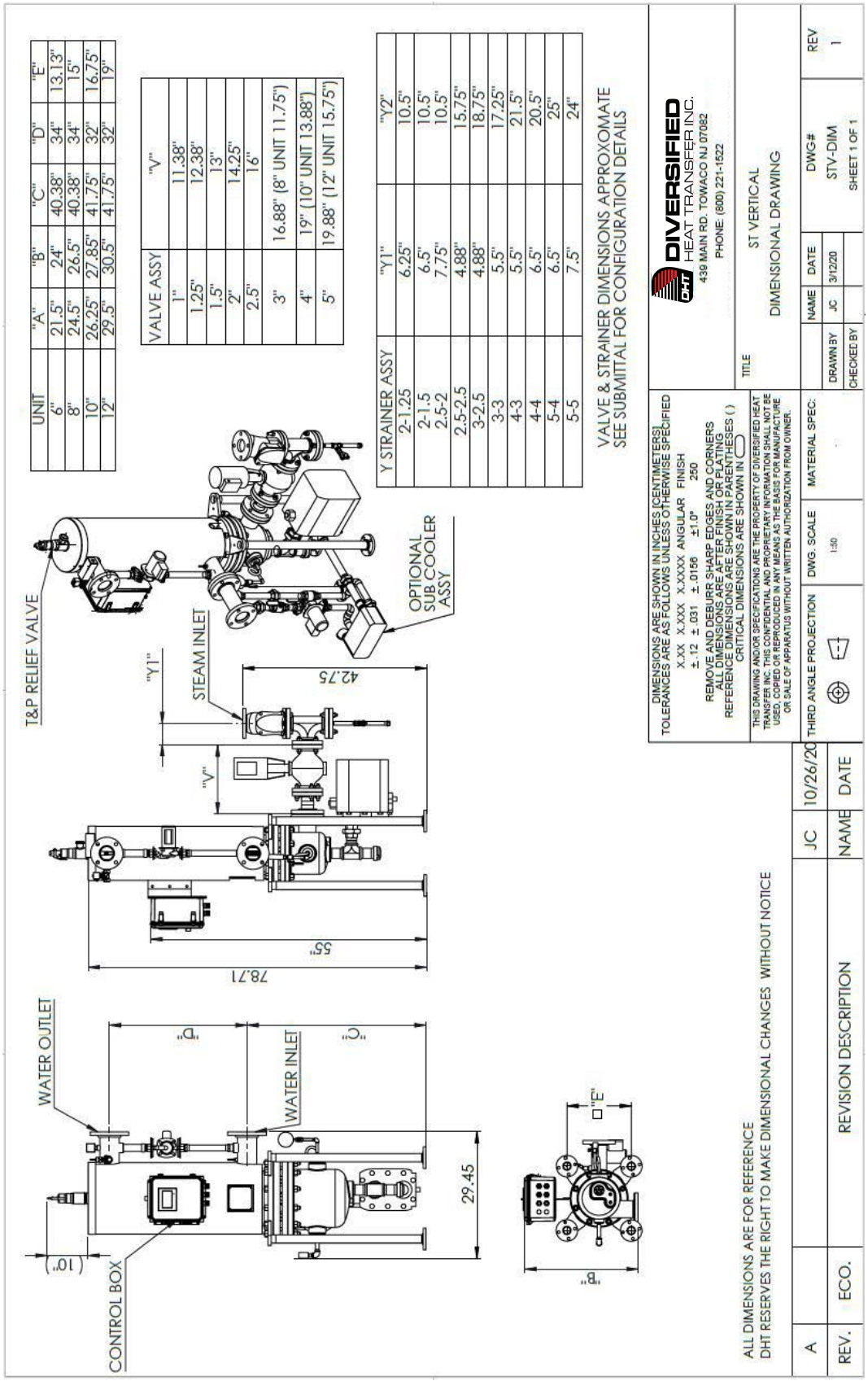


FIG 2-2a: ST SERIES VERTICAL UNIT DIMENSIONAL DRAWING

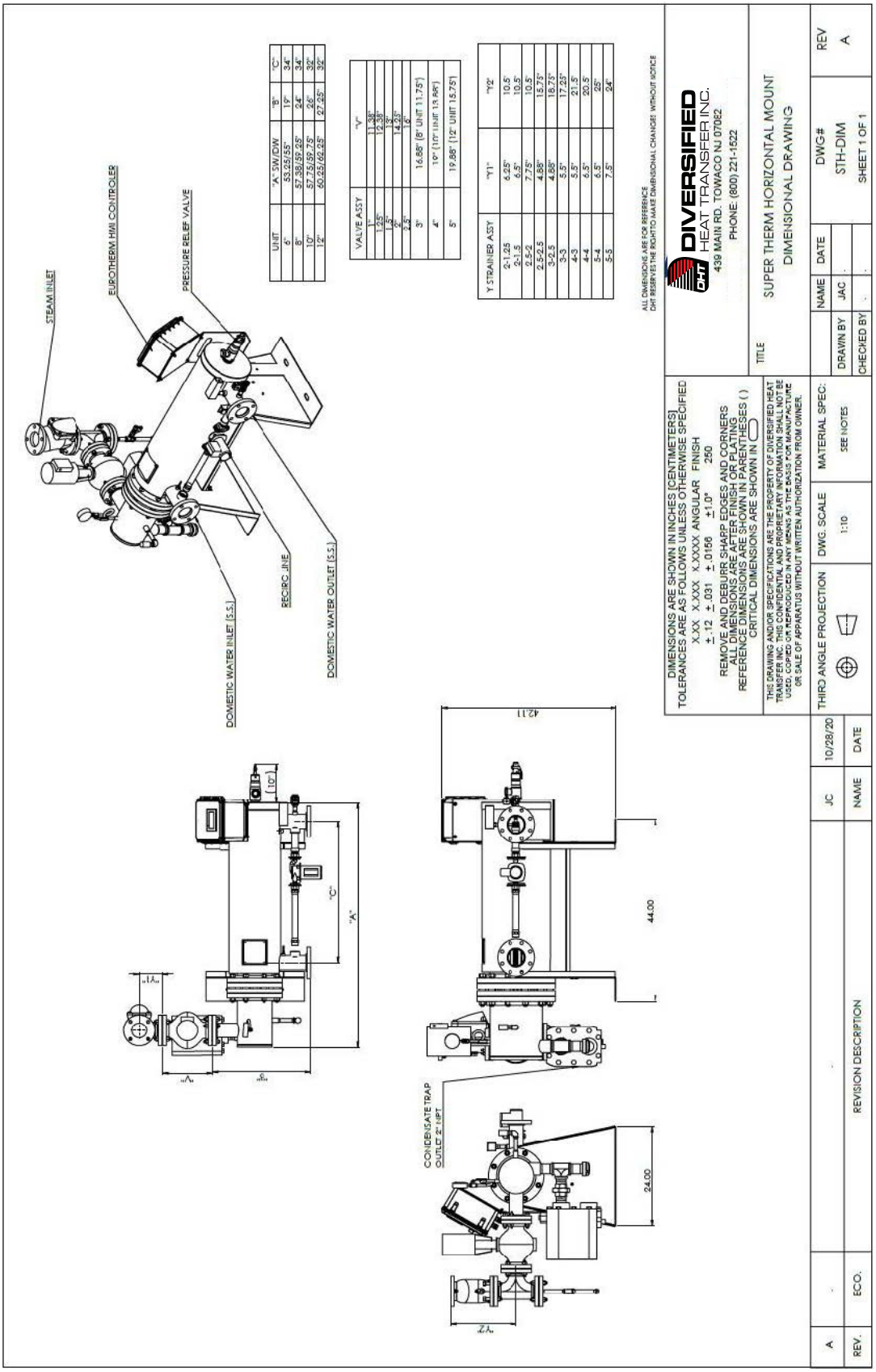


FIG 2-2b: ST SERIES HORIZONTAL UNIT DIMENSIONAL DRAWING

2.4 PLACEMENT

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

NOTES:

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

CAUTION!

Refer to **Section 2.6: Piping Installation and Unit Connections** for **condensate drain piping instructions**. ST Series units must be installed to permit condensate to drain freely by gravity.

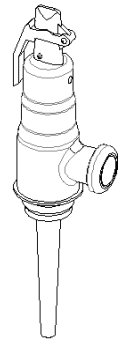
2.5 LOOSE PART INSTALLATION INSTRUCTIONS

The pressure relief valve, control valve, optional steam inlet strainer-piping assembly, and condensate trap assembly are included with the ST Series Water Heater, and must first be assembled to the unit before the field piping and electrical installation procedures are performed. See Figure 2-3.

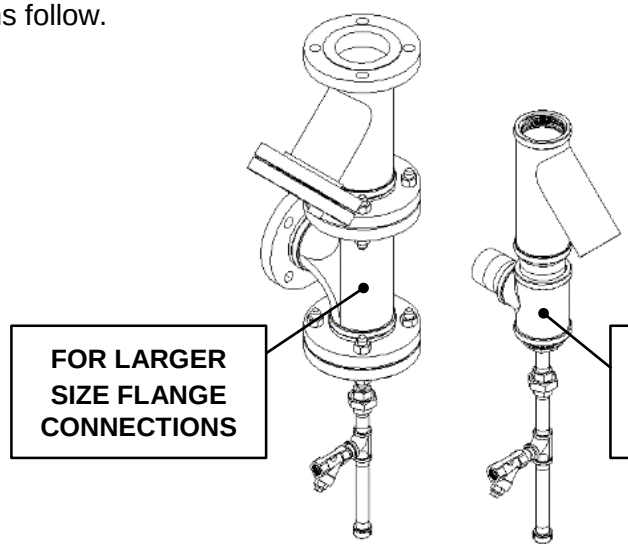
NOTE:

1. Pictures shown may look different than actual component depending upon their size and type. Refer to the latest dimensional drawings to ensure connection details and orientations are up-to-date before proceeding.
2. Under no circumstances should any personnel manually trip the ASME P&T relief valve for any purposes. Otherwise, the warranty will be nullified if it is.

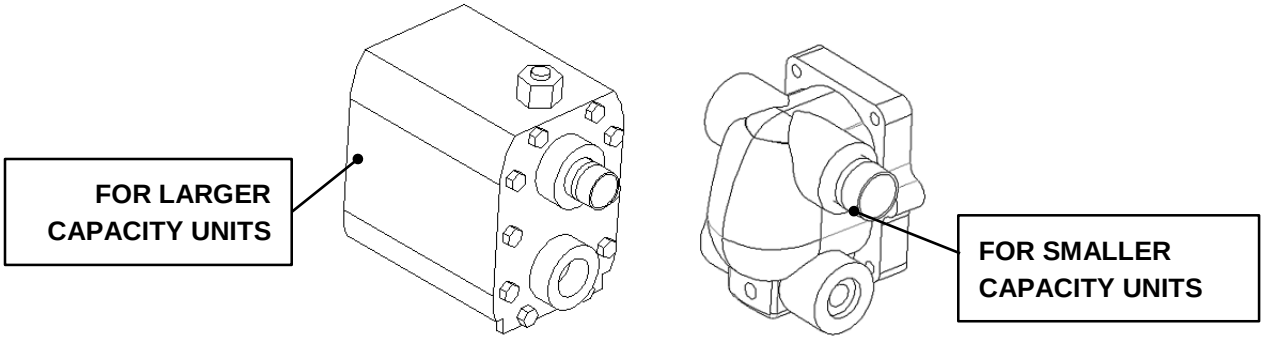
The following sub-assemblies are packed separately within the unit's shipping container for field installation. Installation instructions follow.



T&P Relief Valve



Steam Inlet Piping Assembly



Condensate Trap Assembly

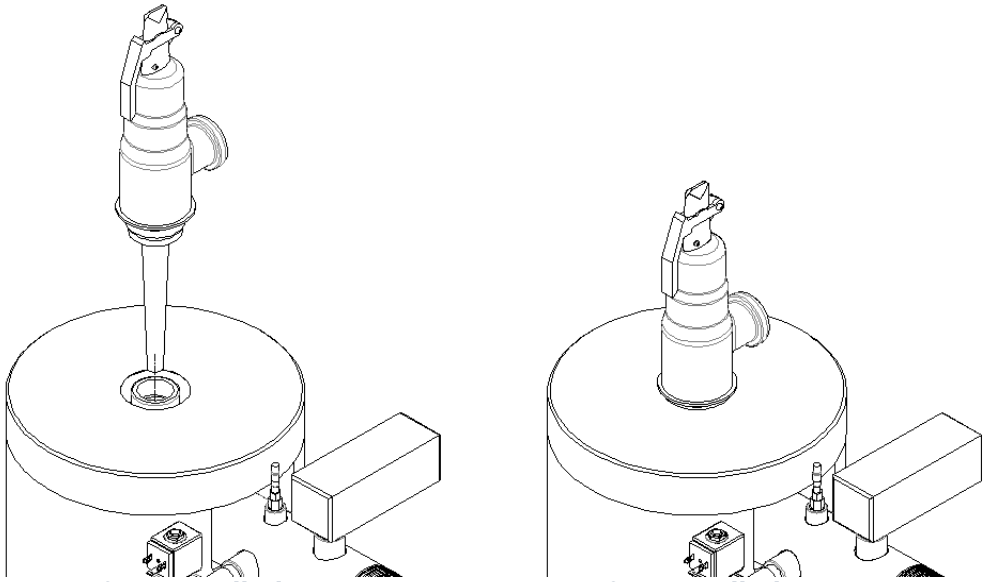
FIG 2-3: FACTORY SUPPLIED LOOSE PART ILLUSTRATIONS

➢ COMPONENT INSTALLATION AND PIPING INSTRUCTIONS

Locate and install the ST Series Heater in the mechanical room as described in Section 2.2 (Site Preparation) according to local codes. Perform Parts 1 to 3 of the instructions below to install the factory supplied component parts.

2.5.1 PART 1: DHW Outlet Pressure Relief Valve Installation

1. Locate the temperature and pressure relief valve shipped with the unit. See Figure 2-4.
2. After installation of the ST Series unit in the mechanical room, carefully make the relief valve connection on top of the unit as shown in following pictures:



Before Installation **After Installation**

FIG 2-4: DWH OUTLET PRESSURE RELIEF VALVE INSTALLATION DIAGRAM

3. A suitable pipe joint compound for potable water should be used on the threaded connections. Any excess compound should be wiped off.
4. Tighten until sealed and facing proper orientation/direction.

NOTE:
Under no circumstances should any personnel manually trip the ASME P&T relief valve for any purposes. Otherwise, the warranty will be nullified if it is.

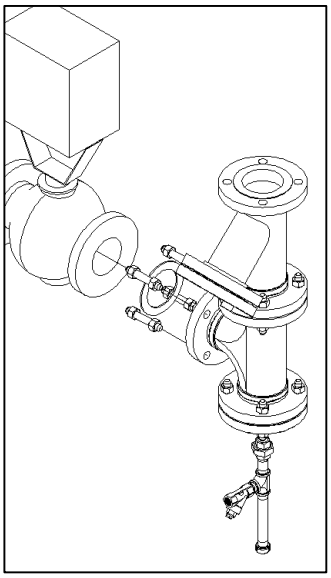
2.5.2 PART 2: Control Valve and Steam Inlet Assembly Installation

1) After the relief valve is installed per the last instruction, locate the Control Valve and optional Steam Inlet sub-assembly, as shown in Figure 2-5, and install as described below:

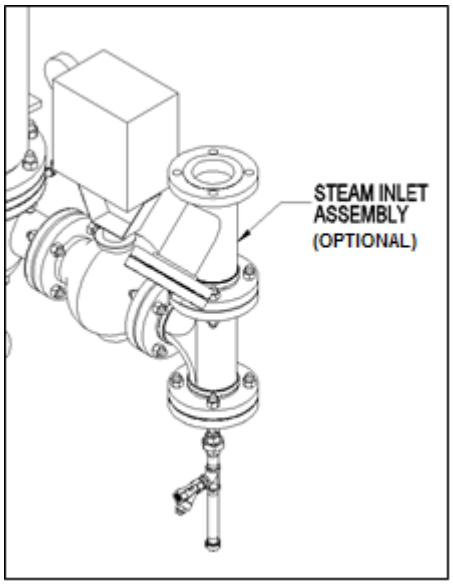
NOTE: It is available in both flange and union connections, depending on the size. Up to two inches (2") is available in union. Larger sizes are available in flanged connections.

2) Provide appropriate support below for the steam inlet piping assembly. Unit is not designed to support this additional weight.

3) Install control valve on the steam head, and then steam inlet sub-assembly on the control valve of the unit as shown in following pictures:



Before Installation



After Installation

FIG 2-5: STEAM INLET PIPING ASSEMBLY INSTALLATION DIAGRAM

For Thread Connections: a suitable pipe joint compound should be used on the threaded connections. Any excess compound should then be wiped off.

For Flange Connections: required appropriate studs, nuts, and gasket are also packed separately.

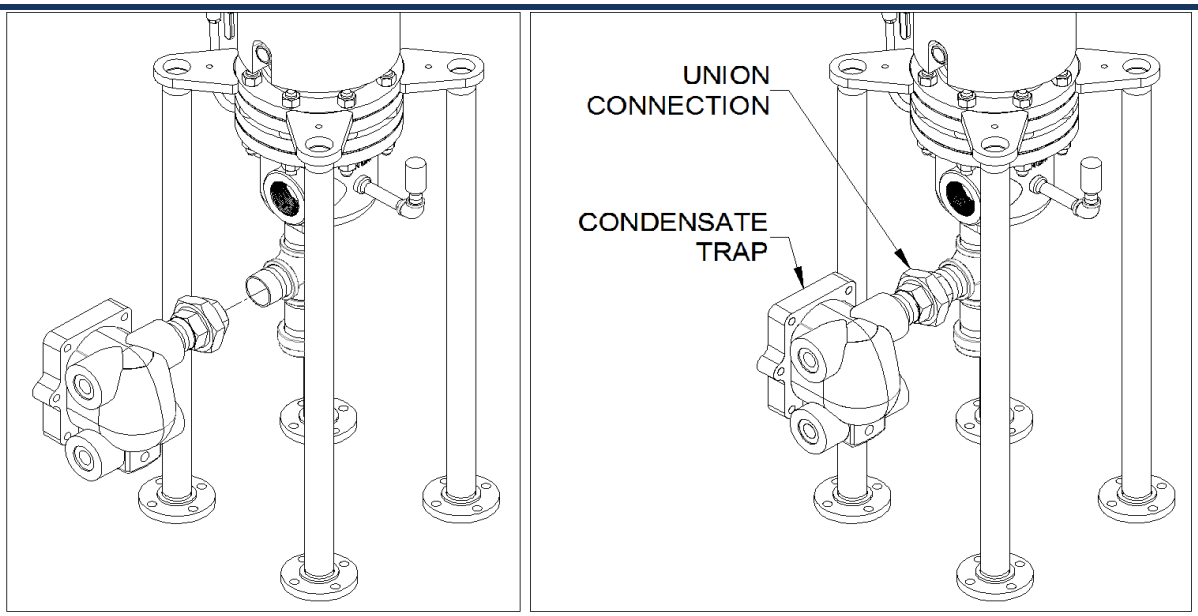
4) Tighten until sealed and facing proper orientation/direction.

2.5.3 PART 3: Condensate Trap Connection Instructions

After the Steam Inlet Piping Assembly is installed per the last instruction, locate the condensate trap assembly, as shown in Figure 2-6, and install as described below:

5) Provide appropriate support below the condensate trap. Unit is not designed to support the weight of the condensate trap outlet assembly.

6) Install it on the condensate outlet piping union of the unit as shown in following pictures:



Before Installation **After Installation**

FIG 2-6: CONDENSATE TRAP MAINTENANCE DIAGRAM

7) A suitable pipe joint compound should be used on the threaded connections. Any excess compound should be wiped off.
8) Tighten until sealed and facing proper orientation/direction.
9) Refer to Section 2.6 and piping installation drawing(s) for additional installation and piping details.
10) Check to make sure there is no leakage around all these joints upon startup of unit.

2.6 PIPING INSTALLATION AND UNIT CONNECTIONS

ST 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 application requirements (single, multiple units, and with or without storage tanks) before making piping connections. CAD drawings are also available on www.dhtnet.com 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 cold water inlet and hot water outlet ports of the unit, as well as pipe diameters and thread/flange size, can be determined using the drawing supplied with the unit. Properly sized water lines should be connected to the unit. A manual shutoff valve should be installed on the inlet water source as an isolation device. 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 installed parallel to each other in order to achieve the combined capacity and proper temperature control. Refer to typical Piping and Installation Drawings in **Section 6.3**.

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

- **Steam inlet piping:** Steam inlet piping to be sized per given steam pressure, steam volume, and supply-line pressure drop to deliver correct volume of steam at sufficient pressure to the control valve.

CAUTION!

Steam, boiler water, or 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.

Make sure that a shutoff valve is installed up stream in the steam line and that it works properly. It is recommended to install pressure gauge between shutoff valve and strainer on the steam inlet assembly. 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.

- **Main Condensate and drip trap drain piping:** Determine exact location and size of the condensate port shown on the drawings and connect condensate piping to the port and to the system following all applicable codes and rules to avoid creating the excessive back pressure to the unit. Shutoff valve and check valve should be installed on the condensate drain line to allow the unit to be isolated from the system.

CAUTION!

The condensate drain piping must be arranged to permit condensate to drain freely by gravity from the unit. Failure to do so can cause improper water temperature control and damage to heat exchanger (premature tube bundle failure) and drainage components.

Do not attempt to lift the condensate above the condensate outlet of the trap without a condensate pump. A pumping steam trap may be substituted if condensate drain by gravity is not feasible after referring to manufacturer's instructions.

- **Drain discharge piping:** All DHT ST Series units are equipped with pressure and temperature relief valves, over temperature solenoid valve, and heat exchanger shell drain. 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 & temperature relief valve, solenoid valve, and condensate traps are 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.

2.7 ELECTRICAL CONNECTIONS

All field wiring connections for power and controls are inside the control panel on the front of the ST Series Water Heater. The wiring label is attached to the inside aluminum door of the control panel. 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, provincial, and local codes.

Connect the system to the correct voltage. The ST 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.

CAUTION!

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

WARNING!

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

CAUTION!

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

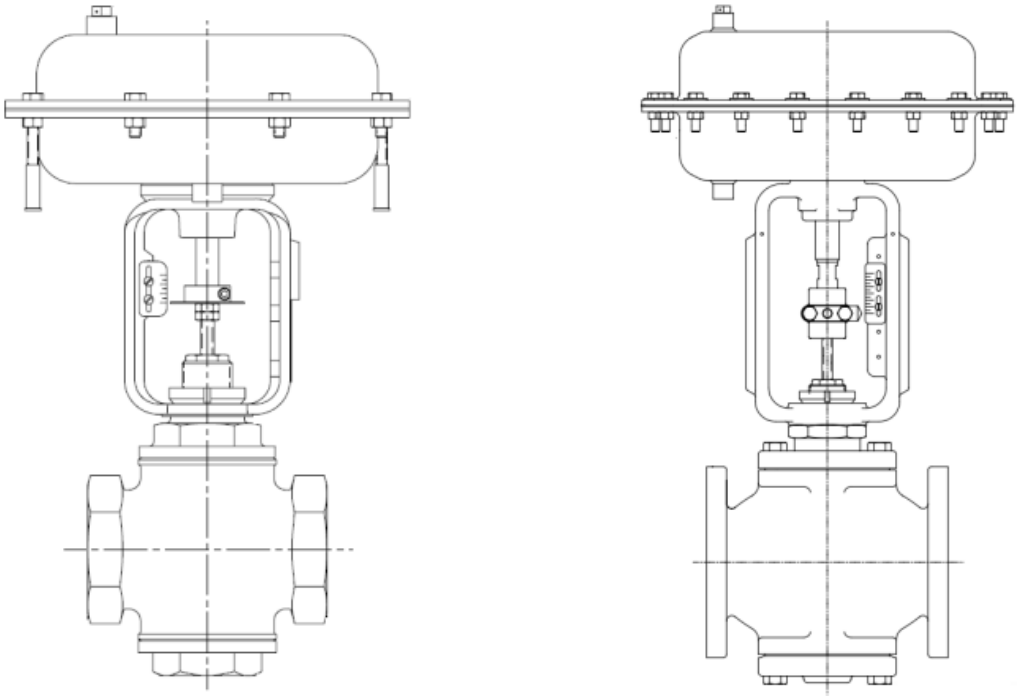
2.8 PNEUMATIC DEVICES INSTALLATION

DHT ST Series units can be equipped with pneumatically activated control valves. In most cases they require instrument air with pressure ranges from 15 to 30 psi. Consult the supplied drawings and specific installation and operation manuals for each component to determine the requirements for that component.

NOTES:

1) Assure that the pneumatic feed has been shut down, and air pressure bled from the system by acceptable methods before attempting any connections.

2) For all pneumatic connections, the use and/or type of joint compound or sealer on the joint should be determined by referring to local codes, accepted practices, or the requirements of the installing contractor.



Up to 2" Thread Connection **Flanged Connection**

FIG 2-7: PNEUMATIC VALVES (Up to 2" and FLANGED) DIAGRAM

Normally closed, 2-way, pneumatically-activated actuators and globe control valves are available in NPT connections up to 2 inches in size, and flanged connections for larger sizes as shown in above pictures. Follow good piping practices and refer to codes and standards in addition to information supplied by DHT. Supply air should be connected to ports or terminals as indicated on the control valve. Final tuning may be required under the actual operating conditions. Refer to section **4.22 Control Valve Technical Information** or supplied pneumatic control valve Installation and Operations Manual before making field piping connections and operating the valve.

2.9 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 or piping must be repaired at once. Leakage of steam, boiler water, or HTHW 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 tube bundle and baffles.
- **Hardness** – Water hardness contributes to the formation of scaling, which impacts the performance of the heater exchanger and may lead to premature tube bundle failures. Water hardness should not exceed 6 grains per gallon or 100 ppm. Water softening may be required if it exceeds these levels.
- **Artificial Softness** – Do NOT use artificially softened water since artificial softening agents generally use salt, which causes corrosion of the heat exchanger and piping components. Do NOT use deionized water.
- **Chloride** – Elevated chloride levels in water accelerate corrosion of the heat exchanger and piping system materials. Concentrations of chlorides in system water should be less than 100 ppm.
- **PH –** The pH must always be between 6.5 to 9.5. However it is recommended to keep it higher than 6.8 for copper materials.

NOTES:

1. CuNi or stainless steel materials can handle wider range of water quality levels as compared to copper. Please consult DHT factory if water quality levels exceeds these limits.
2. Consult DHT factory before using ST Series units for any other non-standard applications.

SECTION 3: OPERATION AND CONTROLS

3.1 INTRODUCTION

This chapter provides information and instructions for the following topics:

- ST Series functional description
- Preparation of unit for operation
- Unit startup procedure instructions
- Unit shutdown procedure instructions
- Controls overview and startup settings
- BAS/BMS communication settings

3.2 ST SERIES FUNCTIONAL DESCRIPTION

DHT's ST Series units are engineered using steam, boiler water, or HTHW as the heating medium. Heat exchanger U-tube bundles are either available in single or double wall configuration, depending upon customer requirement. Heating fluid is on the tube side and the domestic water is on the shell side. Semi-instantaneous operation provides high output by channeling the incoming cold water directly over the heat exchanger tubes in a controlled manner to maximize the heat transfer rates, as compared to conventional stratified heat exchanger convection systems. Velocity of water and pressure drop are controlled by changing water flow directly across the heat exchanger, which increases heat transfer and inhibits scale formation. Domestic hot water temperature is maintained by using either electronic or pneumatic controls.

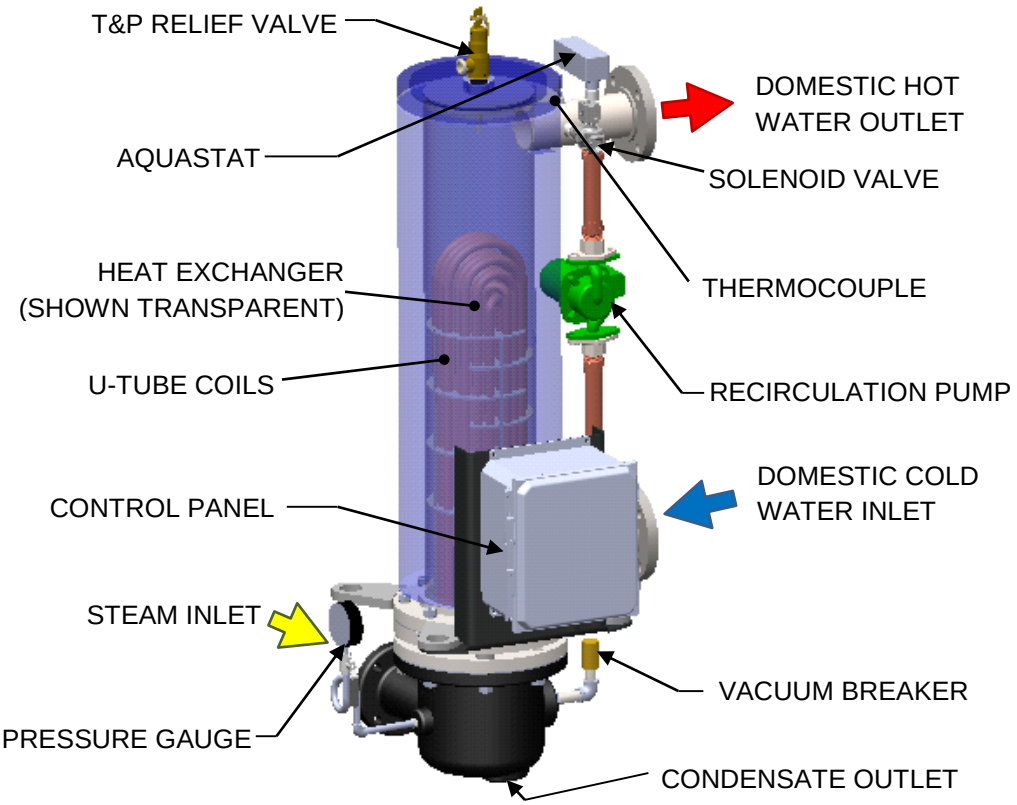


FIG 3-1: ST SERIES HEAT EXCHANGER FUNCTIONAL DIAGRAM

Cold domestic water enters the heat exchanger through the cold water inlet connection (as shown in Figure 3-2). It is distributed over the tubes in the heat exchanger shell and flows upwards. It is heated by steam, boiler water, or HTHW circulating inside the heat exchanger tube bundle. Heated domestic water then exits the heat exchanger from the hot water outlet connection on top of the unit. Unit also includes a constant speed recirculation pump which continuously circulates the heated domestic water through the heat exchanger shell to ensure there is always hot water present in case of demand. Domestic hot water supply temperature is maintained by either electronic or pneumatically operated control valve.

Steam, boiler water, or HTHW enters the heat exchanger coils through the control valve, which is modulated by the 4-20 mA output from the controller based upon the reading from both the feedback temperature sensor on the outlet of the heat exchanger and the feedforward temperature sensor on cold water inlet to heat exchanger. The unit employs a closed-loop feedforward control system to maintain the target temperature set point in tight range. Steam or heating water passes through the first pass, then enters the second pass of the U-tube bundle,

and finally exits through the outlet connection on the bottom/front head as shown. The flow rate of heating medium is modulated to maintain the desired set point in varying load conditions.

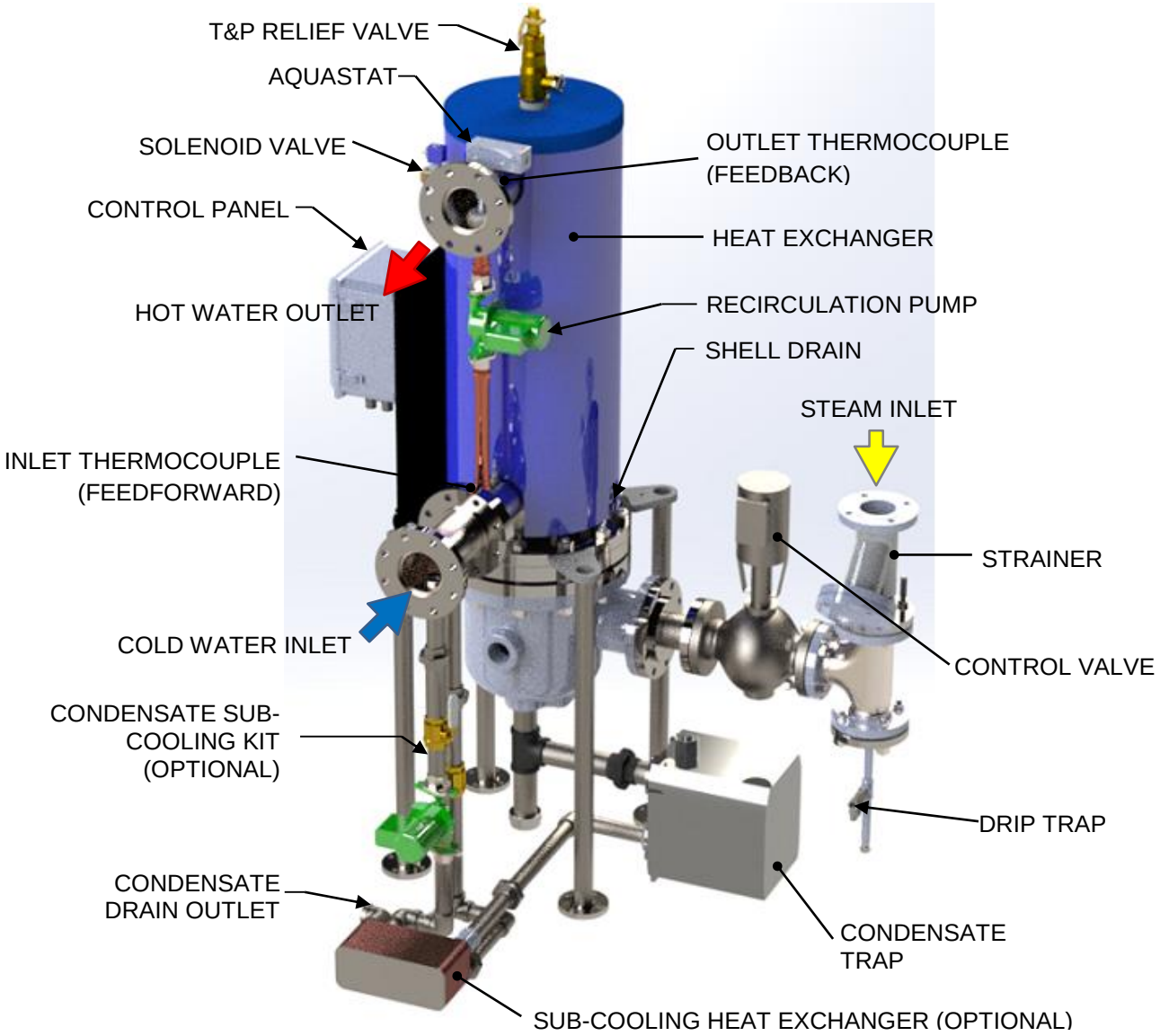
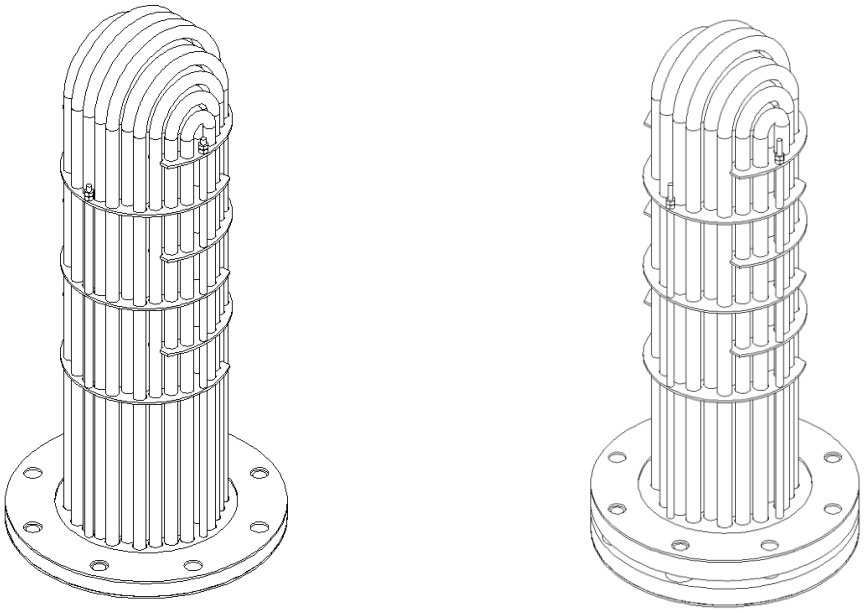


FIG 3-2: ST SERIES WATER HEATER COMPONENT DIAGRAM

Tube Bundle Options: ST Series units are available in either single or double wall U-Tube bundle construction, depending upon customer requirement (see Figure 3-3). Double wall construction has inner and outer walls separated by air gap between them. Steam or boiler water flows through the inner walls, and any condensate or water leaking through the inner walls is collected within the air gap that is vented to atmosphere for leak detection. Similarly, if the domestic water leaks through the outer walls, it is collected within the air gap between the tubes and is vented to atmosphere for leak detection.



SINGLE WALL
U-TUBE BUNDLE

DOUBLE WALL
U-TUBE BUNDLE

FIG 3-3: SINGLE AND DOUBLE WALL U-TUBE ILLUSTRATIONS

Double Wall Construction and Protection Performance:

- Prevents cross-contamination.
- Easy inspections and low maintenance.
- Fully visible, 360° vented leak detection between tubesheets as shown.
- Bolting and gaskets for potable water and heating medium are completely independent.
- Individual tube access for easy maintenance.
- Used to upgrade present single wall tube bundles.
- Double wall U-tube bundle construction is available in either Copper or Cu-NI materials.

DHT ST Series Water Heaters' double wall tube bundle construction meets Uniform Plumbing Code requirements for heating potable water. The heat transfer surface is 5/8" O.D. inner wall and ¾" O.D. outer wall. Both inside and outside surfaces are smooth with no fins or surface irregularities that promote scale formation or corrosion attack. Double wall tubing has a similar overall heating conductivity as a single wall tube of equivalent wall thickness. Each tube has multiple parallel and continuous vent paths. See Figure 3-4.

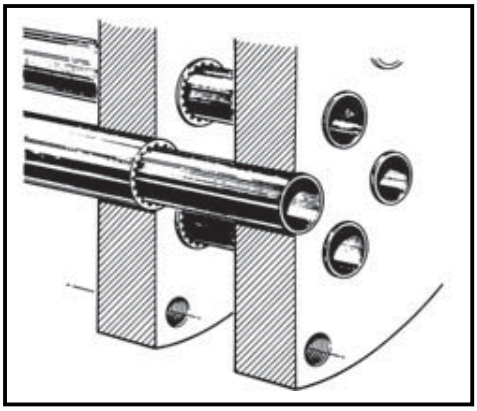


FIG 3-4: U-TUBE DOUBLE WALL CONSTRUCTION DETAIL ILLUSTRATION

Tube failure can be caused by corrosion, erosion, and vibration, and can result in the contamination of the domestic water system by a heating medium such as steam, hydronic water, or glycol solution. There is no practical way to have the heating medium sterile or free from harmful treatment compounds or corrosion byproducts. A low pressure 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 a relatively thin wall heat transfer surface 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. DHT has developed the most practical, “state-of-the-art” double tube wall heaters to preclude any possibility of contaminating the domestic water system.

Safety Controls: An automatic over-temperature limit switch is included, which will cut off all electricity supply to the unit and close the normally closed control valve during over-temperature condition. Power supply is restored if unit goes back to normal operation.

Unit includes primary and secondary alarm functionality in the safety controls. Error messages show on touchscreen display when the heated domestic water temperature reaches the primary alarm setting, and then the alarm starts sounding. In the next step, power supply to the normally closed control valve is interrupted, causing it to close. If the water temperature continues to rise, it turns the secondary alarm on, which then opens the dump solenoid 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, the error message disappears from the home screen, but the siren continue until owner manually presses the switch to turn it off. Power to the control valve is restored and solenoid valve closes. Controls also include aquastat safety over the control panel system in case it malfunctions.

In case of pneumatic controls, the air shutoff solenoid valve shuts off or interrupts air supply to the normally closed control valve, causing it to close. Air supply to control valve is restored if unit goes back to normal operation.

Condensate Sub-Cooling Economizer Kit Option: ST Series Steam-to-Water units are available with optional condensate sub-cooling kit, which includes piping assembly with circulator and a compact brazed plate sub-cooling heat exchanger. This cools down the condensate to safe drain temperatures by recovering waste heat from it. This recovered waste heat energy is used in pre-heating the cold water entering the unit. A portion of cold water is circulated from inlet of the ST Series unit through counter flow direction inside plate heat exchanger compared to condensate flow, and then back to the inlet of unit. Here, it is heated to required set point using

steam. Condensate sub-cooling increases the overall system efficiency above 90%, which requires less steam consumption as compared to a standard unit.

3.3 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.

3.4 UNIT STARTUP PROCEDURES

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

➢ UNIT STARTUP PROCEDURE INSTRUCTIONS

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

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

3) Adjust the operating temperature control to the desired temperature. Refer to Section 3.5 for the exact location of the control and detailed adjusting procedure.

4) Adjust the high temperature limit per actual operating conditions. It is normally factory set at 160°F, considering 140°F operating supply water temperature.

5) Open the steam condensate return valve or steam/boiler water high temperature water return valve.

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

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

CAUTION!
Steam, 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) If no leaks are found, slowly continue to open the manual shutoff valves on the power source inlet.

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

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

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

11) The unit is now ready for normal operation. Proceed to Section 3.6 for setting the temperature and other initial startup parameters using the controller.

3.5 UNIT SHUTDOWN PROCEDURES

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

➢ UNIT SHUTDOWN PROCEDURE INSTRUCTIONS

1. Close all valves in the energy source inlet line (steam, boiler water, or high temperature water).
2. Turn off all power to the electric control, if so equipped.
3. Turn off the pneumatic (instrument air) source. Only applicable for pneumatic controls.
4. When possible, relieve the pressure from energy source line (steam, boiler water, or high temperature water) between the shutoff valve and the unit.
5. Wait 5 minutes or until the dial thermometer starts dropping. Close all remaining valves in the system in this order.
    a) Hot water outlet line.
    b) Cold water inlet line; and
    c) Condensate return line (or boiler/high temperature water return line).
6. After the system has cooled, drain the unit by opening the heat exchanger drain valve and holding the pressure relief valve in the open position. This will prevent the formation of a vacuum and increase the drainage flow.
7. Proceed with the required maintenance or repairs.
8. After performing the required maintenance or repairs, return the unit to operation by following the described above startup procedures in Section 3.4.

3.6 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 set points are user configurable via menu prompts. The preconfigured screens and 'pull-down' sub menus with English prompts assure 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 the full range of math, logic, totalizer, and specialized functions required for single loop process and temperature control of water heating applications.

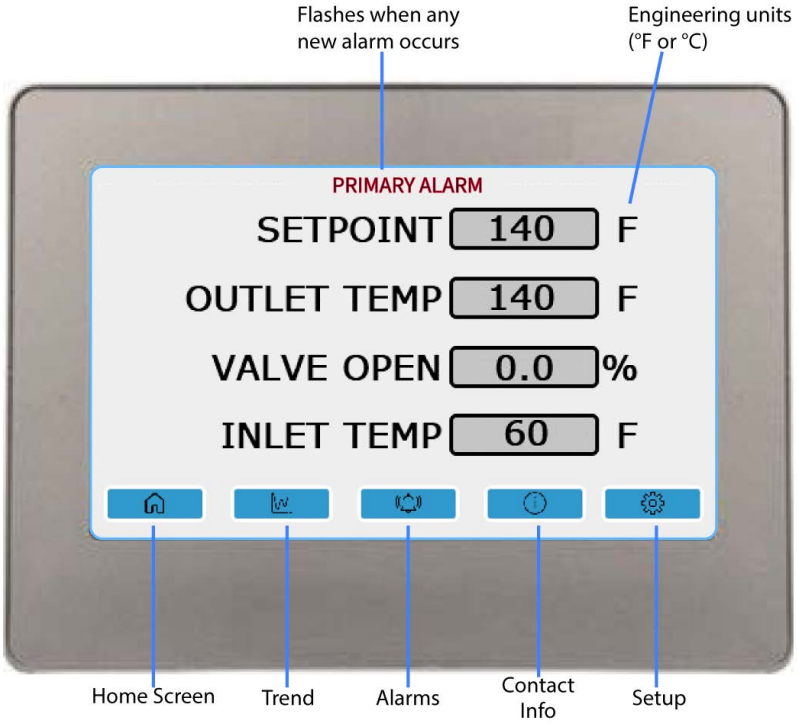
MODBUS RTU®: RS485Network allows single or multiple units to be connected for distributed applications and remote monitoring SCADA applications (optional).

MODBUS TCP/IP and **BACnet UDP/IP:** Ethernet Network allows single or multiple units to be connected for distributed applications and 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.

3.6.1 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 the above picture, this screen displays the real time operating process variables along with the ST Series Water Heater picture. Unit operating status is shown in green (normal operation) and red (faulty operation) colors. The 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 is detected by the controls (when value is outside the limit condition), an alarm appears on top of the display screen. It allows the user to check the alarm type, its status, and the 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. End user level login allows operator to make adjustments to common operating processes and communication variables. Advanced settings are higher-level password protected for normal operation of the unit.

Following time-out applies to display

- If no button presses are detected within a timeout period (default is 30 min.), the display will revert back to the Level 1 "HOME screen."
- If no button presses are detected within a timeout period (default is 5min.), the display screen turns off in order to save power, and the PID controller is operational in the background to maintain the target 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 available as an accessory with the unit. Contact your DHT sales representative or DHT factory if it is required.

3.6.2 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 the 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 and 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.

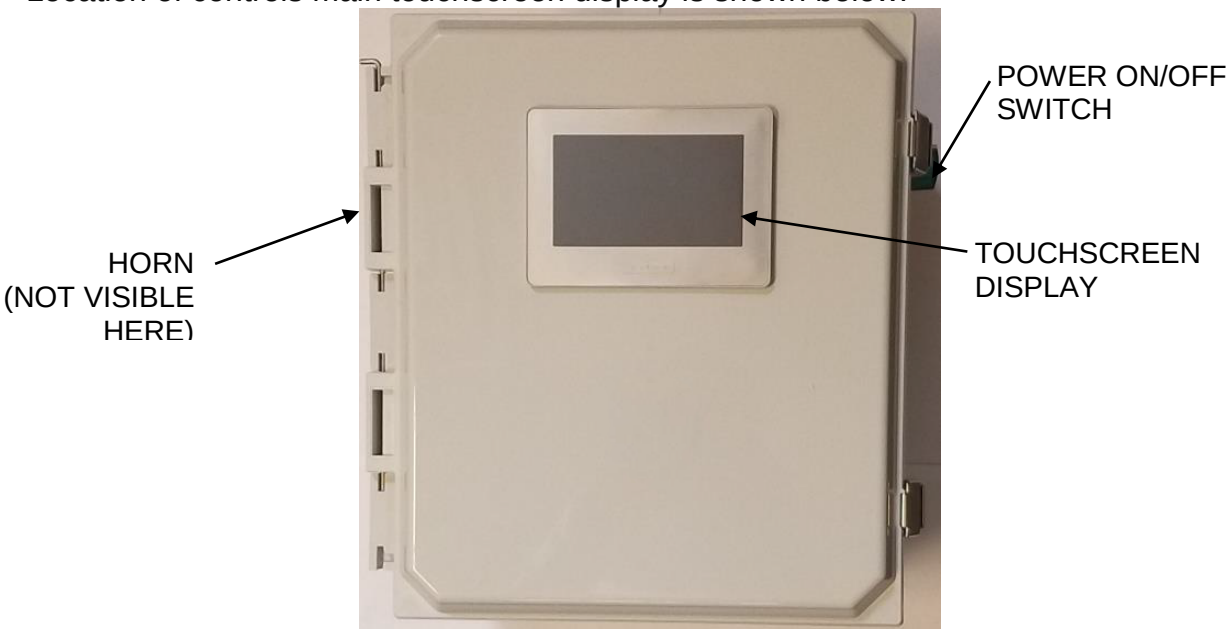
- **Raise+Lower (hold for >3 seconds - Mode):** If a programmer option is enabled, and a configured program is running, holding these buttons will abort the program. If the HOME page is selected, and the Programmer is not running, holding these buttons will invoke the 'Mode' display where the Loop Mode 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.”

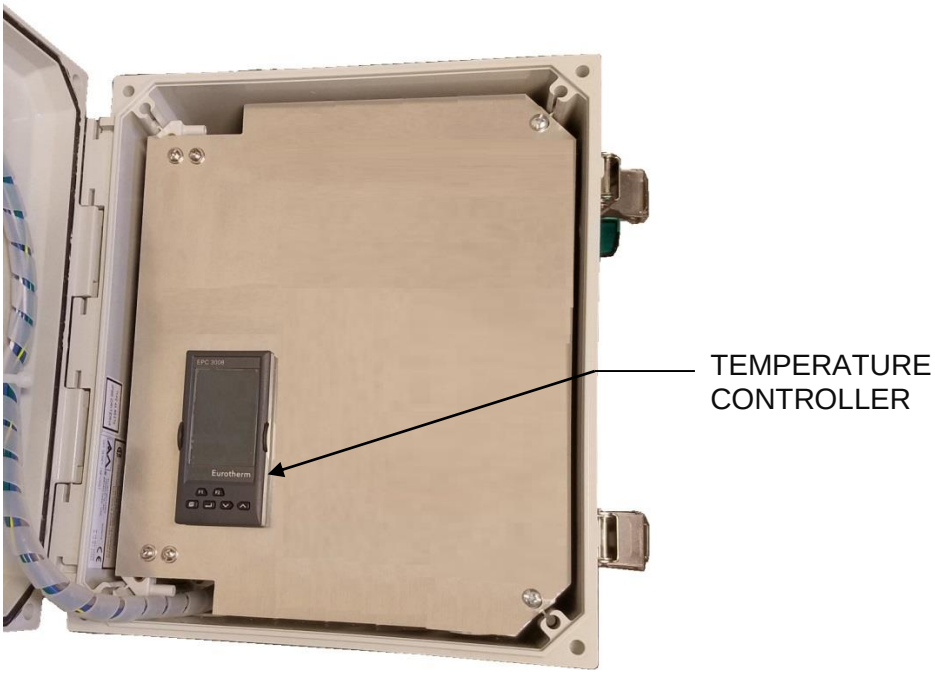
3.7 CONTROLS STARTUP

Location of controls main touchscreen display is shown below.



ST SERIES CONTROL PANEL FRONT

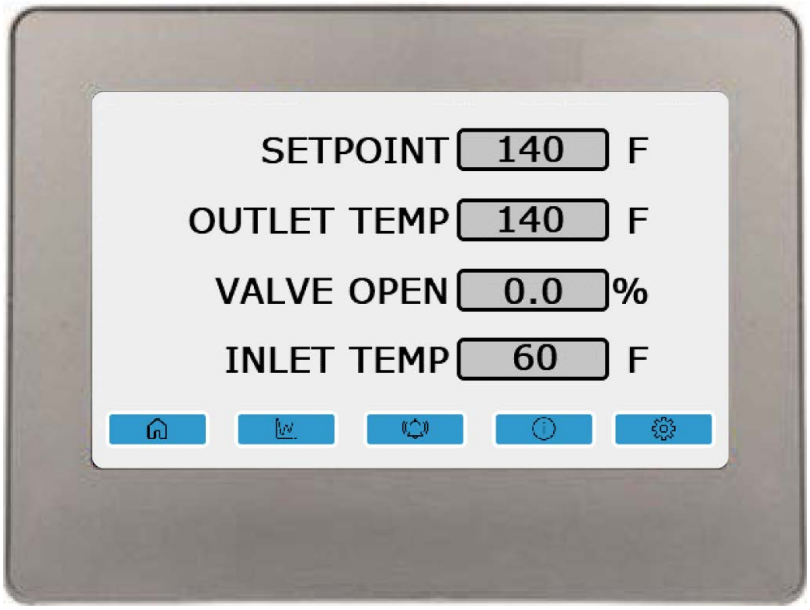
Location of temperature controller is shown below, which can be used as a backup interface when front HMI screen interface is down.



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 set point 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 3.8.



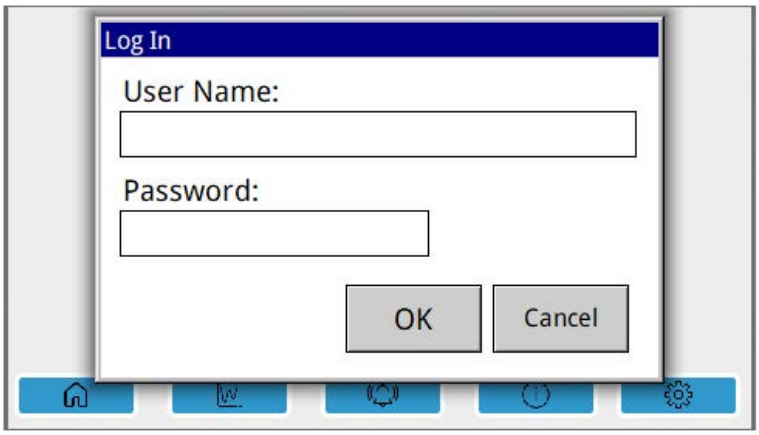
DEFAULT ST SERIES HOME SCREEN

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

3.8 PROGRAMMING THE 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:



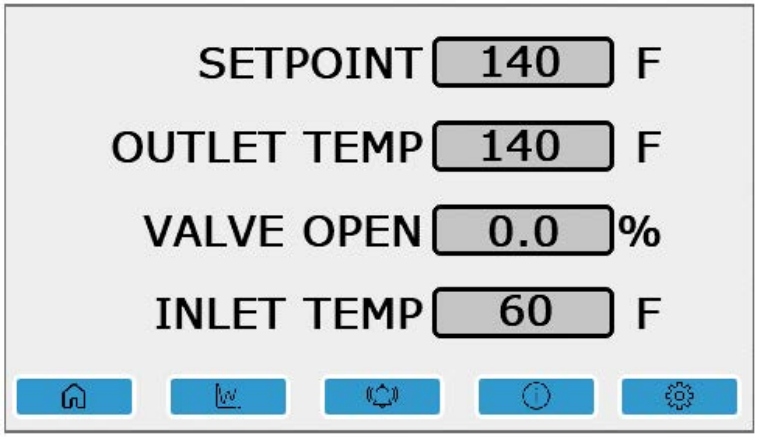
2. Click on required empty box inside the touchscreen display and a keypad appears on the screen. Use this keypad to enter the access login name and password.

NOTES:

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

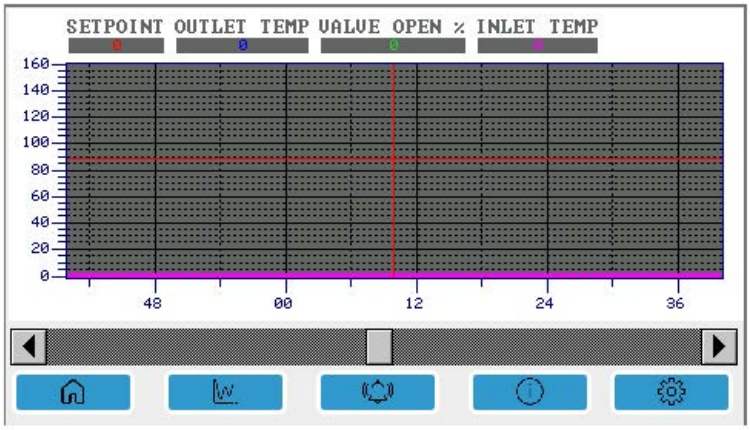
➢ DISPLAY SCREENS AND ADJUSTMENTS

3. The ST 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.

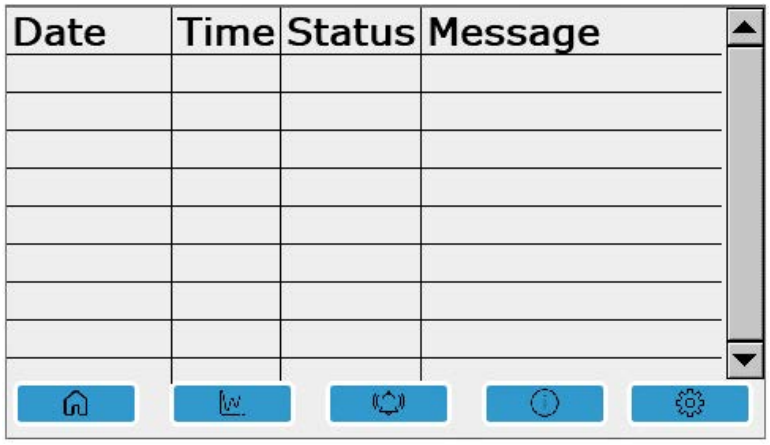


4. The domestic hot water set point can be adjusted anywhere within the range of 35-180°F by entering the operator level password, as shown in steps 1 and 2 above.

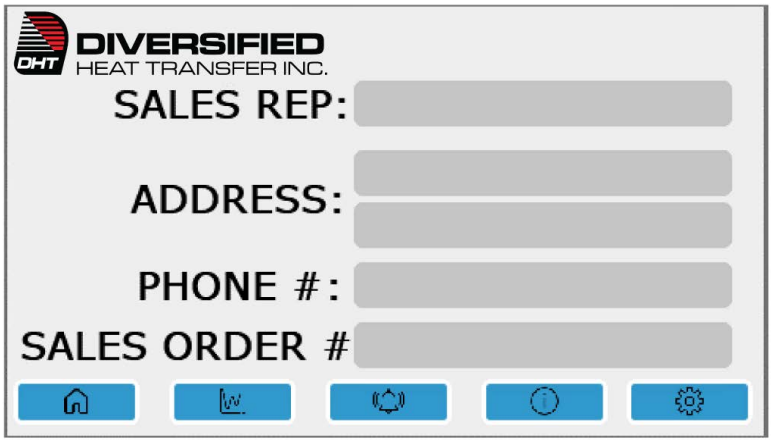
5. The high temperature alarms are default set to 20°F above the set point. If domestic water outlet temperature reading is equal to or higher than this number, the unit status changes from green to red in color and “HIGH TEMP ALARM” message starts flashing in red color on the center top side of the 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 set point.
7. The “Trend screen” shown below displays the real-time trend graphs of domestic outlet & inlet water temperatures, set point, 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 is turned on, or an alarm occurred.



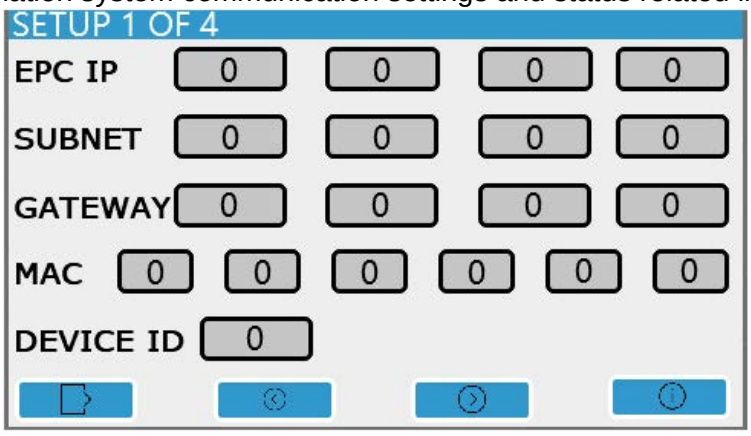
9. The “Contact Information screen” shown below displays the DHT factory and local sales representative company contact information, as well as the serial number information of controller and water heater. These are preconfigured before unit is shipped from factory. Each unit is factory configured to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



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

➢ SETTINGS SCREEN

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



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

NOTES:

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

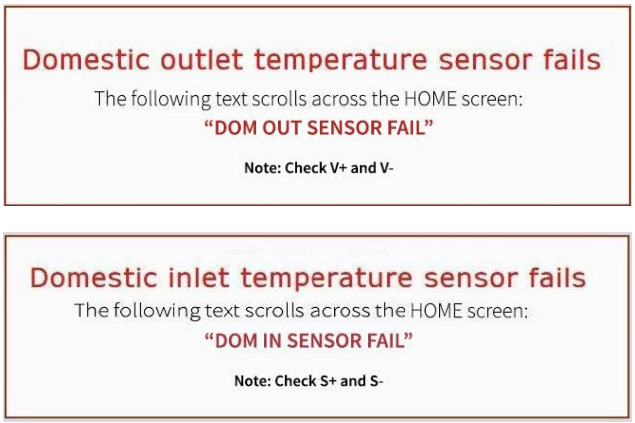
CAUTION!

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

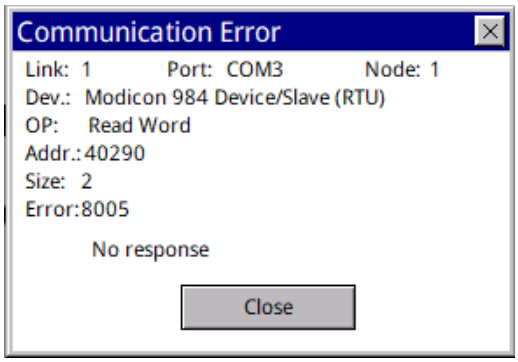
➢ SYSTEM DIAGNOSTICS

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

Banner Items:



Pop Up Items:



Note: Check HD, HE, HF

NOTES:

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

3.9 DATA COMMUNICATIONS

The DHT ST Series Water Heater control system allows the controller to communicate with the external Building Automation System (BAS) or Energy Management System (EMS). It is compatible with standard Modbus RTU or TCP/IP and BACnet UDP/IP multi-protocols. Optional gateway is also available for communications with other protocols.

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

WARNING!

- Maximum communication cable lengths without repeater

  RS485 Network – 4,000 feet

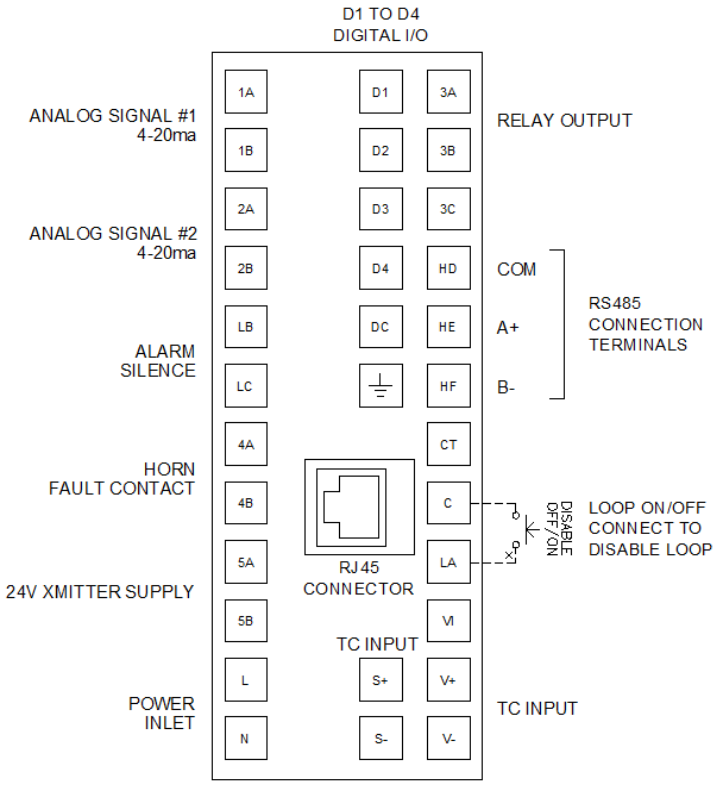
  Ethernet Network – 328 feet

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

NOTES:

- To help prevent ground loops, the cable shield should be grounded at one point only.
- Use twisted, shielded-pair communication wiring.
- Modbus serial (RS485) communication port is utilized to communicate with HMI. RJ 45 (Ethernet) port is available to communicate with building automation system.

3.9.1 Temperature Controller Terminals Layout



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

3.9.2 DHT Controller Communication Features

1. DHT controller auto-detect the protocol of Modbus TCP/IP and BACnet UDP/IP.
    a. The two protocols share the same IP addresses, Subnet masks, and 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. The Bonjour™ service is enabled by default, which 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, and default gateway.
        iii. Dynamic IP addressing.
    d. Static Mode
        i. Default: ON
        ii. User can manually set up IP address, Subnet Masks, and default gateway.
2. Ability to connect through Modbus RTU protocol.

WARNING!
Auto-discovery is on as the default option for simple and quick field setup. However, it makes it easier for a malicious user to discover and access the controller via the network.

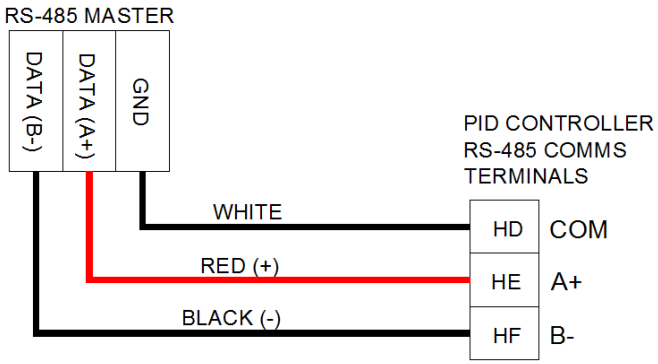
3.9.3 DHT Default Settings Summary for Communication

1. Auto-detection of Modbus TCP/IP and 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

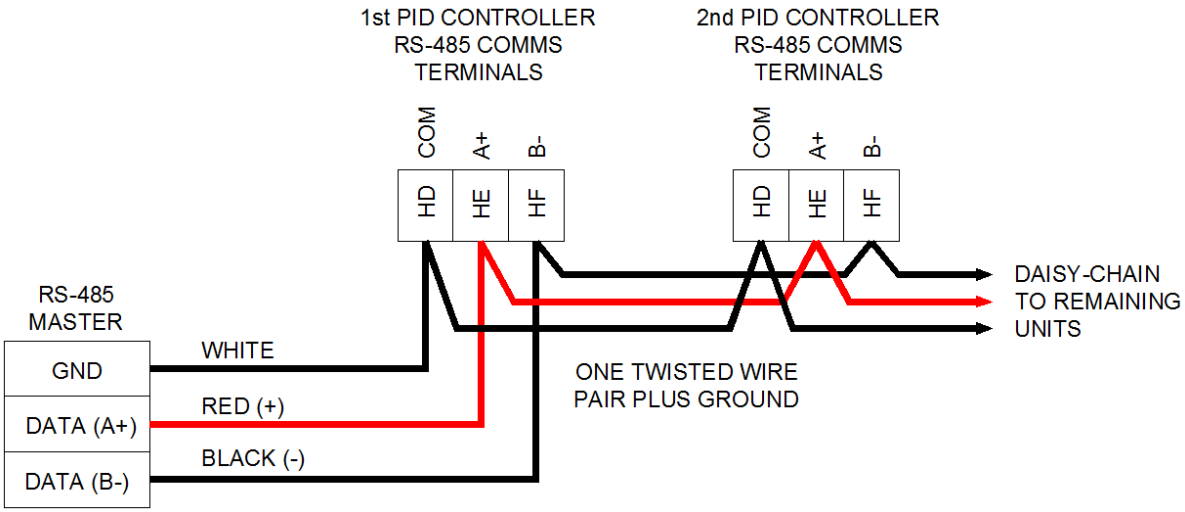
3.9.4 Modbus RTU Communication Wiring

NOTE:
Up to 32 units can be connected in a daisy chain network including BAS Master.

Single unit wiring:



Multiple units' daisy-chain wiring:



3.9.5 Modbus/BACnet Data Addresses and Points

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

Notes:

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

3.9.6 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:

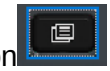


5. Click on scroll button and you will see the passcode screen as shown below:



6. Click on scroll button  again to move to the next digit, and use arrow buttons  to select the passcode. The default passcode is **0004**.
7. If the entered passcode is correct, it will direct to configuration menu screen:



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



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



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



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

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

12. Now click on scroll  button and then click on raise  button to select . Then click on scroll  and you will see the following parameters for Modbus RTU:

    a.  Default Baud rate: 19200

    b. Click on scroll  button

    c.  Default Parity: None

    d. Click on scroll  button

    e.  Slave node. Default: 1

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

    Jump to step 25 in order to save the settings.

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



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

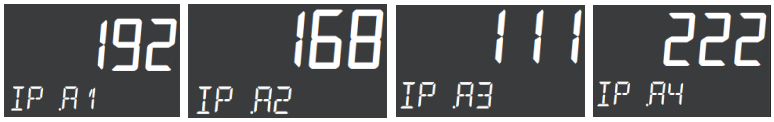
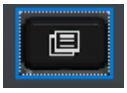
14. Click on scroll button  and you will see “mAIN” screen:



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



*Default is OFF.

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

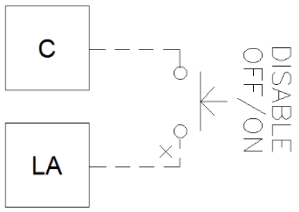
26. Now the controller is ready for normal operation.

3.10 DRY CONTACTS

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

3.10.1 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.

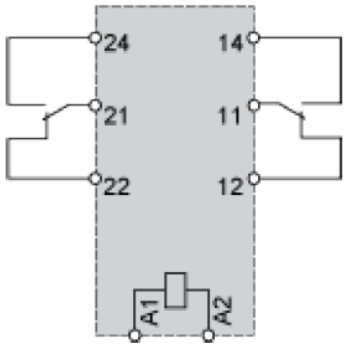


This input is supplied with the current transformer. Contact closure on the remote switch enable (start) the unit.

3.10.2 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 each of normally open contacts (between contacts 11 & 14 and 21 & 24) and normally closed contacts (between contacts 11 & 12 and 21 & 22). Normally open (NO) contacts are rated for 8 amps, and maximum switching voltage is 400 VAC.



SECTION 4: MAINTENANCE

This section covers the service and maintenance actions for ST Series Water Heaters and provides step by step 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 number of the unit(s) prior to contacting DHT.

CAUTION!

All service on the ST Series Water Heaters must be performed by trained and experienced technicians from appropriate service agencies.

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 3.5) and unit startup (Section 3.4).

Carefully examine any component(s) directly connected or linked to the part(s) being replaced before maintenance procedures are started. Consider them for replacement at same time if any of the associated component(s) show signs of wear or improper operation.

4.1 CIRCULATING PUMP MAINTENANCE

DHT ST Series Water Heaters are equipped with a circulating pump to assist in even heating of the water. The following instructions describe the procedure for testing the pump, or replacing it should that be required.

➢ CIRCULATING PUMP INSPECTION AND REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 5 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

2) 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:
   a) After assuring that the power has been turned off, disconnect the electric leads to the circulating pump.
   b) Drain the shell by removing the plug on the shell drain connection as shown in Figure 4-1B, item 17.
   c) Break the flanged joint between the pump and the inlet and outlet piping.
   d) Remove the pump.
   e) Reconnect the pump to the inlet and outlet piping. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and/or type of joint compounds or sealer at the connections.
   f) Reconnect the electric leads to the pump (reference wiring diagram provided with the unit to assure proper wiring).
   g) Follow the startup procedure in Section 3.4 to return the unit to operation. Check for signs of leakage at all connections.

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) Before performing this maintenance procedure, follow Steps 1 through 5 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

2) Ensure that electrical power has been turned off, then disconnect and rewire the electrical connection as required.
3) Turn the power on to check that the component that has been rewired is functioning properly.
4) Follow the startup procedure in Section 3.4 to return the unit to operation.

4.3 PNEUMATIC (INSTRUMENT AIR) CONNECTIONS REFITTING

If any of the pneumatic (instrument air) connections must be refit at the pneumatically activated controls, follow the steps listed below. Instrument air, at pressures as high as 150 psi, can be required for pneumatically activated controls. Air pressure at this level can pose a very dangerous situation. Assure that the air source has been shut down and that the line pressure has been bled before breaking any pneumatic connection.

➢ PNEUMATIC CONNECTIONS REFITTING INSTRUCTIONS

1) Before performing ANY maintenance procedure, follow Steps 1 through 6 of the shutdown procedure in Section 3.5 to take the unit off-line.
2) After assuring the air source has been turned off, break and redo the pneumatic connections in questions.
3) Turn the air supply on and check that the component that has been reconnected is functioning properly.
4) Follow the startup procedure in Section 3.4 to return the unit to operation.

4.4 HEAT EXCHANGER BUNDLE & GASKET MAINTENANCE

The "U-Bend" heat exchanger bundle is the heart of DHT water heaters. Every two years this coil should be removed from the unit and inspected for wear or damage. There is one (1) gasket located between the coil tube face and the flange welded to the shell/tank, and one (1) gasket with a divider so that it will fit between the tubesheet and the head.

➢ HX COIL/GASKET INSPECTION/REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow the steps for the shutdown procedure in Section 3.5 to take the unit off-line.

WARNING!

- Boiler steam and high temperature water can be **very dangerous**, and can lead to possible injury or death if caution is not exercised. Use all recommended procedures in this manual, as well as general safety and acceptable practices when performing any of these maintenance procedures.
- TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

2) Shut OFF the energy source, water inlet and outlet, and condensate/water return line AND make sure that the pressure has been bled from both the water line and energy source systems, that the shell/tank has been completely drained, and that the steam, water, surface, and all other components have cooled.

3) Using care, break the joint between the coil head of the heat exchanger and the small line leading to the energy source pressure gauge.

4) Using care, break the connections between heat exchanger coil head and the energy source inlet and outlet lines.

NOTE: If you are required to make the necessary break at a second location and to rotate the lines to allow heat exchanger coil clearance, ensure the action does not damage the in-line components.

5) Remove the studs and nuts that secure the heat exchanger coil head to the shell, and remove all studs from the unit.

6) Carefully separate the heat exchanger coil head from the mounting flange and remove the coil assembly from the tank.

7) Be careful, as residual steam condensate (or boiler or high temperature water) can leak out from the coil after it is removed, and this could present a scalding danger.

8) There may still be residual steam condensate (or boiler / high temperature eater) in the coil that can run out during removal of the coil from the tank. If sufficient time has not been allowed for cooling, this residual condensate/ water could present a danger of injury.

9) Inspect the heat exchanger coil for buildup of scale and evidence of leakage. If there is no leakage, use care and clean the excess scale from the coils to prepare the heat exchanger coil for re-installation. If leakage is found between the water in the tank and the coils, either repair or replace the heat exchanger coil with a new one.

10) Completely remove the old gaskets, then entirely clean the mating surfaces. Install one of two new gaskets between the coil tube face and the flange welded to the tank, and the gasket (with a divider) between the tubesheet and the head.

11) Insert the heat exchanger coil carefully into the tank, oriented with the divider in the head properly lined up with the coil.

12) Assure that the heat exchanger unit is aligned properly, then clamp the flanges together and follow the torque procedures below:

NOTE: Studs used to secure the heat exchanger in DHT water heaters are A193 B7 grade.

a) Lubricate the stud threads and the nut faces with a suitable lubricant.

b) Insert the studs through the flanges, then start and finger tighten the nuts.

c) Number all bolts so that torqueing requirements can be followed.

NOTE: Refer to Section 4.18 for drawing location and part number information of studs and nuts. Reference the applicable drawing for the unit model being serviced.

d) Apply torque in fifty percent (50%) increments of the final torque value around 140-150 FT-LBS until sealed, before proceeding to the next step.

e) Tighten bolts in the applicable sequential order (0°-180°, 90°-270°, 45°-225°, 135°-315°) at each step until final target torque is reached.

f) Use rotational tightening until all bolts are stable at final torque level. Two (2) complete times around is usually required.

13) Reconnect the steam/ energy source inlet to the heat exchanger coil. If these lines have been broken at a secondary location for coil removal, ensure these connections are also tightened.

NOTE: Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor.

14) Reconnect the small line leading to the energy source pressure gauge.

15) Follow the startup procedure in Section 3.4 to return the unit to operation. Check for signs of leakage at all connections.

4.5 INLET, OUTLET, AND CONDENSATE / WATER RETURN LINE AND MANUAL SHUTOFF VALVES REPLACEMENT

If any of the inlet, outlet, return lines, or shutoff valves are damaged and must be replaced, follow the steps outlined below.

➢ INLET, OUTLET, AND CONDENSATE/WATER RETURN LINE AND MANUAL SHUTOFF VALVES REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 5 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

CAUTION!
It is NOT advised to replace the inlet, outlet, condensate/water return line, and shutoff valves without a complete shutdown of the unit**.** In the absence of a complete shutdown and removal of electrical power, failure of a manual shutoff valve during the maintenance procedure could result in a dangerous situation.

2) Shut OFF the energy source, condensate/water return line, and feed water inlet and outlet AND ensure that both the water lines and energy source systems have been bled of pressure. Ensure that the shell/tank has been drained completely and that all surfaces and components have cooled.
3) Use care and break the joint between the line or valve to be replaced and the unit.
4) Remove the valve or section of line to be replaced.
5) Replace the damaged valve or section of line.
6) Reconnect the valve or line to the unit.

NOTE: Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor.

7) Perform the startup procedure, as described in Section 3.4, to put the unit back online. Check for evidence of leakage at all connections.

4.6 PRESSURE GAUGE (ENERGY SOURCE) REPLACEMENT

If the pressure gauge for the energy source does not function correctly and must be replaced, follow the procedures outlined below.

➢ PRESSURE GAUGE (ENERGY SOURCE) REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 7 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

2) Carefully disconnect the small line connecting the pressure gauge with the heat exchanger coil head from both the head and the gauge.
3) Remove the gauge from its mounting.
4) Mount the new gauge.
5) Reconnect the small line to both the heat exchanger coil head and the gauge.
6) Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and/or type of joint compound or sealer at the connections.
7) Follow the startup procedures outlined in Section 3.4 to put the unit back on-line. Carefully check all connections for any sign of leakage.

4.7 PRESSURE OR T&P RELIEF VALVE (SHELL/TANK) REPLACEMENT

If the water pressure or T&P relief valve mounted on the tank is not functioning correctly and must be replaced, follow the procedures outlined below.

➢ PRESSURE/T&P RELIEF VALVE REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow the shutdown procedure in Section 3.5 to take the unit off-line.

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 on top of the unit.
4) Install the new relief valve in place. Tighten until sealed and facing proper orientation.

NOTE: Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor.

5) Reconnect the drain line from the relief valve to the drain, per local codes.
6) If any were disconnected, reconnect all electric and pneumatic lines and restore power and instrument air to the system.
7) Reference the manufacturer's documentation for the relief that was supplied with your unit for additional installation / setup instructions.
8) Follow the startup procedures outlined in Section 3.4 to put the unit back on-line. Carefully check all connections for any sign of leakage.

4.8 SOLENOID SAFETY SYSTEM INSPECTION & REPLACEMENT

The Solenoid Safety System acts as a fail-safe for DHT ST Series Water Heaters. If it is mandatory that the unit remain in operation during power failures, it should be wired into the building's emergency power system. **Before this is done, it is the duty of the installer/operator to check local codes and requirements to assure that this is an acceptable configuration.**

When power is supplied to the Solenoid Safety System, the system allows the electrically operated controls to supply energy to the unit. The temperature controller monitors the heated hot water supply temperature to make sure it does not exceed the primary over temperature alarm set point. The system cuts off power supply to the steam/boiler water control valve when this over temperature condition occurs. This causes it to "fail close" upon loss of electrical power, and the solenoid valve is energized to start dumping hot water to safe drain in order to relieve the excessive temperature buildup inside the heat exchanger. When the unit goes back to normal operating temperature condition, power to the control valve is restored and the solenoid valve remains closed.

A semi-annual inspection is recommended, but manufacturer recommendations should be followed for frequency of inspection, testing, and maintenance. If it is necessary to replace a malfunctioning system, follow the instructions below.

NOTE: Location of the Solenoid Safety System may vary from unit to unit. Refer to the drawing supplied with the submittal for the exact location and configuration of the Solenoid Safety System in your unit.

➢ SOLENOID SAFETY SYSTEM INSPECTION & REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 7 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

2) Carefully disconnect the line connecting the Solenoid Safety System to the control panel.
3) Carefully disconnect electric leads from the solenoid valve safety system.
4) If the system is pneumatically activated, turn off the instrument air source and disconnect the pneumatic lines from the Solenoid Safety System. Also, disconnect any electric lines connecting pneumatic control valve in this case (similar to step 2 and 3 above).
5) Remove the solenoid safety valve from its mounting.
6) Mount the new solenoid valve.
7) Reconnect the line from the control panel to the solenoid valve safety system on both sides.

NOTE: Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor.

8) Reconnect the small line from the energy source control valve to the safety system.
9) If any were disconnected, reconnect all electric and pneumatic lines and restore power and

instrument air to the system.

10) Reference the manufacturer's documentation for the solenoid safety valve that was supplied with your unit for additional installation / setup instructions.

11) Follow the startup procedure in Section 3.4 to return the unit to operation. Check for signs of leakage at all connections.

4.9 STRAINERS INSPECTION AND REPLACEMENT

The strainers are installed upstream of the energy source shutoff valve for both the coil and the main traps. These strainers must be flushed periodically (approximately every three [3] to six [6] months) to prevent the buildup of any sediment.

➢ STRAINERS INSPECTION AND REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 7 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

2) Location of the strainers may differ between units. Refer to the drawing that accompanies the submittal sheet for the exact location.

3) Break the line connections on the INLET side of both strainers, then break the line connection on the OUTLET side of the strainers.

4) Remove and inspect the strainers for wear or damage.

5) Clean out any sediment found in the strainers. Replace the strainers if cleaning does not adequately restore function.

6) Replace the strainers in the system, back-in-line.

7) Reinstall the inlet and outlet lines to both strainers following the manufacturer recommendations, while adhering to local codes, as well as proper safety and accepted practices.

8) Follow the startup procedure in Section 3.4 to return the unit to operation. Check for signs of leakage at all connections.

4.10 CONTROL VALVE INSPECTION AND REPLACEMENT

The temperature control valve is installed upstream of the heat exchanger coil and ***must be interlocked*** with the high temperature cut off solenoid. The manufacturer documentation included with the unit gives specifics for operation and maintenance of the control valve. The location of the temperature control valve and its interlocks with other components can be found in the drawing accompanying the submittal sheet for the unit, and should be referred to before performing this maintenance procedure.

➢ CONTROL VALVE INSPECTION AND REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 7 of the shutdown procedure in Section 3.5 to take the unit off-line.

WARNING!

- Boiler steam and high temperature water can be **very dangerous**, and can lead to possible injury or death if caution is not exercised. Use all recommended procedures in this manual, as well as general safety and acceptable practices when performing any of these maintenance procedures.
- TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.

2) Assure that the energy source, condensate/water return line, and water inlet and outlet have been shut off, that the pressure has been bled from both the steam and energy source systems, that the shell/tank has been completely drained, and that all components and surfaces have cooled.
3) For electrically activated control valves, turn off the power and disconnect the leads to the valve.
4) For pneumatically activated control valves, turn off the instrument air source, bleed the pressure from the line, and disconnect the lines to the valve.
5) Break the joints between the pressure control valve and feed water valve, solenoid safety unit, and auxiliary trap line.
6) Break the connections between the energy source inlet line and the heat exchanger coil.

NOTE: If you are required to make the necessary break at a second location and to rotate the lines to allow heat exchanger coil clearance, ensure the action does not damage the in-line components.

7) Remove the control valve from the system.
8) Follow the supplied manufacturer instructions for inspecting the valve. If found to be malfunctioning, replace the valve.
9) Reinstall the control valve by reconnecting it to the heat exchanger coil outlet line and the energy source inlet line. Reconnect the small line from the shell/tank outlet line to the safety system.

NOTE: Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor.

10) Place the valve in the same orientation as it was when removed and tighten the connections. If lines were also broken in a secondary location, ensure those connections are also tightened

11) Reconnect the solenoid safety unit and the auxiliary trap line to the control valve.

12) Follow the startup procedure in Section 3.4 to return the unit to operation. Check for signs of leakage at all connections.

4.11 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.

4.12 TRAPS (MAIN & AUXILIARY) REPLACEMENT (STEAM SYSTEMS ONLY)

On units that use a steam energy source, the main and auxiliary traps are installed upstream of the condensate shutoff valve. The flow of condensate is controlled by the rise and fall of a float in the body of the trap. To replace a malfunctioning condensate trap, follow the instructions below.

➢ TRAPS (MAIN & AUXILIARY) REPLACEMENT INSTRUCTIONS

1) Before performing this maintenance procedure, follow Steps 1 through 7 of the shutdown procedure in Section 3.5 to take the unit off-line.

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

2) The trap location may differ between units. Refer to the drawing that accompanies the submittal sheet for the exact location of the trap.
3) Break the joint on the INLET side of both traps, then break the joint on the OUTLET side of both traps.
4) Remove and inspect the traps for wear or damage.
5) Replace traps if they are malfunctioning.
6) Install the traps back in the system, in-line.
7) Reconnect the all inlet and outlet lines to both traps.

NOTE: Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor.

8) Follow the startup procedure in Section 3.4 to return the unit to operation. Check for signs of leakage at all connections.

4.13 CLEANING OF HEAT EXCHANGERS AND TANKS

Heat exchangers and tanks are cleansed by flushing the units with fluids, which do not react with materials of the units. Dirt deposited in the heat exchanger/tank will result in an increase in pressure drop, lower temperature difference in the heated medium, or a higher exit temperature on heating medium side. It is recommended to clean heat exchangers and tanks twice a year.

4.13.1 DISASSEMBLY AND REASSEMBLY

This heat exchanger is designed to function in various domestic water heating applications. It is required to disassemble and reassemble the heat exchanger after checking for tube leaks or regular cleaning etc. DHT units are designed to easily remove the tube bundle from bottom of the unit when installed at their location. It requires tooling, including wrenches, torque wrenches, and sealing compounds.

CAUTION!

Proper caution must be taken during disassembly and reassembly of the heat exchanger in order to prevent any damage to the components and/or injury.

4.14 REPLACEABLE PARTS LIST

The following is a list of parts that are generally replaceable by trained/certified personnel on DHT water heaters. Replaceable parts may vary to some degree, depending on model and specific design configuration. Refer to the original design specifications or contact DHT, Inc. with any questions regarding replaceable parts.

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
- Gaskets
- Heat Exchanger Tube Bundle
- Pressure Gauge
- T&P Relief Valve
- Solenoid Valve
- Auxiliary Trap
- Main Condensate Trap
- PID Controller
- HMI
- Recirculation Pump
- Thermocouples
- Aquastat
- Vacuum Breaker
- Control Panel Parts
- Other Piping Components

NOTE:
Refer to **Section 4.18 Parts and Accessories** for complete list and part number information.

4.15 RECOMMENDED SPARE PARTS:

TABLE 4-3: RECOMMENDED SPARE PARTS

REFERENCE	ITEM NO.	QUANTITY PER UNIT	PART NAME
FIG. 4-1A	4	1	GASKET
FIG. 4-1A	5	1	GASKET W/ RIB
FIG. 4-1B	19a	1	PRESSURE GAUGE
FIG. 4-1B	13	2	THERMOCOUPLES
FIG. 4-1C	16	1	AQUASTAT
FIG. 4-1C	14	1	SOLENOID VALVE
FIG. 4-1B	20a	1	VACUUM BREAKER
FIG. 4-2	25 & 28	SEE TABLE 4-11	GASKETS (STEAM INLET)

For the replacement heat exchanger tube bundle model and serial number, refer to the nameplate mounted on the jacket of the unit.

4.16 ORDERING INFORMATION

All replacement parts for DHT ST Series units can be ordered directly from your local authorized sales representative/agent. Visit Rep Locator page on the DHT website to find your local sales representative's contact information.

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

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

4.17 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 (steam, boiler water, or high temperature water), and power connections.

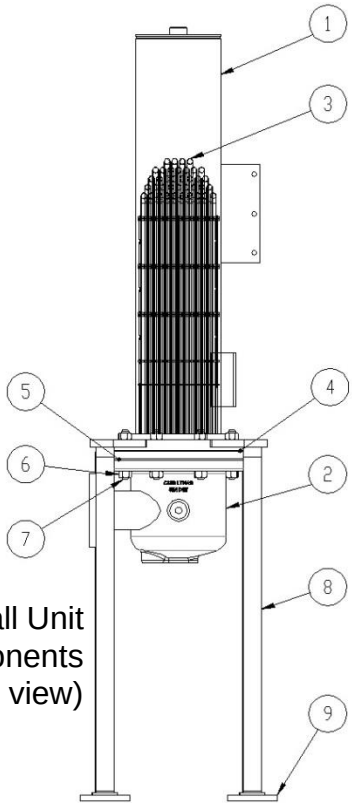
TABLE 4-4: RECOMMENDED INSPECTIONS TIME INTERVAL TABLE

TO BE INSPECTED	PER MANUFACTURE SPECS.	WEEKLY	MONTHLY	3 MONTHS	6 MONTHS	1 YEAR
Recirculation Pump	X					
Control Valve	X					
Temperature & Pressure Gauges				X		
Heat Exchanger Tube Bundle & Gaskets			X			
Inlet, Outlet & Return Connections				X		
Pneumatic Connections				X		
Power & Ground Connections				X		
Relief Valves	X					
Isolation Valves		X				
Solenoid & Aquastat Safety System				X		
Strainers				X		
Traps- Main & Auxiliary					X	
PID Controller & Thermocouple					X	
Vacuum Breaker			X			

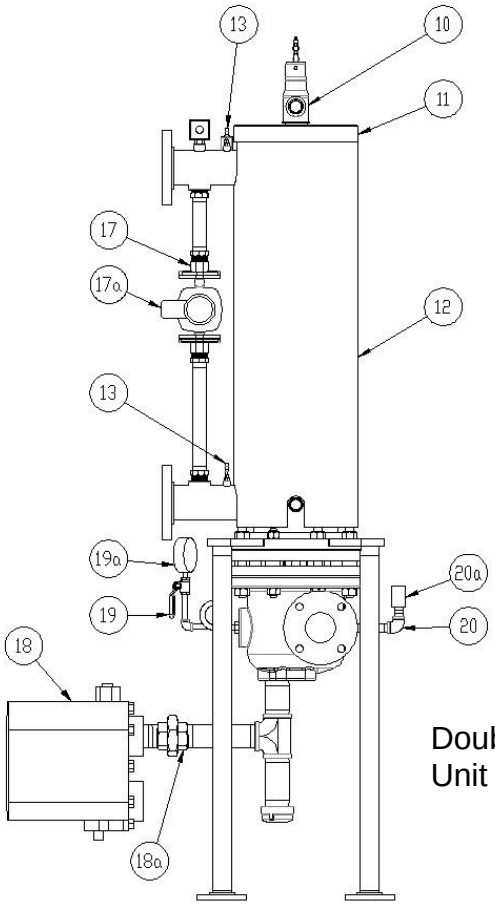
NOTE:
It is mandatory to keep maintenance/inspections logs and applicable federal, state, and local regulations near the unit following DHT Installation, Operation, and Maintenance (IOM). Failing to do so will void DHT warranty.

4.18 PARTS AND ACCESSORIES

Single Wall Unit internal components shown (side view)

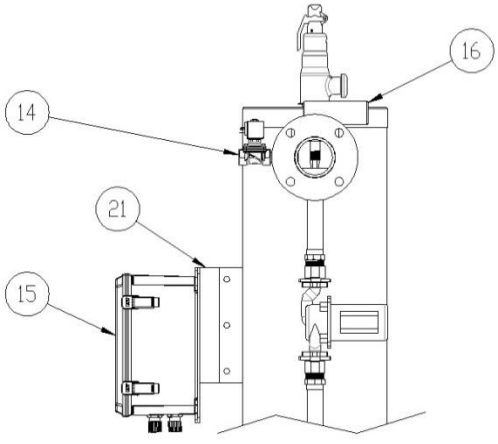


Drawing "A"



Drawing "B"

Double Wall Unit shown



Drawing "C"

FIG 4-1: VERTICAL ST SERIES PARTS DRAWINGS

TABLE 4-5: 6 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
1	76002-6	1	SHELL ASSEMBLY
2	44001-6	1	CAST HEAD
3	28007-6S-CU	1 (OPTIONS)	TUBE BUNDLE KIT – COPPER SINGLE WALL
	28007-6S-CN		TUBE BUNDLE KIT – CUNI SINGLE WALL
	28007-6S-SS		TUBE BUNDLE KIT – STAINLESS STEEL SINGLE WALL
	28007-6D-CU		TUBE BUNDLE KIT – COPPER DOUBLE WALL
	28007-6D-CN		TUBE BUNDLE KIT – CUNI DOUBLE WALL
	28034-6D-CU-KIT		TUBE BUNDLE KIT – 6" COPPER 5/8" DOUBLE WALL W/ GASKETS
	28034-6D-CN-KIT		TUBE BUNDLE KIT – 6" CUNI 5/8" DOUBLE WALL W/ GASKETS
4	23001-6	1	GASKET
5	23006-6	1	GASKET W/ RIB
6	11002-.75	16	HEX NUT 3/4"-10 - UNC 2B
7	10044-.75-5	8	STUD – 3/4"-10 X 5" LG - UNC 2A (FOR SINGLE WALL UNIT)
	10044-.75-7	8	STUD – 3/4"-10 X 7" LG – UNC 2A (FOR DOUBLE WALL UNIT)
8	75007-1.5-36	4	1-1/2" NPT PIPE NIPPLE LEG
9	79005-1.5	4	1-1/2" NPT SORF FLANGE
10	22007-340-3	1	T&P RELIEF VALVE (SEE TABLE 4-10)
11	20005-6	1	INSULATION CAP
12	20004-6V	1	INSULATION JACKET–VERTICAL UNIT
	20004-6H	1	INSULATION JACKET–HORIZONTAL UNIT
13	62003	2	THERMOCOUPLE
14	22011-.5	1	SOLENOID VALVE
15	64002-ST	1	CONTROL PANEL
16	62001	1	AQUASTAT
	22009-6.38	1	AQUASTAT WELL
17	74025-6	1	RECIRCULATION LINE ASSY KIT
17a	22008-.75	1	RECIRCULATION PUMP ONLY
18	ST-90024-TAB	1	CONDENSATE TRAP ASSY KIT (SEE TABLE 4-9 FOR TRAP MODEL. EXAMPLE: ST-90024-20JD8)
18a	SEE TABLE 4-9	1	CONDENSATE TRAP ONLY
19	27001-2	1	PRESSURE GAUGE ASSEMBLY KIT
19a	24001-TAB	1	PRESSURE GAUGE ONLY (TAB IS -30, -60 OR -160)
20	28001-1	1	VACUUM BREAKER ASSEMBLY KIT
20a	22026	1	VACUUM BREAKER ONLY
21	40010	1	CONTROL PANEL BRACKET

TABLE 4-6: 8 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
1	76002-8	1	SHELL ASSEMBLY
2	44001-8	1	CAST HEAD
3	28007-8S-CU	1 (OPTIONS)	TUBE BUNDLE KIT – COPPER SINGLE WALL
	28007-8S-CN		TUBE BUNDLE KIT – CUNI SINGLE WALL
	28007-8S-SS		TUBE BUNDLE KIT – STAINLESS STEEL SINGLE WALL
	28007-8D-CU		TUBE BUNDLE KIT – COPPER DOUBLE WALL
	28007-8D-CN		TUBE BUNDLE KIT – CUNI DOUBLE WALL
	28034-8D-CU-KIT		TUBE BUNDLE KIT – 8" COPPER 5/8" DOUBLE WALL W/ GASKETS
	28034-8D-CN-KIT		TUBE BUNDLE KIT – 8" CUNI 5/8" DOUBLE WALL W/ GASKETS
4	23001-8	1	GASKET
5	23006-8	1	GASKET W/ RIB
6	11002-.75	16	HEX NUT 3/4"-10 - UNC 2B (SINGLE WALL ONLY)
	11002-.75	16	HEX NUT 3/4"-10 - UNC 2B (DOUBLE WALL ONLY)

TABLE 4-6: 8 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
7	10044-.75-5	8	STUD – 3/4"-10 X 5" LG - UNC 2A (SINGLE WALL ONLY)
	10044-.75-7	8	STUD – 3/4"-10 X 7" LG – UNC 2A (DOUBLE WALL ONLY)
8	75007-1.5-36	4	1-1/2" NPT PIPE NIPPLE LEG
9	79005-1.5	4	1-1/2" NPT SORF FLANGE
10	22007-340-3	1	T&P RELIEF VALVE (SEE TABLE 4-10)
11	20005-8	1	INSULATION CAP
12	20004-8V	1	INSULATION JACKET–VERTICAL UNIT
	20004-8H	1	INSULATION JACKET–HORIZONTAL UNIT
13	62003	2	THERMOCOUPLE
14	22011-.5	1	SOLENOID VALVE
15	64002-ST	1	CONTROL PANEL
16	62001	1	AQUASTAT
	22009-6.38	1	AQUASTAT WELL
17	74025-8	1	RECIRCULATION LINE ASSY KIT
17a	22008-.75	1	RECIRCULATION PUMP ONLY
18	ST-90024-TAB	1	CONDENSATE TRAP ASSY KIT (SEE TABLE 4-9 FOR TRAP MODEL. EXAMPLE: ST-90024-20JD8)
18a	SEE TABLE 4-9	1	CONDENSATE TRAP ONLY
19	27001-2	1	PRESSURE GAUGE ASSEMBLY KIT
19a	24001-TAB	1	PRESSURE GAUGE ONLY (TAB IS -30, -60 OR -160)
20	28001-1	1	VACUUM BREAKER ASSEMBLY KIT
20a	22026	1	VACUUM BREAKER ONLY
21	40010	1	CONTROL PANEL BRACKET

TABLE 4-7: 10 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
1	76002-10	1	SHELL ASSEMBLY
2	44001-10	1	CAST HEAD
3	28007-10S-CU	1 (OPTIONS)	TUBE BUNDLE KIT – COPPER SINGLE WALL
	28007-10S-CN		TUBE BUNDLE KIT – CUNI SINGLE WALL
	28007-10S-SS		TUBE BUNDLE KIT – STAINLESS STEEL SINGLE WALL
	28007-10D-CU		TUBE BUNDLE KIT– COPPER DOUBLE WALL
	28007-10D-CN		TUBE BUNDLE KIT – CUNI DOUBLE WALL
	28034-10D-CU-KIT		TUBE BUNDLE KIT – 10" COPPER 5/8" DOUBLE WALL W/ GASKETS
	28034-10D-CN-KIT		TUBE BUNDLE KIT – 10" CUNI 5/8" DOUBLE WALL W/ GASKETS
4	23001-10	1	GASKET
5	23006-10	1	GASKET W/ RIB
6	11002-.875	24	HEX NUT 7/8"-9 - UNC 2B
7	10044-.875-6	12	STUD – 7/8"-9 X 6" LG - UNC 2A (FOR SINGLE WALL UNIT)
	10044-.875-8	12	STUD – 7/8"-9 X 8" LG – UNC 2A (FOR DOUBLE WALL UNIT)
8	75007-1.5-36	4	1-1/2" NPT PIPE NIPPLE LEG
9	79005-1.5	4	1-1/2" NPT SORF FLANGE
10	22007-340-3	1	T&P RELIEF VALVE (SEE TABLE 4-10)
11	20005-10	1	INSULATION CAP
12	20004-10V	1	INSULATION JACKET–VERTICAL UNIT
	20004-10H	1	INSULATION JACKET–HORIZONTAL UNIT
13	62003	2	THERMOCOUPLE

TABLE 4-7: 10 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
14	22011-.5	1	SOLENOID VALVE
15	64002-ST	1	CONTROL PANEL
16	62001	1	AQUASTAT
	22009-6.38	1	AQUASTAT WELL
17	74025-10	1	RECIRCULATION LINE ASSY KIT
17a	22008-.75	1	RECIRCULATION PUMP ONLY
18	ST-90024-TAB	1	CONDENSATE TRAP ASSY KIT (SEE TABLE 4-9 FOR TRAP MODEL. EXAMPLE: ST-90024-20JD8)
18a	SEE TABLE 4-9	1	CONDENSATE TRAP ONLY
19	27001-2	1	PRESSURE GAUGE ASSEMBLY KIT
19a	24001-TAB	1	PRESSURE GAUGE ONLY (TAB IS -30, -60 OR -160)
20	28001-1	1	VACUUM BREAKER ASSEMBLY KIT
20a	22026	1	VACUUM BREAKER ONLY
21	40010	1	CONTROL PANEL BRACKET

TABLE 4-8: 12 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
1	76002-12	1	SHELL ASSEMBLY
2	44001-12	1	CAST HEAD
3	28007-12S-CU	1 (OPTIONS)	TUBE BUNDLE KIT – COPPER SINGLE WALL
	28007-12S-CN		TUBE BUNDLE KIT – CUNI SINGLE WALL
	28007-12S-SS		TUBE BUNDLE KIT – SAINLESS STEEL SINGLE WALL
	28007-12D-CU		TUBE BUNDLE KIT – COPPER DOUBLE WALL
	28007-12D-CN		TUBE BUNDLE KIT – CUNI DOUBLE WALL
	28034-12D-CU-KIT		TUBE BUNDLE KIT – 12" COPPER 5/8" DOUBLE WALL W/ GASKETS
	28034-12D-CN-KIT		TUBE BUNDLE KIT – 12" CUNI 5/8" DOUBLE WALL W/ GASKETS
4	23001-12	1	GASKET
5	23006-12	1	GASKET W/ RIB
6	11002-.875	24	HEX NUT 7/8"-9 - UNC 2B
7	10044-.875-6	12	STUD – 7/8"-9 X 6" LG - UNC 2A (FOR SINGLE WALL UNIT)
	10044-.875-8	12	STUD – 7/8"-9 X 8" LG – UNC 2A (FOR DOUBLE WALL UNIT)
8	75007-1.5-36	4	1-1/2" NPT PIPE NIPPLE LEG
9	79005-1.5	4	1-1/2" NPT SORF FLANGE
10	22007-340-3	1	T&P RELIEF VALVE (SEE TABLE 4-10)
11	20005-12	1	INSULATION CAP
12	20004-12V	1	INSULATION JACKET–VERTICAL UNIT
	20004-12H	1	INSULATION JACKET–HORIZONTAL UNIT
13	62003	2	THERMOCOUPLE
14	22011-.5	1	SOLENOID VALVE
15	64002-ST	1	CONTROL PANEL
16	62001	1	AQUASTAT
	22009-6.38	1	AQUASTAT WELL
17	74025-12	1	RECIRCULATION LINE ASSY KIT
17a	22008-.75	1	RECIRCULATION PUMP ONLY
18	ST-90024-TAB	1	CONDENSATE TRAP ASSY KIT (SEE TABLE 4-9 FOR TRAP MODEL. EXAMPLE: ST-90024-20JD8)
18a	SEE TABLE 4-9	1	CONDENSATE TRAP ONLY
19	27001-2	1	PRESSURE GAUGE ASSEMBLY KIT
19a	24001-TAB	1	PRESSURE GAUGE ONLY (TAB IS -30, -60 OR -160)

TABLE 4-8: 12 INCH SIZE STV/STH UNITS PARTS

ITEM NO.	PART NO.	QUANTITY	PART NAME
20	28001-2	1	VACUUM BREAKER ASSEMBLY KIT
20a	22026	1	VACUUM BREAKER ONLY
21	40010	1	CONTROL PANEL BRACKET

TABLE 4-9: CONDENSATE TRAP PART NUMBERS

ITEM NO.	PART NO.	QUANTITY	PART NAME
18a	22010-30-B8	1	CONDENSATE TRAP, 30B8
	22010-20-JD8	1	CONDENSATE TRAP, 20JD8
	22010-75-JD8	1	CONDENSATE TRAP, 75JD8
	22010-50-KD10	1	CONDENSATE TRAP, 50KD10

TABLE 4-10: ST SERIES T&P RELIEF VALVE OPTIONS

ITEM NO.	PART NO.	QUANTITY	PART NAME
10	22007-40L-3	1	T&P RELIEF VALVE (LF40L-3)
	22007-40L-2	1	T&P RELIEF VALVE (LF40L-2)
	22007-140S-3	1	T&P RELIEF VALVE (LF140S-3)
	22007-240X-6	1	T&P RELIEF VALVE (LF240X-6)
	22007-340-3	1	T&P RELIEF VALVE (LF340-3)

TABLE 4-11: STANDARD HORIZONTAL UNITS SPECIFIC PARTS

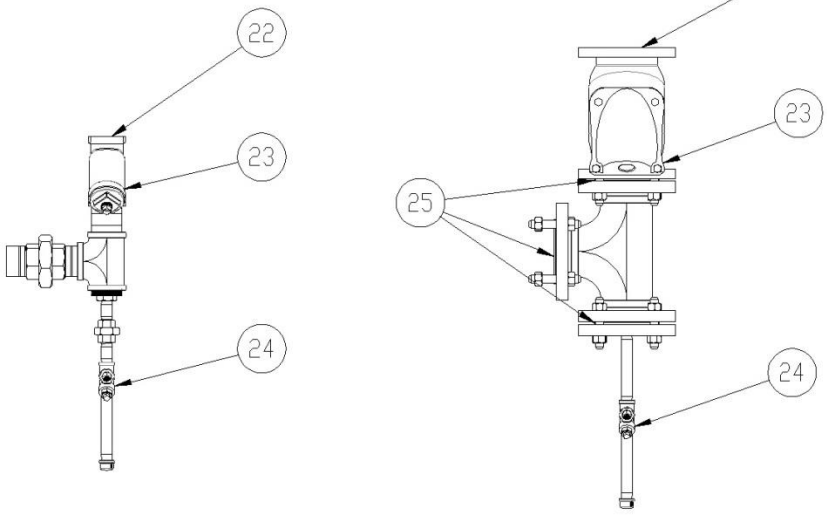
ITEM NO.	PART NUMBER	QUANTITY	DESCRIPTION
1	76001-6	1	SHELL ASSEMBLY, 6” SIZE UNIT
	76001-8		SHELL ASSEMBLY, 8” SIZE UNIT
	76001-10		SHELL ASSEMBLY, 10” SIZE UNIT
	76001-12		SHELL ASSEMBLY, 12” SIZE UNIT
2	74024-6	1	STEAM HEAD, 6” SIZE UNIT
	74024-8		STEAM HEAD, 8” SIZE UNIT
	74024-10		STEAM HEAD, 10” SIZE UNIT
	74024-12		STEAM HEAD, 12” SIZE UNIT
8	54001-6	1	BASE ASSEMBLY, 6” SIZE UNIT
	54001-8		BASE ASSEMBLY, 8” SIZE UNIT
	54001-10		BASE ASSEMBLY, 10” SIZE UNIT
	54001-12		BASE ASSEMBLY, 12” SIZE UNIT

NOTES:

1. Tube bundle kits include tube bundle, shell flange gasket, steam head gasket, and instructions sheet TID-0001.

2. Some of the part numbers for horizontal, customized, or HTHW units may vary. Please consult with factory or local sales representative per the unit serial number to ensure correct parts are being used.

4.19 STEAM INLET KIT PART NUMBERS (OPTIONAL)



1.25-2" THREADED **2.5-5" FLANGED**

FIG 4-2a: STEAM INLET STRAINER ASSEMBLY PARTS DIAGRAM

TABLE 4-12: STEAM INLET KIT PART NUMBERS

ITEM NO.	STRAINER SIZE	22	23	24	25
PART NAME		STRAINER ASSEMBLY KIT	STRAINER	DRIP TRAP	GASKET
PART NO. (QUANTITY)	1.25"	ST-90026-1.25 (1)	22024-1.25 (1)	22028-.5 (1)	-
	1.5"	ST-90026-1.5 (1)	22024-1.5 (1)		-
	2.0"	ST-90026-2 (1)	22024-1.2 (1)		-
	2.5"	ST-90026-2.5 (1)	22024-2.5 (1)		23002-2.5 (3)
	3.0"	ST-90026-3 (1)	22024-3 (1)		23002-3 (3)
	4.0"	ST-90026-4 (1)	22024-4 (1)		23002-4 (3)
	5.0"	ST-90026-5 (1)	22024-5 (1)		23002-5 (3)

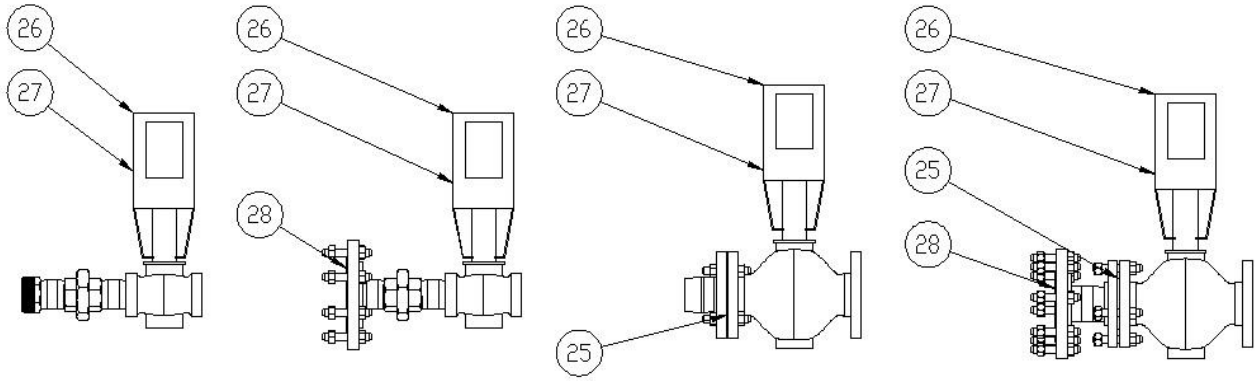


FIG 4-2b: CONTROL VALVE ASSEMBLY PARTS DIAGRAM

TABLE 4-13: CONTROL VALVE KIT PART NUMBERS

ITEM NO.	CONTROL VALVE SIZE	26	27	28	25
PART NAME		CONTROL VALVE ASSEMBLY KIT	CONTROL VALVE	GASKET	GASKET
PART NO. (QUANTITY)	1.0”	ST-90025-1-“B” (1)	22015-1 (1)	SEE TABLE 4-13 (1)	-
	1.25”	ST-90025-1.25-“B” (1)	22015-1.25 (1)		-
	1.5”	ST-90025-1.5-“B” (1)	22015-1.5 (1)		-
	2.0”	ST-90025-2-“B” (1)	22015-2 (1)		-
	2.5”	ST-90025-2.5-“B” (1)	22015-2.5 (1)		23002-2.5 (1)
	3.0”	ST-90025-3-“B” (1)	22015-3 (1)		23002-3 (1)
	4.0”	ST-90025-4-“B” (1)	22015-4 (1)		23002-4 (1)
	5.0”	ST-90025-5-“B” (1)	22015-5 (1)		23002-5 (1)

NOTES:

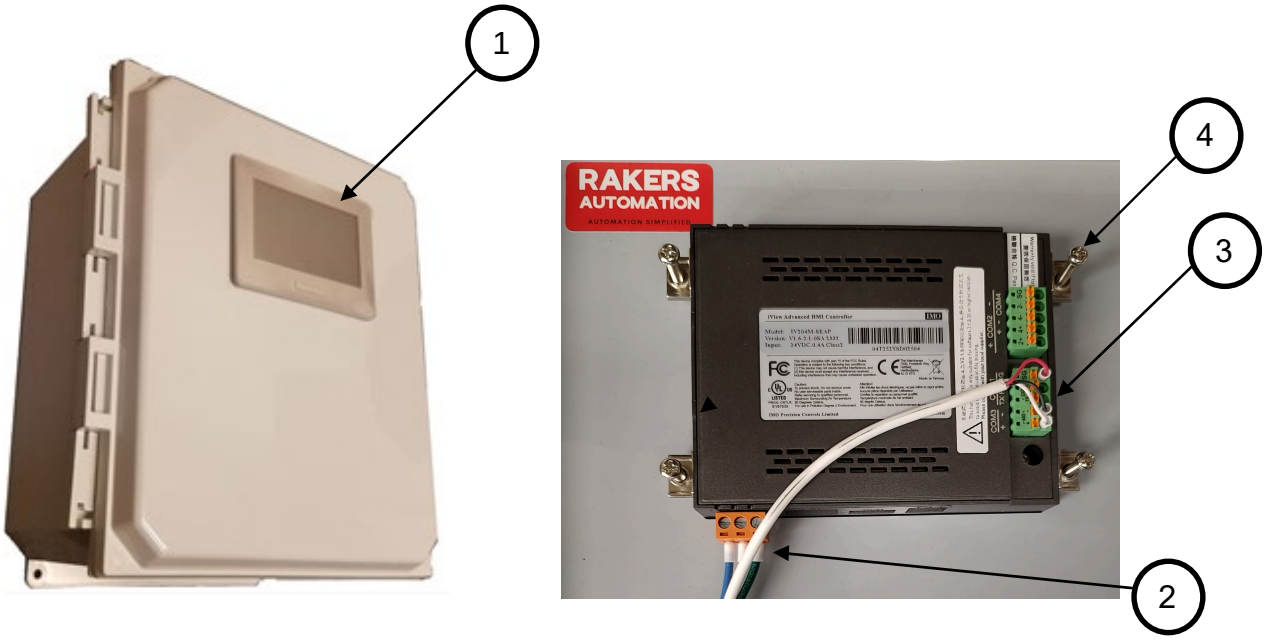
1. “B” stands for unit size (e.g. - 6).

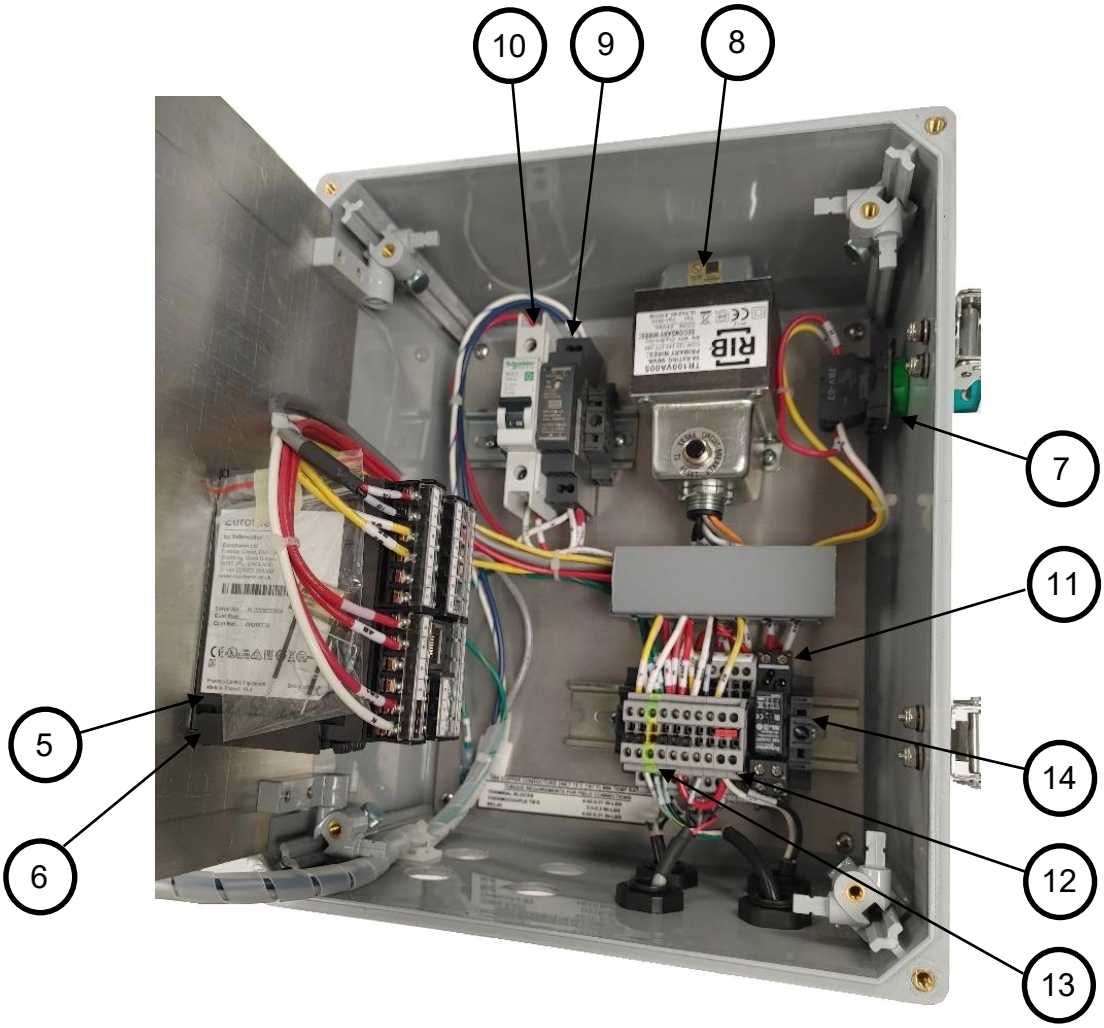
2. Control valve part number varies for certain sizes with respect to the valve and/or actuator types. Please consult factory or local sales representative.

TABLE 4-14: STEAM HEAD TO CONTROL VALVE CONNECTION GASKET PART NUMBERS

ITEM NO.	PART NUMBER	DESCRIPTION
28	23002-3-1.5	3” X 1.5” REDUCING FLANGE GASKET
	23002-3-2	3” x 2” REDUCING FLANGE GASKET
	23002-2.5	2.5” FLANGE GASKET
	23002-3-2.5	3” X 2.5” REDUCING FLANGE GASKET
	23002-4-2.5	4” X 2.5” REDUCING FLANGE GASKET
	23002-3	3” FLANGE GASKET
	23002-4-3	4” X 3” REDUCING FLANGE GASKET
	23002-5-2.5	5” X 2.5” REDUCING FLANGE GASKET
	23002-5-3	5” X 3” REDUCING FLANGE GASKET
	23002-4	4” FLANGE GASKET
	23002-5-4	5” X 4” REDUCING FLANGE GASKET
	23002-5	5” FLANGE GASKET

4.20 CONTROL BOX PARTS





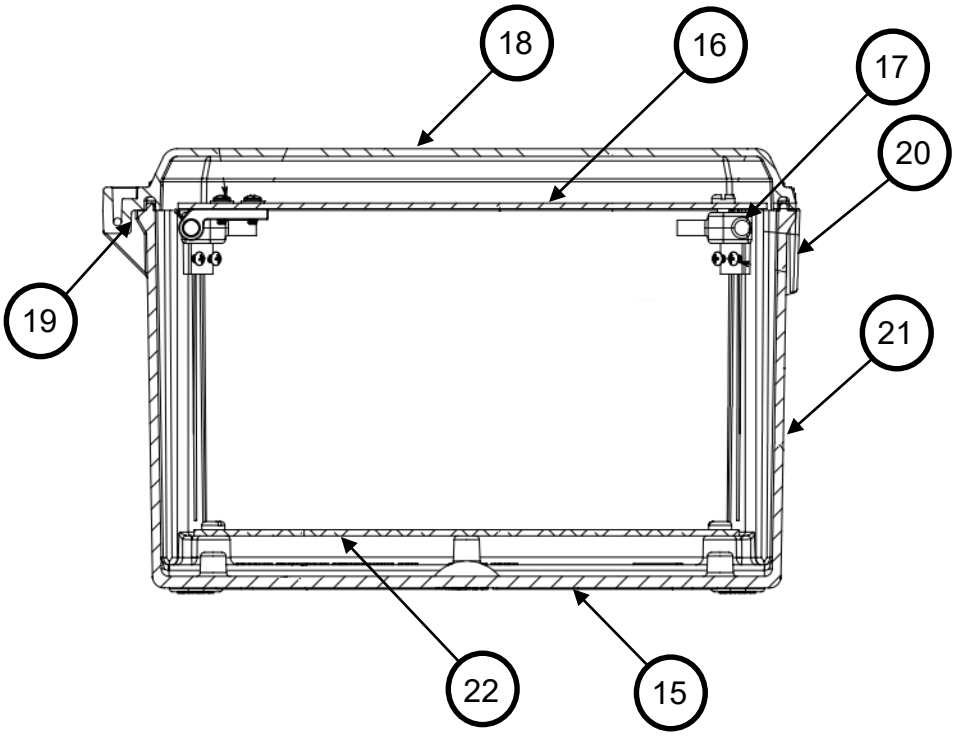


TABLE 4-14: CONTROL PANEL PART NUMBERS

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

TABLE 4-14: CONTROL PANEL PART NUMBERS

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

4.21 CONTROL VALVE TECHNICAL INFORMATION

Click on the following links in order to download the Control Valves documentation which is required for startup and maintenance:

4.21.1 Siemens Electronic Control Valves:

Actuator: Click here to download the Installation Instructions.

PSF Automation Actuator: Click here to download the installation instructions.

1/2 to 2-Inch Valve, Two-Way, and Actuator Assembly Selection: Click here to download the Technical Bulletin.

2-1/2 to 6-Inch Valve, Two-Way, and Actuator Assembly Selection: Click here to download the Technical Bulletin.

4.21.2 Warren Electronic Control Valves:

1/2 to 6-Inch Control Valve: Click here to download the IOM Instructions.

NOTE:
Electronic version of this manual can be found on DHT's website that contains online link to these documents. Consult factory or your authorized sales representative for technical support regarding these valves in case of any question

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SECTION 5: TROUBLESHOOTING

The following table shows issues that a DHT ST Series Water Heating Unit may encounter during its operation, 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.	1. Inlet steam/energy source pressure is too low.	1. Check the steam/energy source pressure gauge. Adjust the inlet pressure to meet the design requirements if the reading is low. If there is a restriction in the primary energy source line, the gauge reading will drop drastically when the heat exchanger calls for full energy, even though the pressure seems to be normal during light demand. If the incoming energy source pressure is correct, its pressure gauge reading should reach design pressure as the hot water supply temperature approaches set point.
	2. Inlet steam/energy source pressure control valve is not opening properly.	2. See the adjustment and testing instructions contained in the supplied Installation/Operations Manual for the specific temperature control value installed on the unit. Replace the valve if necessary. Refer to Section 4.21 Control Valve Technical Information if hard copy is not available.
	3. The condensate drain/water return piping has not been installed properly to allow the condensate to drain freely (by gravity)/water return circulation; the condensate drain/water return line is restricted; or the condensate/water return check valve is leaking or has failed.	3. Rearrange the condensate drain/water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the condensate drain/water return line. Replace the check valve if it is leaking or has failed. Inspect F&T trap and drip line. If condensate drain/water return line is restricted due to trap, contact the local DHT representative for the required trap size. Also inspect vacuum breaker for any malfunctioning.
	4. The water heater temperature control system/valve is not operating properly.	4. See the adjustment and testing instructions contained in Section 3.6 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.
	5. There is a leakage in the heat exchanger coil.	5. Shut off the primary energy source to unit and break connection in the condensate/water return line to verify the presence of leakage. Steam condensate or boiler / high temperature water will drain from the coil in the beginning, but the flow should stop after a short

		period of time. It the flow continues and water is leaking from shell into the coil; disassemble, inspect, repair (if possible), or replace the heat exchanger coil and reassemble the unit.
	6. The heat exchanger coil is heavily scaled or damaged.	6. Call DHT or your authorized representative for instructions on repair or replacement. Refer to the nameplate for the model and serial numbers of the unit and heat exchanger coil. Include these numbers in all correspondence.
	7. Water heater and control valve being used at higher than rated design capacity.	7. 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.
	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.
DHW supply temperature is too high	1. The water heater temperature control system/valve is not operating properly.	1. See the adjustment and testing instructions contained in Section 3.6 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 4.21 Control Valve Technical Information** if hard copy is not available.
	2. The temperature controller or thermometer indicates wrong value.	2. Inspect and replace the temperature controller, thermocouple and/or thermometer if any of them are not functioning properly.
	3. Incoming water is preheated too much.	3. Maintain incoming cold water at least 10°F below the hot water supply temperature.
DHW supply outlet temperature fluctuates significantly	1. Inlet steam/energy source control valve does not open/close properly.	1. See the adjustment and testing instructions contained in the supplied manual for the specific temperature control valve installed on the unit. Replace the control valve and/or actuator if necessary. Refer to **Section 4.22 Control Valve Technical Information** if hard copy is not available.
	2. Inlet steam/energy source pressure is too low.	2. Check the steam/energy source pressure gauge. Adjust the inlet pressure to meet the design requirements if the reading is low. If there is any restriction in the steam/energy source line, the gauge reading will drop extremely when the heat exchanger calls for full energy, even though the pressure seems to be normal during light demand. If the incoming energy source pressure is correct, its pressure gauge reading should reach design pressure as the pressure in the heat exchanger as hot water supply temperature approaches set point.

	3. Water heater and control valve being used at higher than rated design capacity. 4. There is a water leakage in the heat exchanger coil. 5. The condensate drain/water return piping has not been installed properly to allow the condensate to drain freely (by gravity)/water return circulation; the condensate drain/water return line is restricted; or the condensate/water return check valve is leaking or has failed. 6. Recirculating pump malfunctions/failed. 7. Ground wiring connection is loose or disconnected. 8. The water heater temperature control system is not operating properly	3. 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. 4. Shut off the primary energy source to unit and break connection in the condensate/water return line to verify the presence of leakage. Steam condensate or boiler / high temperature water will drain from the coil in the beginning, but the flow should stop after a short period of time. It the flow continues and water is leaking from shell into the coil; disassemble, inspect, repair (if possible), or replace the heat exchanger coil and reassemble the unit. 5. Rearrange the condensate drain/water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the condensate drain/water return line. Replace the check valve if it is leaking or has failed. Inspect F&T trap and drip line. If condensate drain/water return line is restricted due to trap, contact the local DHT representative for the required trap size. Also inspect vacuum breaker for any malfunctioning. 6. Recirculation piping temperature should be same as the hot water outlet temperature when recirculation pump is operating properly. Check the power supply or repair/replace the pump if needed. Also check building recirculation pump aquastat settings if being used. 7. Check the ground connection to make sure it is not loose, which can cause electrical nuisance for temperature control (building stray voltage). 8. Refer to the PID settings adjustment and testing instructions contained in Section 3.6 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace it if needed.
Excessive or insufficient condensate (steam, boiler water, or high temperature hot water) being returned from the unit.	1. The condensate drain/water return piping has not been installed properly to allow the condensate drain freely (by gravity)/water return circulation; the condensate drain/water return line is restricted; or the condensate/water return check valve is leaking or has failed.	1. Rearrange the condensate drain/water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the condensate drain/water return line. Replace the check valve if it is leaking or has failed. Inspect F&T trap and drip line. If condensate drain/water return line is restricted due to trap, contact the local DHT representative for the required trap size. Also inspect vacuum breaker for any malfunctioning.

	2. There is a water leakage in the heat exchanger coils.	2. Shut off the primary energy source to unit and break connection in the condensate/water return line to verify the presence of leakage. Steam condensate or boiler / high temperature water will drain from the coil in the beginning, but the flow should stop after a short period of time. If the flow continues and water is leaking from shell into the coil; disassemble, inspect, repair (if possible), or replace the heat exchanger coil and reassemble the unit.
Steam is discharged into the condensate drain	1. The heat exchanger coil is heavily scaled or damaged. 2. Undersized or faulty condensate trap(s).	1. Call DHT or your authorized representative, for instructions on repair or replacement. Refer to the nameplate for the model and serial numbers of the unit and heat exchanger coil. Include these numbers in all correspondence. 2. Contact the local DHT representative for the required trap size if it is faulty.
Temperature and Pressure or pressure only relief valve “pops”.	1. Inlet steam/energy source control valve does not close properly. 2. Incoming water is preheated too much. 3. Improperly sized or disconnected expansion tank in closed loop piping system. 4. Inadequate water hammer arrestors. 5. System/incoming water pressure is too high. 6. Relief valve is faulty. 7. Aquastat/over temperature settings in PID controller or solenoid valve not properly set or defective.	1. See the adjustment and testing instructions contained in Section 3.6 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 if necessary. Refer to **Section 4.22 Control Valve Technical Information** if hard copy is not available. 2. Maintain incoming cold water at least 10°F below the hot water supply temperature. 3. Install the properly sized expansion tank in the closed loop piping system as shown in Installation and Piping drawings in Section 6.3. 4. In order to avoid any shock waves, install water hammer arrestors/shock absorbers in the hot and cold water systems as needed. 5. Bring the system water pressure below the relief valve setting. 6. Inspect and adjust or replace the relief valve if it has failed. Contact DHT representative for replacement. 7. Check and readjust as necessary. Replace the defective parts as necessary. Refer to adjustment instructions contained in Section 3.6.
Water heater shuts down at or too close to (above or below) the	1. Over temperature limit settings not properly set or defective.	1. Refer to adjustment instructions contained in Section 3.6. Replace the defective parts as necessary.

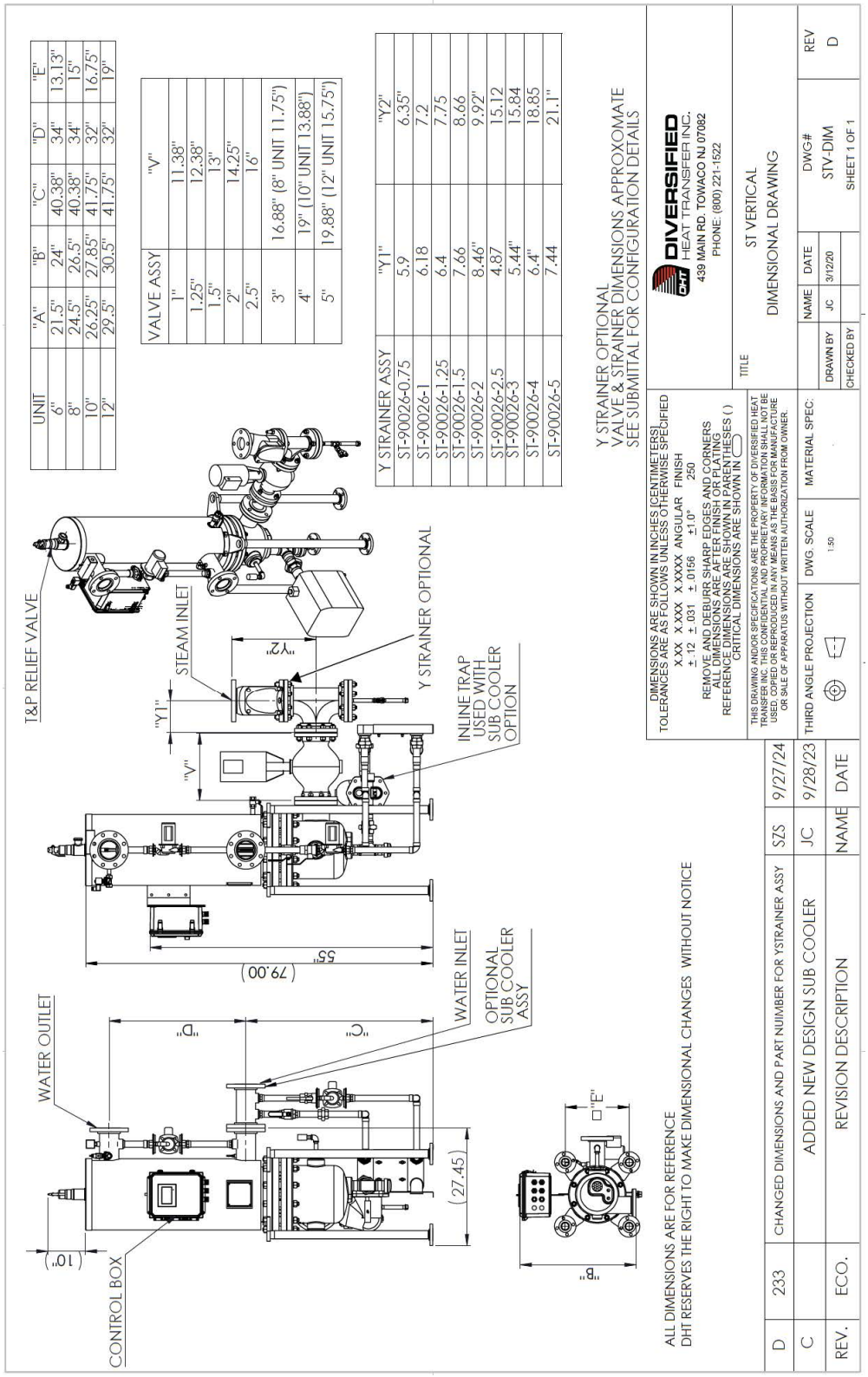
design outlet water temperature.		
A loud banging in the water heater, primary piping, or condensate/water return piping (not to be confused with a normal clicking noise made during operation).	1. The condensate drain/water return piping has not been installed properly to allow the condensate to drain freely (by gravity)/water return circulation; the condensate drain/water return line is restricted; or the condensate/water return check valve is leaking or has failed. 2. Primary/inlet steam line is not properly trapped (steam as energy source only). 3. Vacuum breaker is faulty. 4. Improperly sized or disconnected expansion tank in closed loop piping system. 5. Inadequate water hammer arrestors.	1. Rearrange the condensate drain/water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the condensate drain/water return line. Replace the check valve if it is leaking or has failed. Inspect F&T trap and drip line. If condensate drain/water return line is restricted due to trap, contact the local DHT representative for the required trap size. Also inspect vacuum breaker for any malfunctioning. 2. Reconfigure the primary/inlet steam line to allow main and auxiliary (drip) traps to function properly. 3. Check and replace the vacuum breaker if faulty. 4. Install the properly sized expansion tank in the closed loop piping system as shown in Installation and Piping drawings in Section 6.3. 5. 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 3.6. 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. Over-temperature solenoid valve leaks/open. 4. Recirculating pump malfunctions/failed. Flow is stagnant through the heat exchanger.	1. Check and readjust the over-temperature setting as necessary. Refer to adjustment instructions contained in Section 3.6. Replace the defective parts. 2. Replace the thermocouple if shorted. 3. Readjust or replace the solenoid valve if defective. 4. Check to make sure pump is functioning properly. Also, check for any blockage in the piping to ensure proper flow through heat exchanger.
Solenoid Valve does not open and DHW supply temperature is higher than the secondary alarm limit.	1. Solenoid valve is defective or disconnected.	1. Check to make sure solenoid valve wiring is done correctly and not loose. Also, check to make sure voltage is present. Replace the solenoid valve if defective.

	2. Automatic over temperature settings not properly set, loose wiring or defective parts.	2. Check and readjust the over-temperature setting as necessary. Refer to adjustment instructions contained in Section 3.6. Replace the defective parts.
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.

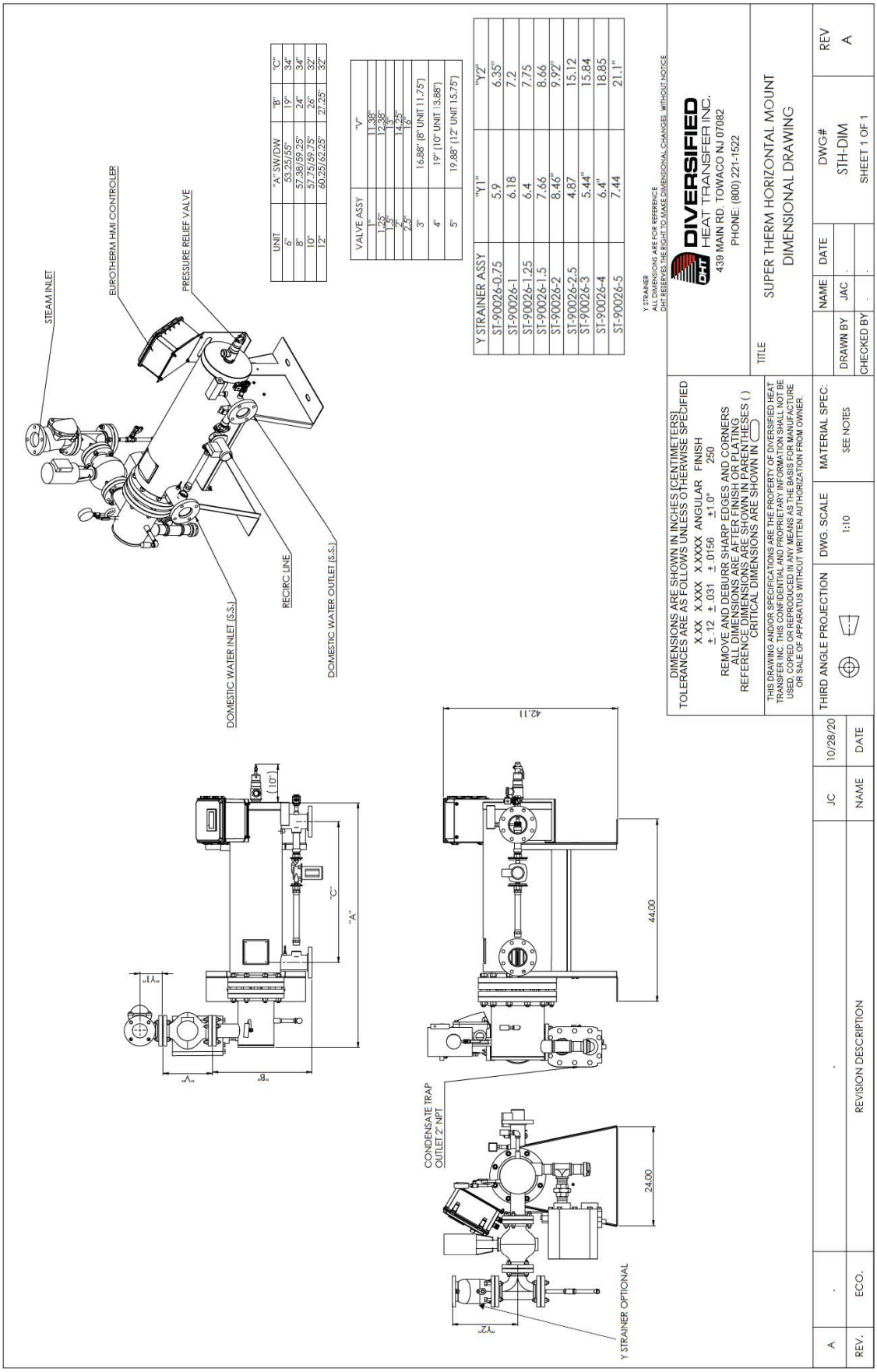
NOTE:
Use of non-DHT thermocouple on unit may lead to temperature controls issues. See 4.19 for DHT thermocouple part number details.

SECTION 6: TECHNICAL DRAWINGS & FORMS

6.1 DIMENSIONAL DRAWINGS

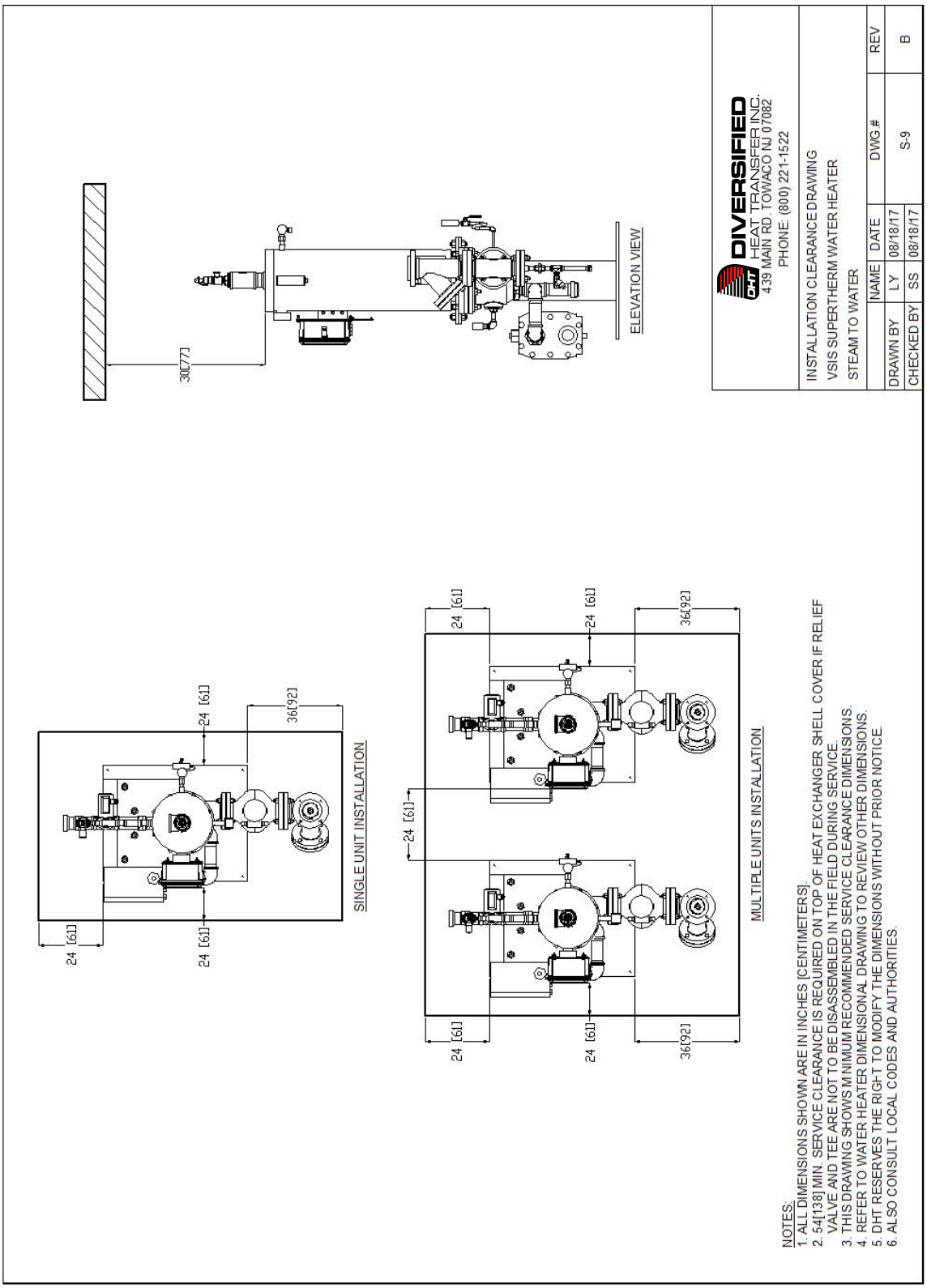


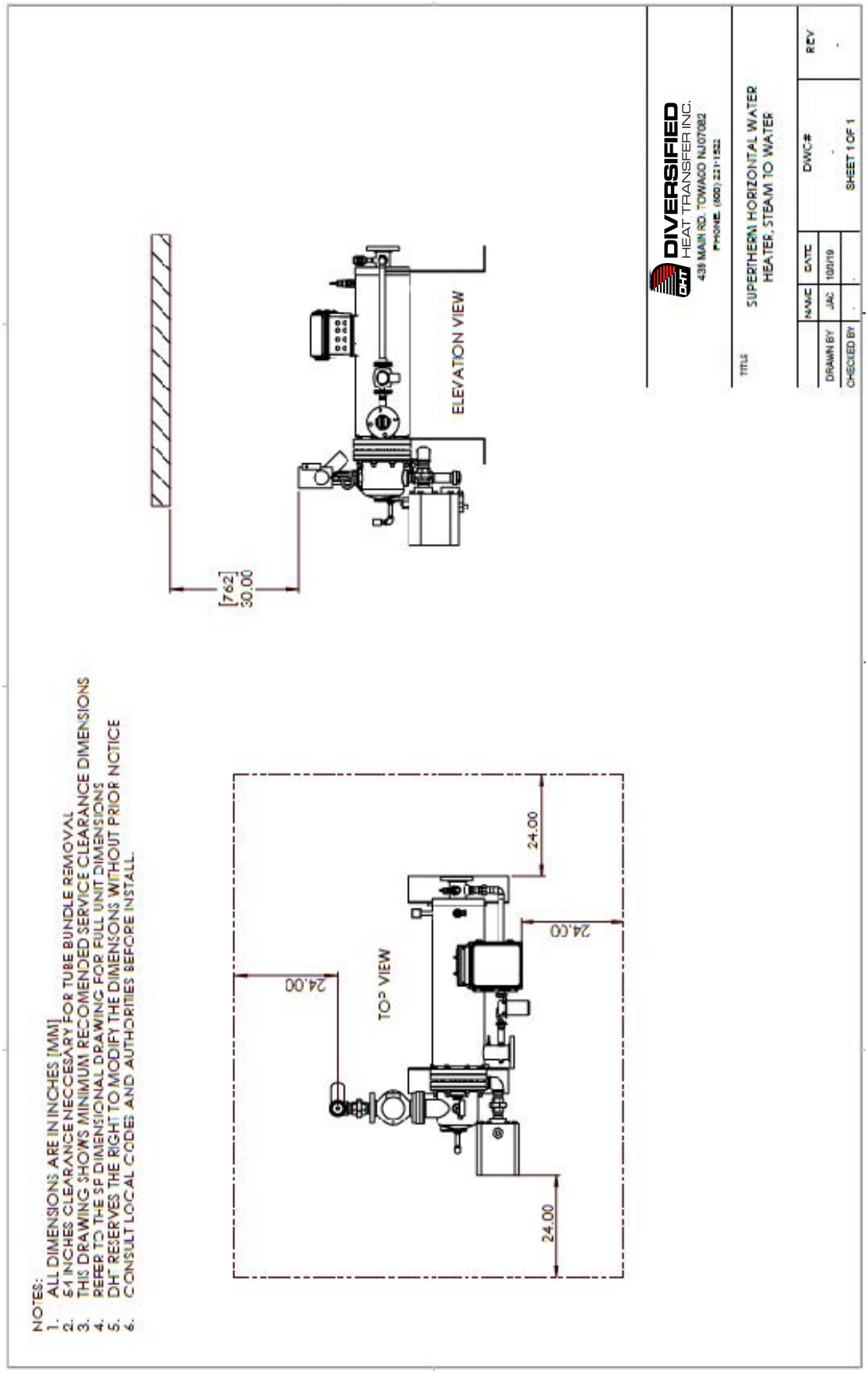
ST SERIES VERTICAL UNITS DIMENSIONAL DRAWING



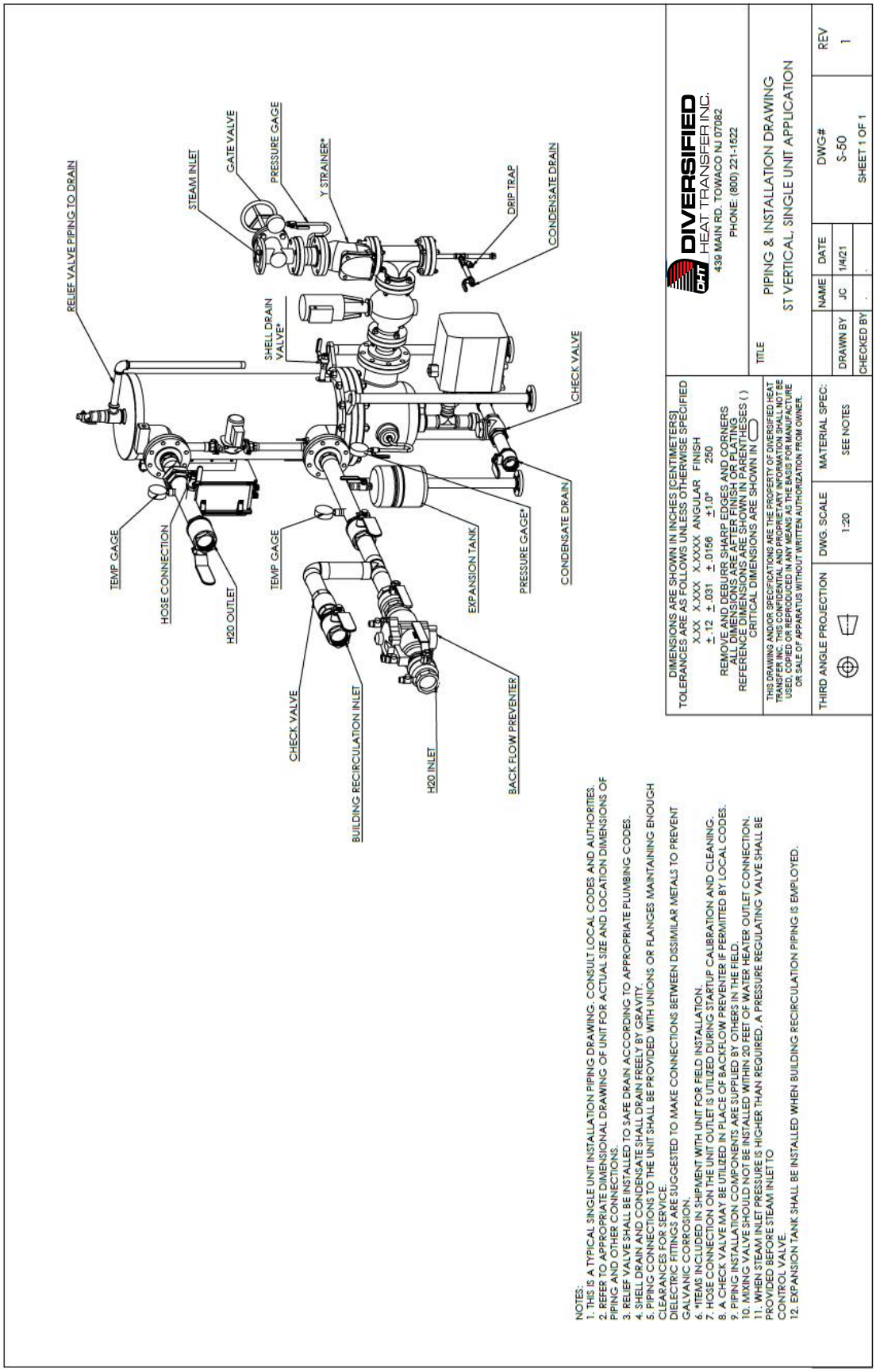
ST SERIES HORIZONTAL UNITS DIMENSIONAL DRAWING

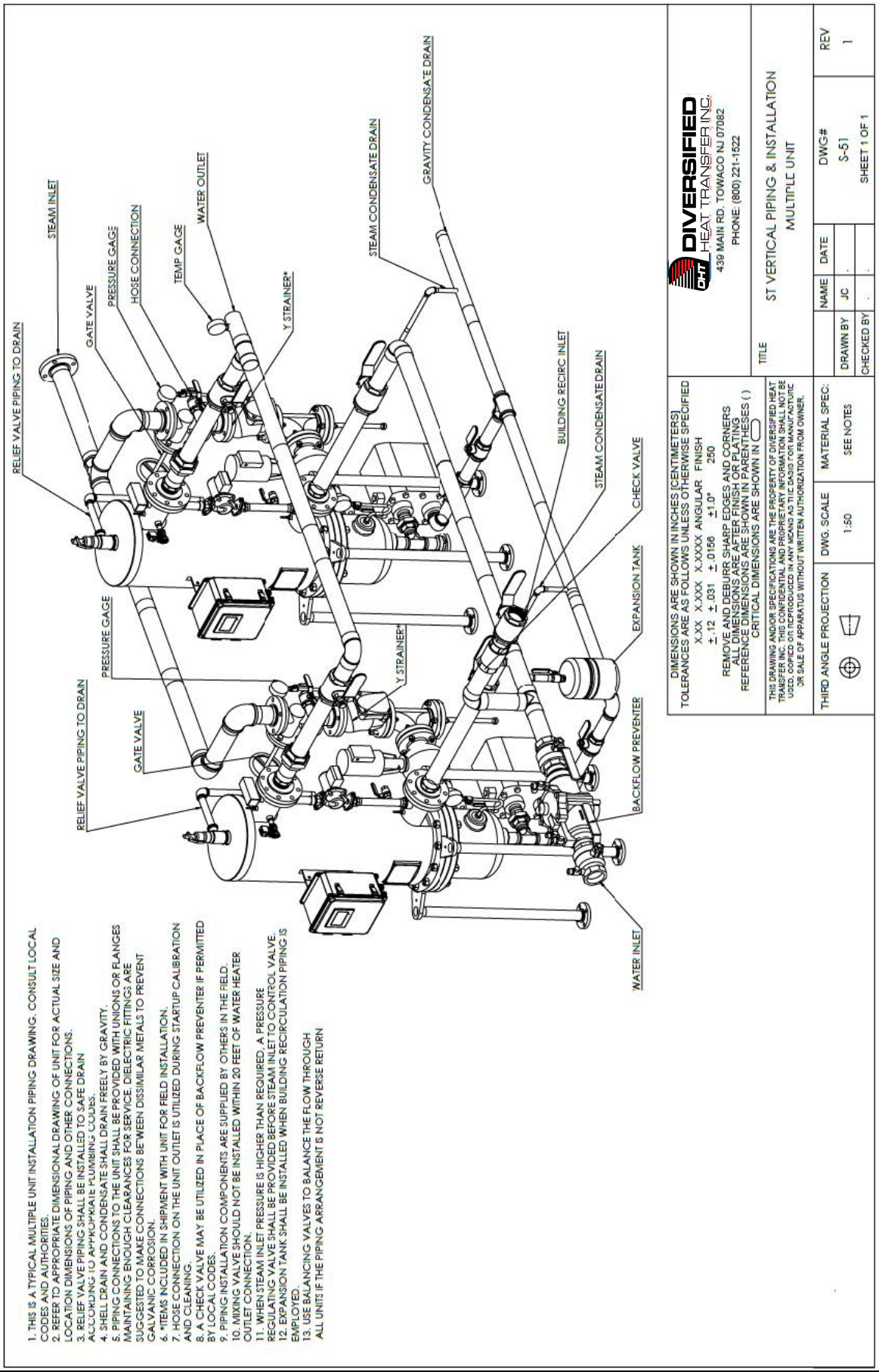
6.2 CLEARANCE DRAWINGS

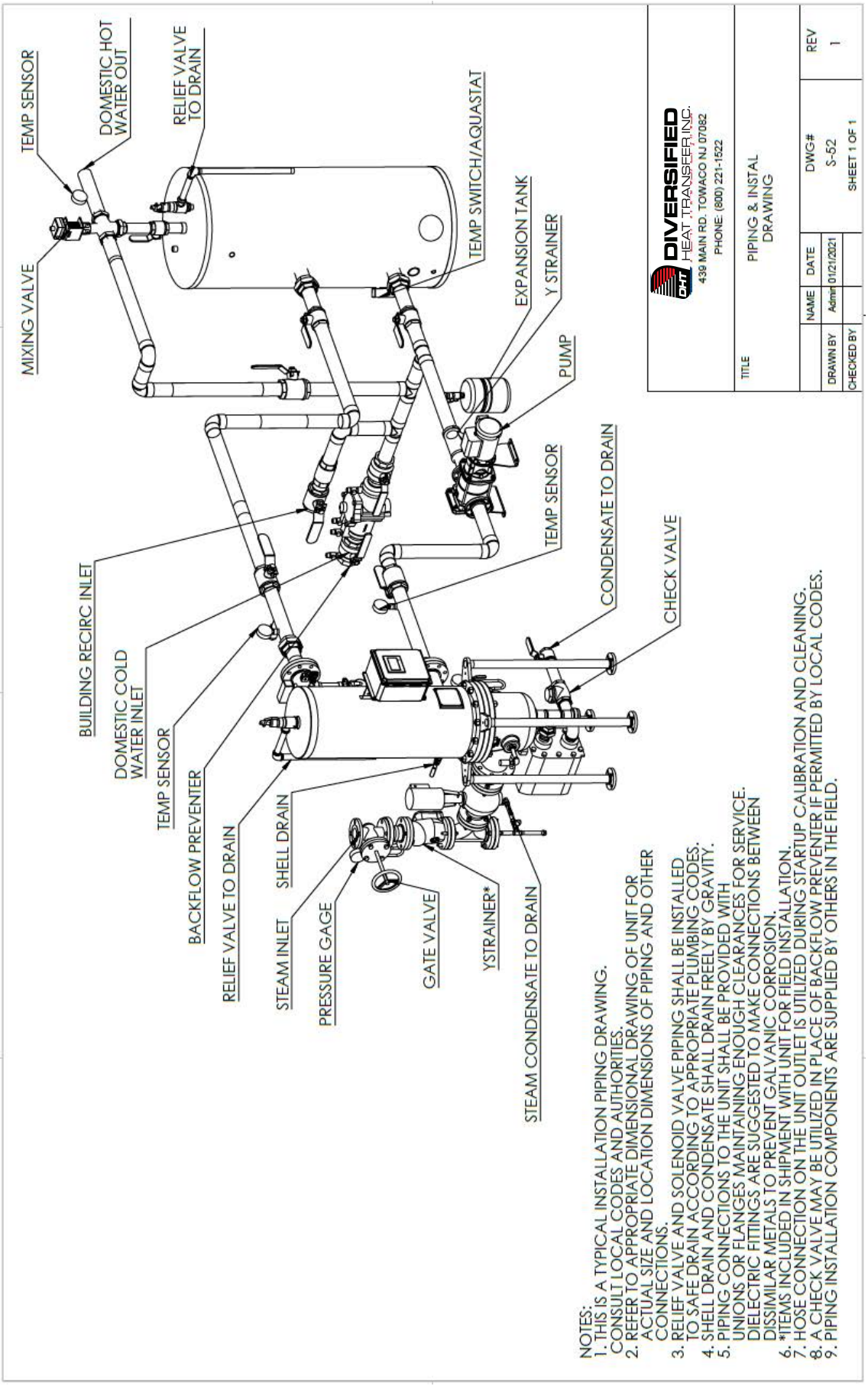


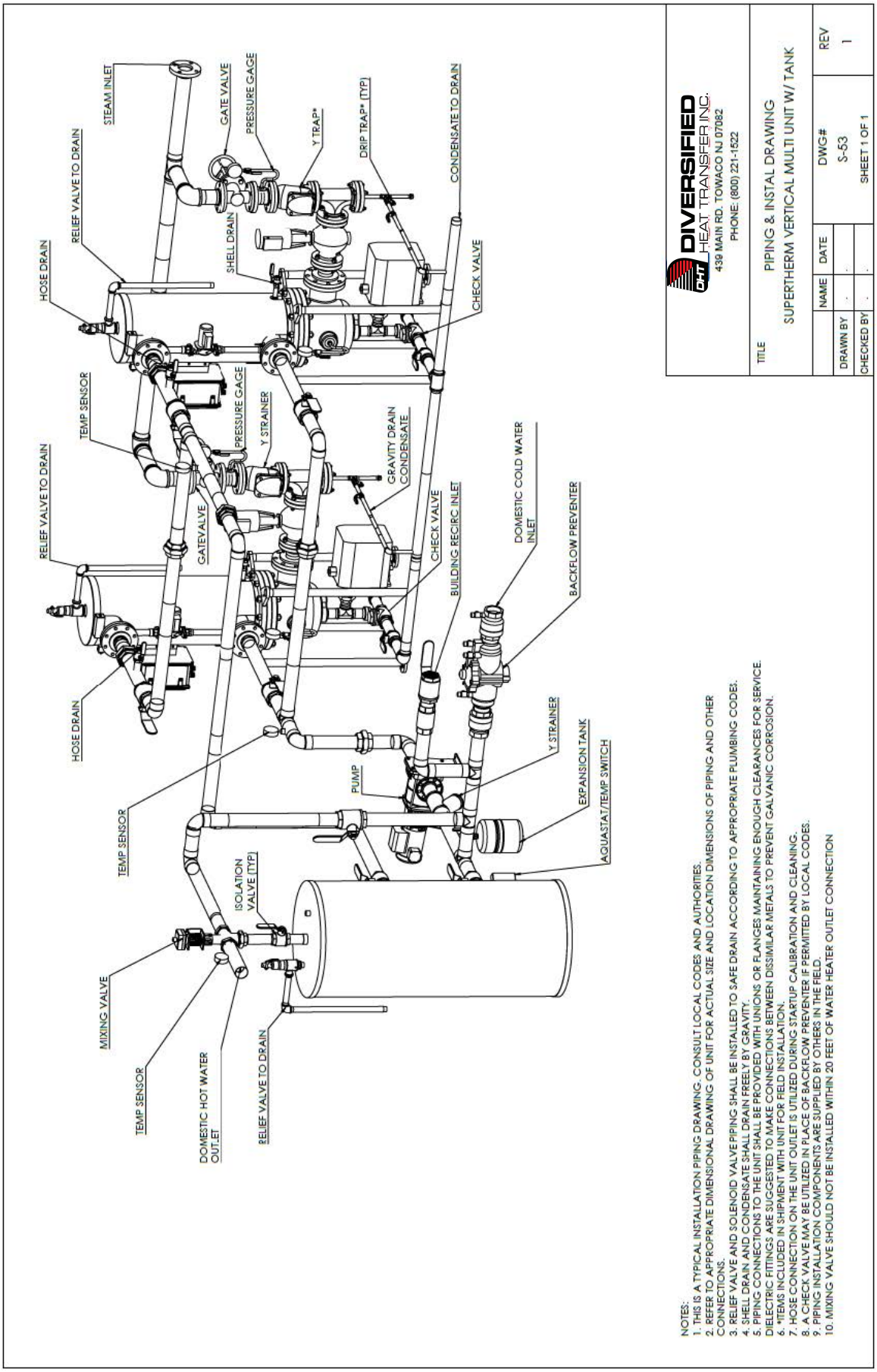

DIVERSIFIED
HEAT TRANSFER INC.
439 MAIN RD. TOWACO NJ 07082
PHONE: (800) 221-1522
TITLE
SUPERTHERM HORIZONTAL WATER
HEATER, STEAM TO WATER
NAME
DATE
DRAWN BY
JAC
10/2/19
CHECKED BY
DWG#
REV
SHEET 1 OF 1
ELEVATION VIEW
[762]
30.00
TOP VIEW
24.00
24.00
24.00
24.00
NOTES:
1. ALL DIMENSIONS ARE IN INCHES [MM]
2. 24 INCHES CLEARANCE NECCESARY FOR TUBE BUNDLE REMOVAL
3. THIS DRAWING SHOWS MINIMUM RECOMENDED SERVICE CLEARANCE DIMENSIONS
4. REFER TO THE SP DIMENSIONAL DRAWING FOR FULL UNIT DIMENSIONS
5. DHT RESERVES THE RIGHT TO MODIFY THE DIMENSIONS WITHOUT PRIOR NOTICE
6. CONSULT LOCAL CODES AND AUTHORITIES BEFORE INSTALL.

6.3 PIPING AND INSTALLATION DRAWINGS

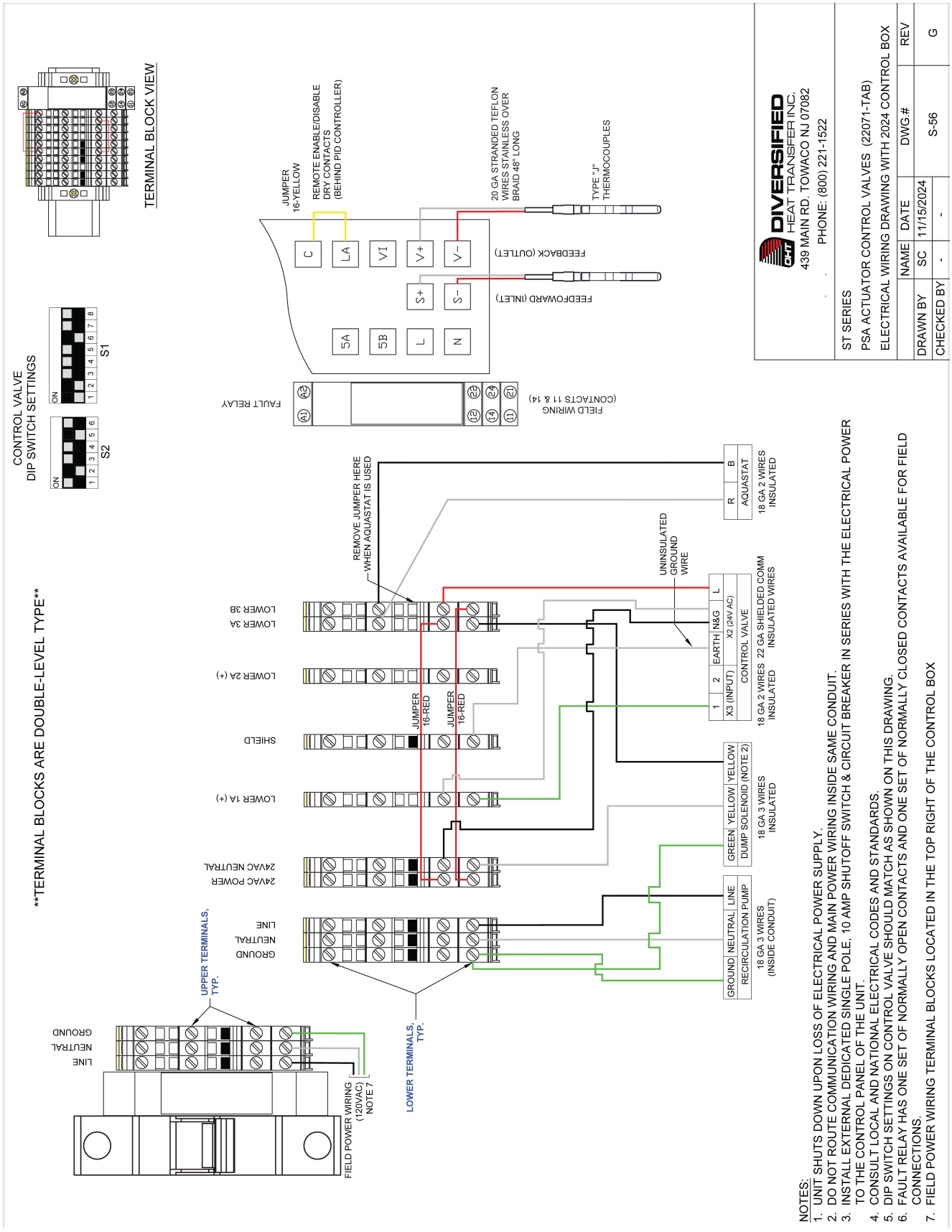


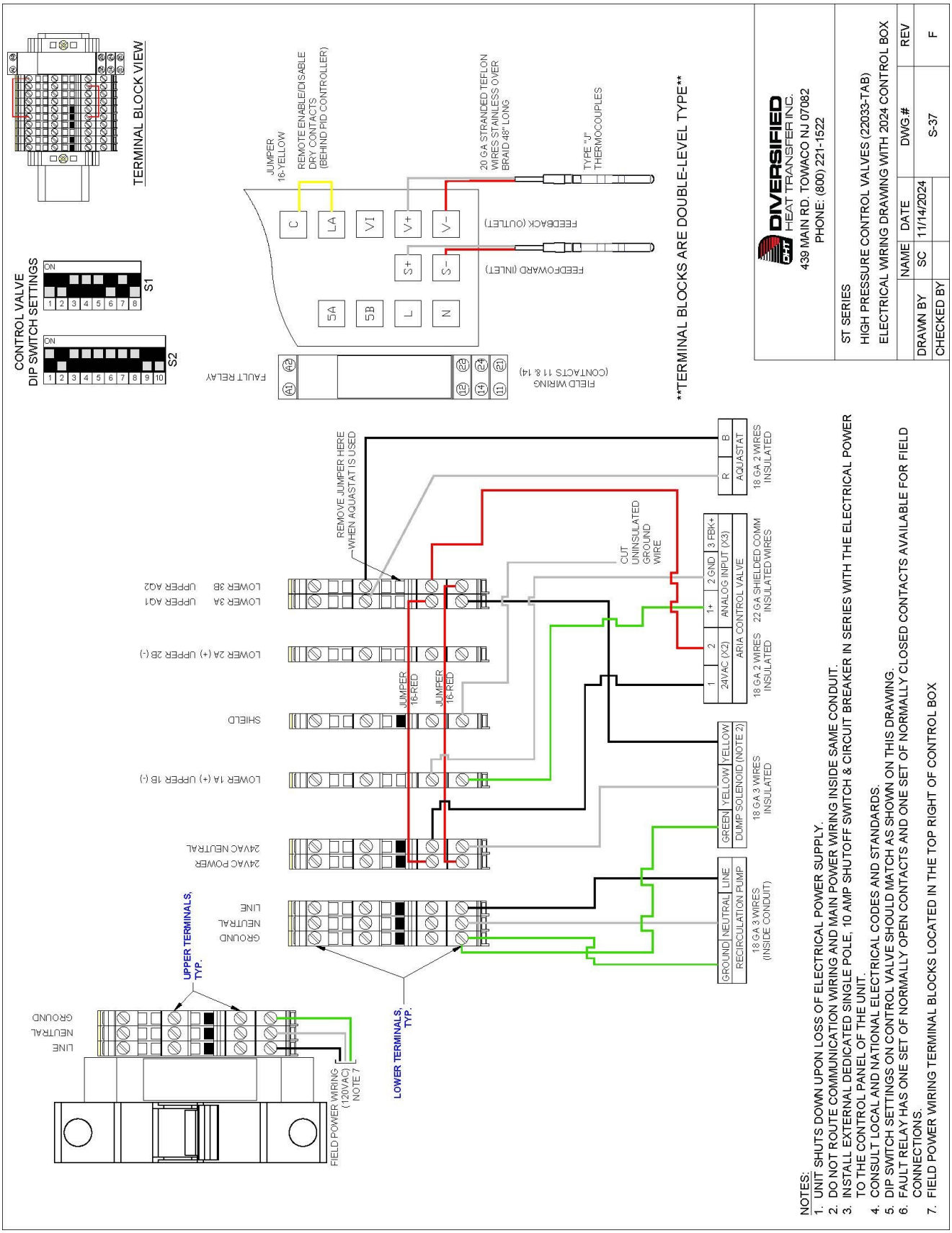

RELIEF VALVE PIPING TO DRAIN
STEAM INLET
GATE VALVE
PRESSURE GAGE
HOSE CONNECTION
TEMP GAGE
WATER OUTLET
Y STRAINER*
STEAM CONDENSATE DRAIN
GRAVITY CONDENSATE DRAIN
BUILDING RECIRC INLET
STEAM CONDENSATE DRAIN
CHECK VALVE
EXPANSION TANK
BACKFLOW PREVENTER
WATER INLET
Y STRAINER*
PRESSURE GAGE
GATE VALVE
RELIEF VALVE PIPING TO DRAIN
1. THIS IS A TYPICAL MULTIPLE UNIT 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 VALVE PIPING SHALL BE INSTALLED TO SAFE DRAIN ACCORDING TO APPROPRIATE PLUMBING CODES.
4. SHELL DRAIN AND CONDENSATE SHALL DRAIN FREELY BY GRAVITY.
5. 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.
6. *ITEMS INCLUDED IN SHIPMENT WITH UNIT FOR FIELD INSTALLATION.
7. HOSE CONNECTION ON THE UNIT OUTLET IS UTILIZED DURING STARTUP CALIBRATION AND CLEANING.
8. A CHECK VALVE MAY BE UTILIZED IN PLACE OF BACKFLOW PREVENTER IF PERMITTED BY LOCAL CODES.
9. PIPING INSTALLATION COMPONENTS ARE SUPPLIED BY OTHERS IN THE FIELD.
10. MIXING VALVE SHOULD NOT BE INSTALLED WITHIN 20 FEET OF WATER HEATER OUTLET CONNECTION.
11. WHEN STEAM INLET PRESSURE IS HIGHER THAN REQUIRED, A PRESSURE REGULATING VALVE SHALL BE PROVIDED BEFORE STEAM INLET TO CONTROL VALVE.
12. EXPANSION TANK SHALL BE INSTALLED WHEN BUILDING RECIRCULATION PIPING IS EMPLOYED.
13. USE BALANCING VALVES TO BALANCE THE FLOW THROUGH ALL UNITS IF THE PIPING ARRANGEMENT IS NOT REVERSE RETURN
DIMENSIONS ARE SHOWN IN INCHES [CENTIMETERS]
TOLERANCES ARE AS FOLLOWS UNLESS OTHERWISE SPECIFIED
X.XX X.XXX X.XXXX ANGULAR FINISH
±.12 ±.031 ±.0156 ±1.0° 250
REMOVE AND DEBURR SHARP EDGES AND CORNERS
ALL DIMENSIONS ARE AFTER FINISH OR PLATING
REFERENCE DIMENSIONS ARE SHOWN IN PARENTHESES ( )
CRITICAL DIMENSIONS ARE SHOWN IN
THIS DRAWING AND/OR SPECIFICATIONS ARE THE PROPERTY OF DIVERSIFIED HEAT TRANSFER INC. THIS CONFIDENTIAL AND PROPRIETARY INFORMATION SHALL NOT BE USED, COPIED, REPRODUCED OR DISCLOSED IN WHOLE OR IN PART NOR USED FOR SALE OF APPARATUS WITHOUT WRITTEN AUTHORIZATION FROM OWNER.
THIRD ANGLE PROJECTION
DWG. SCALE
1:50
MATERIAL SPEC:
SEE NOTES
DIVERSIFIED HEAT TRANSFER INC.
439 MAIN RD. TOWACO NJ 07082
PHONE: (800) 221-1522
TITLE
ST VERTICAL PIPING & INSTALLATION
MULTIPLE UNIT
NAME
DATE
DRAWN BY
JC
CHECKED BY
DWG#
S-51
SHEET 1 OF 1
REV
1


TEMP SENSOR
DOMESTIC HOT WATER OUT
RELIEF VALVE TO DRAIN
MIXING VALVE
TEMP SWITCH/AQUASTAT
EXPANSION TANK
Y STRAINER
PUMP
BUILDING RECIRC INLET
DOMESTIC COLD WATER INLET
TEMP SENSOR
BACKFLOW PREVENTER
RELIEF VALVE TO DRAIN
STEAM INLET
SHELL DRAIN
PRESSURE GAGE
GATE VALVE
YSTRAINER*
STEAM CONDENSATE TO DRAIN
TEMP SENSOR
CONDENSATE TO DRAIN
CHECK VALVE
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 VALVE AND SOLENOID VALVE PIPING SHALL BE INSTALLED TO SAFE DRAIN ACCORDING TO APPROPRIATE PLUMBING CODES.
4. SHELL DRAIN AND CONDENSATE SHALL DRAIN FREELY BY GRAVITY.
5. 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.
6. *ITEMS INCLUDED IN SHIPMENT WITH UNIT FOR FIELD INSTALLATION.
7. HOSE CONNECTION ON THE UNIT OUTLET IS UTILIZED DURING STARTUP CALIBRATION AND CLEANING.
8. A CHECK VALVE MAY BE UTILIZED IN PLACE OF BACKFLOW PREVENTER IF PERMITTED BY LOCAL CODES.
9. PIPING INSTALLATION COMPONENTS ARE SUPPLIED BY OTHERS IN THE FIELD.
DIVERSIFIED HEAT TRANSFER,INC.
439 MAIN RD. TOWACO NJ 07082
PHONE: (800) 221-1522
TITLE
PIPING & INSTAL DRAWING
NAME
DATE
DWG#
REV
DRAWN BY
Admin
01/21/2021
S-52
1
CHECKED BY
SHEET 1 OF 1


STEAM INLET
GATE VALVE
PRESSURE GAGE
Y TRAP*
DRIP TRAP* (TYP)
CONDENSATE TO DRAIN
RELIEF VALVE TO DRAIN
SHELL DRAIN
CHECK VALVE
HOSE DRAIN
TEMP SENSOR
PRESSURE GAGE
Y STRAINER
GRAVITY DRAIN CONDENSATE
RELIEF VALVE TO DRAIN
GATEVALVE
CHECK VALVE
BUILDING RECIRC INLET
DOMESTIC COLD WATER INLET
BACKFLOW PREVENTER
HOSE DRAIN
Y STRAINER
PUMP
EXPANSION TANK
TEMP SENSOR
AQUASTAT/TEMP SWITCH
ISOLATION VALVE (TYP)
MIXING VALVE
TEMP SENSOR
DOMESTIC HOT WATER OUTLET
RELIEF VALVE TO DRAIN
DIVERSIFIED HEAT TRANSFER INC.
439 MAIN RD. TOWACO NJ 07082
PHONE: (800) 221-1522
TITLE
PIPING & INSTAL DRAWING
SUPERTHERM VERTICAL MULTI UNIT W/ TANK
NAME
DATE
DRAWN BY
CHECKED BY
DWG#
S-53
REV
1
SHEET 1 OF 1
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 VALVE AND SOLENOID VALVE PIPING SHALL BE INSTALLED TO SAFE DRAIN ACCORDING TO APPROPRIATE PLUMBING CODES.
4. SHELL DRAIN AND CONDENSATE SHALL DRAIN FREELY BY GRAVITY.
5. PIPING CONNECTIONS TO THE UNIT SHALL BE PROVIDED WITH UNIONS OR FLANGES MAINTAINING ENOUGH CLEARANCES FOR SERVICE. DIELECTRIC FITINGS ARE SUGGESTED TO MAKE CONNECTIONS BETWEEN DISSIMILAR METALS TO PREVENT GALVANIC CORROSION.
6. *ITEMS INCLUDED IN SHIPMENT WITH UNIT FOR FIELD INSTALLATION.
7. HOSE CONNECTION ON THE UNIT OUTLET IS UTILIZED DURING STARTUP CALIBRATION AND CLEANING.
8. A CHECK VALVE MAY BE UTILIZED IN PLACE OF BACKFLOW PREVENTER IF PERMITTED BY LOCAL CODES.
9. PIPING INSTALLATION COMPONENTS ARE SUPPLIED BY OTHERS IN THE FIELD.
10. MIXING VALVE SHOULD NOT BE INSTALLED WITHIN 20 FEET OF WATER HEATER OUTLET CONNECTION

6.4 ELECTRICAL WIRING DIAGRAMS/SCHEMATICS




TERMINAL BLOCK VIEW
CONTROL VALVE DIP SWITCH SETTINGS
S1
S2
FAULT RELAY
JUMPER 16-YELLOW
REMOTE ENABLE/DISABLE DRY CONTACTS (BEHIND PID CONTROLLER)
20 GA STRANDED TEFLON WIRES,STAINLESS OVER BRAID 48" LONG
TYPE "J" THERMOCOUPLES
FEEDBACK (OUTLET)
FEEDFOWARD (INLET)
FIELD WIRING (CONTACTS 11 & 14)
TERMINAL BLOCKS ARE DOUBLE-LEVEL TYPE
DIVERSIFIED HEAT TRANSFER INC.
439 MAIN RD. TOWACO NJ 07082
PHONE: (800) 221-1522
ST SERIES
HIGH PRESSURE CONTROL VALVES (22033-TAB)
ELECTRICAL WIRING DRAWING WITH 2024 CONTROL BOX
DRAWN BY SC 11/14/2024
CHECKED BY
DWG.# S-37
REV F
REMOVE JUMPER HERE WHEN AQUASTAT IS USED
CUT UNINSULATED GROUND WIRE
AQUASTAT
ARIA CONTROL VALVE
ANALOG INPUT (X3)
24VAC (X2)
DUMP SOLENOID (NOTE 2)
RECIRCULATION PUMP
18 GA 2 WIRES INSULATED
22 GA SHIELDED COMM INSULATED WIRES
18 GA 3 WIRES INSULATED
18 GA 3 WIRES (INSIDE CONDUIT)
JUMPER 16-RED
SHIELD
LOWER 2A (+) UPPER 2B (-)
LOWER 1A (+) UPPER 1B (-)
24VAC NEUTRAL
24VAC POWER
GROUND
NEUTRAL
LINE
UPPER TERMINALS, TYP.
LOWER TERMINALS, TYP.
FIELD POWER WIRING (120VAC) NOTE 7
NOTES:
1. UNIT SHUTS DOWN UPON LOSS OF ELECTRICAL POWER SUPPLY.
2. DO NOT ROUTE COMMUNICATION WIRING AND MAIN POWER WIRING INSIDE SAME CONDUIT.
3. INSTALL EXTERNAL DEDICATED SINGLE POLE, 10 AMP SHUTOFF SWITCH & CIRCUIT BREAKER IN SERIES WITH THE ELECTRICAL POWER TO THE CONTROL PANEL OF THE UNIT.
4. CONSULT LOCAL AND NATIONAL ELECTRICAL CODES AND STANDARDS.
5. DIP SWITCH SETTINGS ON CONTROL VALVE SHOULD MATCH AS SHOWN ON THIS DRAWING.
6. FAULT RELAY HAS ONE SET OF NORMALLY OPEN CONTACTS AND ONE SET OF NORMALLY CLOSED CONTACTS AVAILABLE FOR FIELD CONNECTIONS.
7. FIELD POWER WIRING TERMINAL BLOCKS LOCATED IN THE TOP RIGHT OF CONTROL BOX

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 ST Series Installation Form

DIVERSIFIED HEAT TRANSFER INC.

ST SERIES INSTALLATION FORM

Please complete ONE (1) form for each SITE at which DHT ST 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.

Completed by: _____ Date: _____

UNIT AND LOCATION	
Installation Name:	Technician:
Street Address:	Company:
City, State, Zip:	
Phone#:	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. Does the installation meet DHT recommended clearances?	☐ Yes	☐ No
2. Does condensate gravity drain?	☐ Yes	☐ No
3. Is there any lift in the condensate piping?	☐ Yes	☐ No
4. Does condensate drain to a receiver?	☐ Yes	☐ No
5. Is the relief valve piped to drain or within 12" of floor?	☐ Yes	☐ No
6. Is the unit's drain piped to the floor or a drain?	☐ Yes	☐ No
7. Is a recirculation system used to maintain system water temperature?	☐ Yes	☐ No
8. If yes, what is the recirculation pump capacity in GPM?	GPM	
9. Is heat trace used to maintain system water temperatures?	☐ Yes	☐ No
10. What is the outlet water temperature set point?	°F	
11. What is the high limit temperature switch setting?	°F	
12. For a multiple unit installation, does the system utilize one or more of the following balancing methods?		
Reverse Return Piping	☐ Yes	☐ No
Balancing Valves	☐ Yes	☐ No
Current Feed Manifolds	☐ Yes	☐ No

FOR HEATERS USING A STORAGE TANK		
1. Storage tank is:	☐ Stratified	☐ Accumulator

DIVERSIFIED HEAT TRANSFER INC.

2. Does the tank have	☐ Baffle		☐ Dispersion Tube	
3. What is the storage tanks volume?	Gallons			
4. What is the heater outlet temperature?	°F			
5. Position of aquastat:	☐ Upper 1/3	☐ Middle 1/3	☐ Lower 1/3	☐ No aquastat
6. What is the aquastat temperature setting?	°F			
7. Does the aquastat control the pump between the tank & heater?	☐ Yes		☐ No	
8. Is a throttling valve installed between the pump and heater?	☐ Yes		☐ No	
9. Is there a bypass loop around the pump?	☐ Yes		☐ No	
10. What is the capacity of pump between the tank and heater?	GPM			

WATER HEATER INSTALLATION		
1. Are isolation valves installed in the inlet piping?	☐ Yes	☐ No
2. Are isolation valves installed in the outlet piping?	☐ Yes	☐ No
3. Is a hose bib installed in the outlet piping?	☐ Yes	☐ No
4. Are check valves installed in the cold water inlet?	☐ Yes	☐ No
5. Are check valves installed in the recirculation line?	☐ Yes	☐ No
6. Building recirculation is piped to:	☐ Inlet Side of Heater	☐ Inlet Side of Heater
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 plant delta T?	°F	

VALVE INFORMATION			
1. What is the inlet steam pressure to the valve?	PSI		
2. What is the inlet temp of Boiler Water?	°F		
3. Has the boiler water flow been balanced between the units?	☐ Yes	☐ No	
4. Type of valve:	☐ Pneumatic	☐ Self- Contained	☐ Electric
	☐ Other (specify model/ manufacturer)		

DIVERSIFIED HEAT TRANSFER INC.

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

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.

Other Notes:

DIVERSIFIED HEAT TRANSFER INC.

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

6.5.3 ST Series Startup Form

DIVERSIFIED HEAT TRANSFER INC.

ST SERIES START-UP FORM

Please complete ONE (1) form for each SITE at which DHT ST 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.

Completed by: _____ Date: _____

UNIT AND LOCATION	
Installation Name:	Technician:
Street Address:	Company:
City, State, Zip:	
Phone#:	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. Does the installation meet DHT recommended clearances?		☐ Yes	☐ No
2. Does condensate gravity drain?		☐ Yes	☐ No
3. Does condensate drain to a receiver?		☐ Yes	☐ No
4. Is the relief valve piped to drain or within 12" of floor?		☐ Yes	☐ No
5. Is the unit's drain piped to the floor or a drain?		☐ Yes	☐ No
6. Is a recirculation system used to maintain system water temperature?		☐ Yes	☐ No
7. If yes, what is the recirculation pump capacity in GPM?		GPM	
8. What is the outlet water temperature set point?		°F	
9. What is the high limit temperature switch setting?		°F	
10. For a multiple unit installation, does the system utilize one or more of the following balancing methods for domestic water?	Reverse Return Piping	☐ Yes	☐ No
	Balancing Valves	☐ Yes	☐ No
	Current Feed Manifolds	☐ Yes	☐ No

FOR HEATERS USING A STORAGE TANK		
1. Storage tank is:	☐ Stratified	☐ Accumulator
2. Does the tank have	☐ Baffle	☐ Dispersion Tube
3. What is the storage tanks volume?	Gallons	
4. What is the heater outlet temperature?	°F	

DIVERSIFIED HEAT TRANSFER INC.

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

WATER HEATER INSTALLATION		
1. Are isolation valves installed in the inlet piping?	☐ Yes	☐ No
2. Are isolation valves installed in the outlet piping?	☐ Yes	☐ No
3. Is a hose bib installed in the outlet piping?	☐ Yes	☐ No
4. Are check valves installed in the cold water inlet?	☐ Yes	☐ No
5. Are check valves installed in the recirculation line?	☐ Yes	☐ No
6. Building recirculation is piped to:	☐ Inlet Side of Heater	☐ Inlet Side of Heater
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 plant delta T?	°F	

VALVE INFORMATION			
1. What is the inlet steam pressure to the valve?	PSI		
2. What is the inlet temp of Boiler Water?	°F		
3. Has the boiler water flow been balanced between the units?	☐ Yes	☐ No	
4. Type of valve:	☐ Pneumatic	☐ Self- Contained	☐ Electric
	☐ Other (specify model/ manufacturer)		

SECTION 7: WARRANTY

ST SERIES WATER HEATER PRODUCT SPECIFIC LIMITED 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 ST Series Water Heater. The ST Series Water Heater must be operated in accordance with the conditions stated herein, against the indicated failures. The ST 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.

- **TUBE BUNDLE** shall carry a non-prorated (5) year warranty against failure due to thermal shock, mechanical failure, manufacturing or material defect. The tube bundle shall not be warranted from failure due to scaling, liming, corrosion, or erosion due to water or installation conditions.
- **SHELL** shall carry a non-prorated (10) year warranty.
- **ALL OTHER COMPONENTS** shall carry a non-prorated (1) year warranty.

CONDITIONS OF WARRANTY:

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

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

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

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

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

A. Any product which has been altered or repaired by other than Seller's personnel;
B. Deterioration or failure of any product due to:
    a. abrasion, corrosion, erosion or fouling,
    b. misuse,
    c. modification not authorized by Seller in writing
    d. improper installation, lack of or improper maintenance or operation;

C. Equipment not furnished by Seller, either mounted or unmounted, or when contracted for by a party or parties other than Seller to be installed or handled;

D. The suitability of any product for any particular application;

E. The design or operation of owner's plant or equipment or of any facility or system of which any product may be made a part;

F. Any damage to the product due to abrasion, erosion, corrosion, deterioration, abnormal temperatures, or the influence of foreign matter or energy;

G. The performance of any product under conditions varying materially from those under which such product is usually tested under industry standards at the time of shipment;

H. 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;

I. Discoloration or rusty water caused by piping, fittings, valves, pumps, or other sources outside of the ST Series Water Heater;

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. Damage to surrounding area or property caused by leakage or malfunction;

L. 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 ST Series Water Heater or components;

M. 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

N. 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.

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.

-END-

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Change Log:

Date	Description	Changed By
03/18/2021	Initial Release	SS
4/12/2021	First Edit	KG @ Writing Assistance, LLC