Installation, Operation, and Maintenance

T270WM Modular Water Source Heat Pump Water Heater

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

May 2025

WSHP-SVX025A-EN

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/ sleeves, butyl gloves, safety glasses, hard hat/ bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠ WARNING

Cancer and Reproductive Harm!

This product can expose you to chemicals including lead and bisphenol A (BPA), which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

⚠ WARNING

Explosion Hazard!

Failure to follow instructions below could result in death or serious injury from explosion due to oxygen reacting violently with oil.

Do not use oxygen to purge or pressurize system for leak test.

⚠ WARNING

Electrical Shock Hazard!

Failure to follow instructions below could result in death or serious injury.

Before performing any service, turn off power to the water heater and label all wires prior to disconnecting. Wiring errors can cause improper and dangerous operation.

⚠ WARNING

Burn Hazard!

Water temperature over 125°F (52°C) can cause severe burns instantly resulting in death or serious injury.

- **Always feel water temperature before bathing or showering.**
- **Install temperature-limiting devices like mixing valves when required by orders for safe water temperatures at fixtures.**

⚠ WARNING

Explosion Hazard!

Failure to follow instructions below could result in death or serious injury due to water tank explosion from overheated water.

Install properly sized temperature and pressure relief valve in the opening provided on connected storage tanks.

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Table of Contents

General Description

Purpose

Water source units are water-to-water Commercial Heat Pump Water Heaters (CHPWHs) using R513A refrigerant in a closed and factory charged circuit. A double wall heat exchanger provides heat to a potable water circuit. Potable water is piped to the heat pump in a loop to and from external storage tanks. Circulation is provided by the integral circulator in the heat pump. A single wall heat exchanger extracts heat from a source water loop, such as a ground loop or condenser loop.

Usage

Water heaters are designed to provide hot water in a single-pass or a multi-pass configuration, determined when the unit is ordered.

In a single-pass configuration, water is delivered at full usable temperature to the potable storage tank in one pass. This allows for faster recovery of usable water temperatures than in traditional multi-pass configurations. This system is not an on-demand heater and does require external and stratified storage to operate effectively. Building recirculation loops must be returned to a separate swing tank to preserve this stratification.

Multi-pass units do not require swing tanks, and recirculate water to and from primary storage, raising the water several degrees with each pass. This requires larger primary storage tanks but can be more appropriate in some retrofit applications, especially for part-load heat pump contributions.

Flexible Installation

The enclosure is designed to minimize its footprint, and to simplify placement considerations for multiple-unit installations, including zero side clearance requirements for installation and service. As a monobloc style heat pump, the unit arrives ready to connect to electrical, condensate, source water loops, and potable water infrastructure in the field.

It features an integral load side circulator, water temperature control valve, and a double wall heat exchanger for direct piped domestic hot water.

Controls and Electrical

The T270WM water source line is available in 208-230, 440-480, and 575v 3-phase variants with a single point power connection. All R513A heat pumps feature an SCCR rating of 100.

All units are Modbus and BACnet® capable using the BMS Gateway accessory option, ready to be integrated into BMS systems by 3rd party integrators using Bacnet/IP and MSTP protocols.

All R513A units are certified to UL/CSA 60335-2-1 and -40.

For More Information

Please refer to the Performance Specifications for appropriate operating ranges and requirements.

Performance Specifications and Requirements

Table 1. T270WM performance specifications

Performance Specifications	Single-pass	Multi-pass
Nominal DOE capacity[a]	278,800 BTUs/hr.	
Nominal DOE performance[a]	4.1 COP	
Recovery Rate 2[b]	664 gal./hr.	
Min. ambient exposure	33° F	
DHW Loop		
Max water pressure	150 psig	
outlet operating range[c]	100 - 175° F	
Inlet operating range	40 - 115	40 - 140
Design flow rate	22.0 GPM	36.0 GPM
Water circuit pressure drop[d]	16.9 Ft. Hd.	7.4 Ft. Hd.
Heat pump Cv value[d]	8	20
DHW external head allowance[e]	19.5 Ft. Hd.	18.7 Ft. Hd.
Min. cold cycle volume[f]	119 Gal.	
Min. warm cycle volume[g]	N/A	334 Gal.
Min. tank volume[h]	N/A	835 Gal.
Source Loop		
Max Water Pressure	300 psig	
Source Water Operating Range	35 - 120° F	
Design Flow Rate	48 GPM	
Water Circuit Pressure Drop[d]	11.11 Ft. Hd.	
Heat Pump Cv Value[d]	22	
Misc.		
Sound Pressure (Front/Left/Right/Rear)[i]	72.1 - 71.9 - 70.9 - 73.6	
Certifications	UL60335-1, UL60335-2-40, CSA C22.2 60335-1, CSA 60335-2- 40 (LC16116-1)	

[a] Nominal heating performance is 100% water source at 80.6° F, DHW 120° F LWT, and 70° F EWT.
[b] Recovery Rate is at nominal heating performance condition producing 120° F water.
[c] Maximum LWT not available at all ambient conditions. See max LWT graph.
[d] Heat Pump pressure drop and Cv value are for external pump applications at design flow rate.
[e] Piping pressure drop allowed by integral circulator in the heat pump.
[f] Cold ccle volume is the volume below the cold trigger sensor. Cold in water over 70° F will need more volume.
[g] Warm cycle volume is the volume of water below the warm/recirc trigger sensor.
[h] Tank volume is based on individual project demands but cannot be lower than this minimum value in any case.
[i] Sound Pressure measured 3-feet away, 3-feet from ground.

Important: *R513A heat pumps will suspend operation when source loop conditions drop below their stated minimums. Single-pass heat pumps may limit their outgoing water temperature in lower ambient conditions. See the Maximum LWT diagram for details.*

NOTICE

Equipment Damage!

Failure to follow instructions below could result in performance degradation or equipment damage.

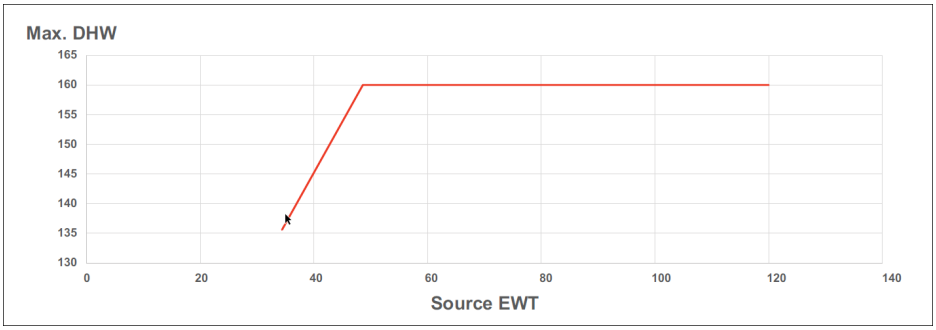
- **Do not install heat pumps such that they would need to be operated in conditions outside of their performance specifications.**
- **Do not install water source heat pumps in conditions that may freeze.**

Expanded Performance Data

Table 2. T270WM expanded performance (50° EWT, 140° LWT, 100% water source side)

Entering Source Water	Supply Heating Capacity (Btu/hr)	Source Cooling Capacity (Btu/hr)	Power Input (kW)	Heating COP	Cooling COP	Combined COP
90°F	280,400	203,630	22.5	3.7	2.7	6.3
80°F	253,600	178,536	22.0	3.4	2.4	5.8
70°F	226,900	153,542	21.5	3.1	2.1	5.2
60°F	200,600	129,460	20.9	2.8	1.8	4.6
50°F	174,400	105,478	20.2	2.5	1.5	4.1
40°F	152,200	87,031	19.1	2.3	1.3	3.7

Figure 1. Maximum source EWT - maximum DHW



Note: *Maximum source ETW: 120° F*

Electrical Specifications

Table 3. T270WM – electrical specifications

Main Power Input	208-230/3/60	460/3/60	575/3/60
Minimum circuit ampacity (MCA)	108	55	38
Minimum overcurrent protection (MOCP)	175	100	60
Rated load amps (RLA)	88	45	30
Short circuit current rating (SCCR)	100		
Internal component data			

Table 3. T270WM – electrical specifications (continued)

Main Power Input	208-230/3/60	460/3/60	575/3/60
Compressor locked rotor amps (LRA)	605	272	238
Compressor horsepower (HP)	25		

Sound Pressure Data

Table 4. T270WM sound pressure data

	Leq	1:1 Octave									
	LAeq (dBA)	31.5 Hz (dB)	63 Hz (dB)	125 Hz (dB)	250 Hz (dB)	500 Hz (dB)	1 kHz (dB)	2 kHz (dB)	4 kHz (dB)	8 kHz (dB)	16 kHz (dB)
Front	72.1	62.4	68.3	70.3	72	70	68.9	57.9	59.3	48	35.8
Left	71.9	61.1	73.7	69.9	73.3	72.1	65.8	59.1	59.1	48.7	36.2
Right	70.9	59	70.9	65.5	70.3	68.2	66.5	61	59.8	49.2	34
Rear	73.6	60.4	72.1	69.7	69.3	70.9	71.2	59.7	60.2	48.9	35.5

Physical Specifications and Clearances

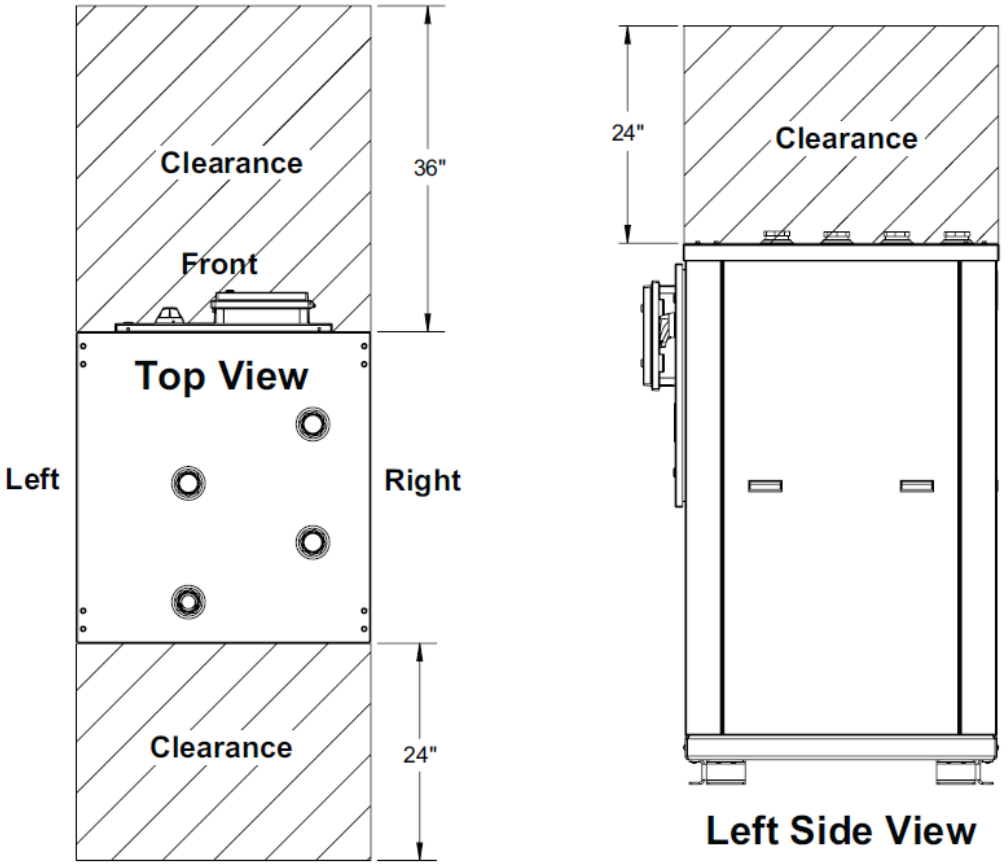
Table 5. T270WM physical specifications

Physical Specifications	
Domestic water connections	2–in. FPT
Source water connections	2–in. FPT
Internal DHW water volume (gal.)	4.7
Internal source water volume (gal.)	0.4
Dimensions (in.)	32-1/2–in. L x 39–in. D x 66-1/4–in. H
Weight (lbs.)	1074 Dry / 1113 operating

Table 5. T270WM physical specifications (continued)

Physical Specifications	
Compressor type	Scroll
Refrigerant	R513A
Factory charge	38.5
Oil charge (initial/recharge)	230/220
Salt spray resistance cabinet/ evap	1000

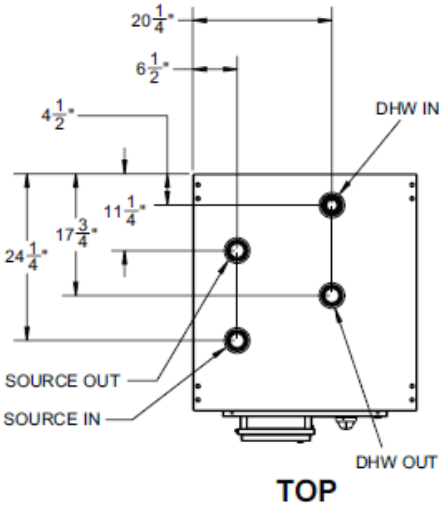
Figure 2. T270WM model clearances



Note: *If vibration transmission and/or seismic activity is a concern for installation, account for the additional height of vibration isolation or seismic measures as recommended by a qualified engineer.*

Dimensions

T270WM



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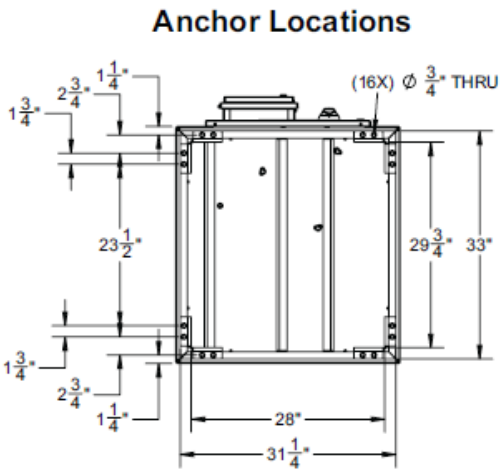

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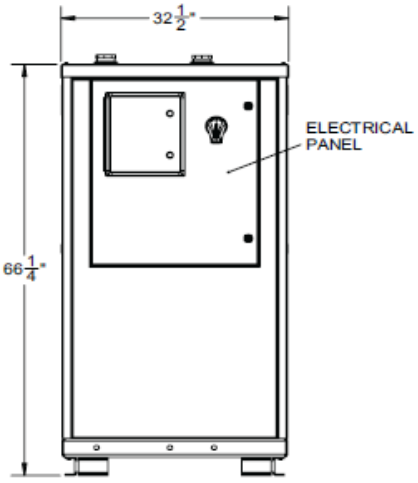
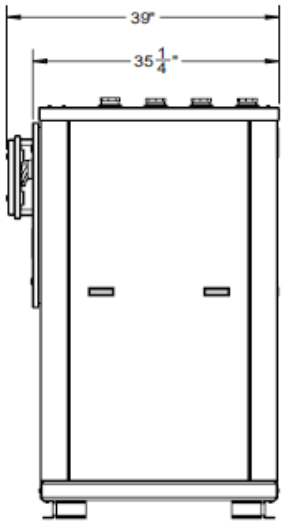
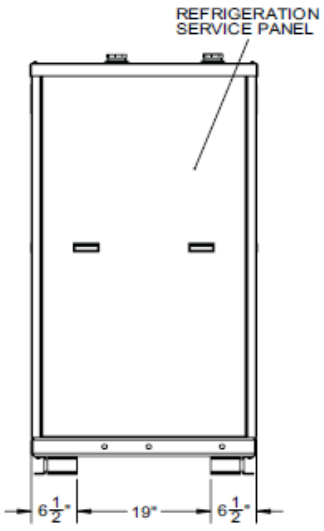


FRONT



LEFT



BACK

Pre-Order Checklist

- ☐ Thoroughly review this manual and become familiar with the equipment's installation requirements. The manual has been organized to follow the general sequence of most installations. If any details are not clear or questions are not answered contact your sales representative to resolve them ahead of time.
- ☐ Review performance specifications against the intended installed environment and water temperature requirements, and confirm the unit will perform appropriately for the conditions. Confirm all options and accessories are correct and appropriate.
- ☐ Review physical specifications to confirm the unit will have adequate installation space, support, and clearances, become familiar with piping and wiring connections to confirm all attached infrastructure will be able to access the unit.
- ☐ Evaluate the need for backup heat production, especially in applications with colder source water. Units without antifreeze additives in their source water should not be run below 45°F. inlet source water temperatures.
- ☐ Develop a plan to deliver, transport, mount, and secure the unit.
- ☐ Double check the voltage requirements of the unit, to confirm it is compatible with the available voltage on site.
- ☐ Double check the intended piping configuration for the project (single-pass or multi-pass) and confirm the correct model is ordered for the application.
- ☐ Water-to-Water heat pumps are multidisciplinary installations that may require any or all of the following trade specialties to support: site prep/structural, electrical, plumbing, automation/controls, and refrigeration. Confirm that various specialties involved in the project are well informed as to their role in the installation and are properly certified and qualified in their specialties in accordance with all governing codes and regulations.
- ☐ Confirm that qualified refrigeration technicians are available for installation troubleshooting support and ongoing system maintenance. If this is in question, contact your local sales representative to discuss support options.

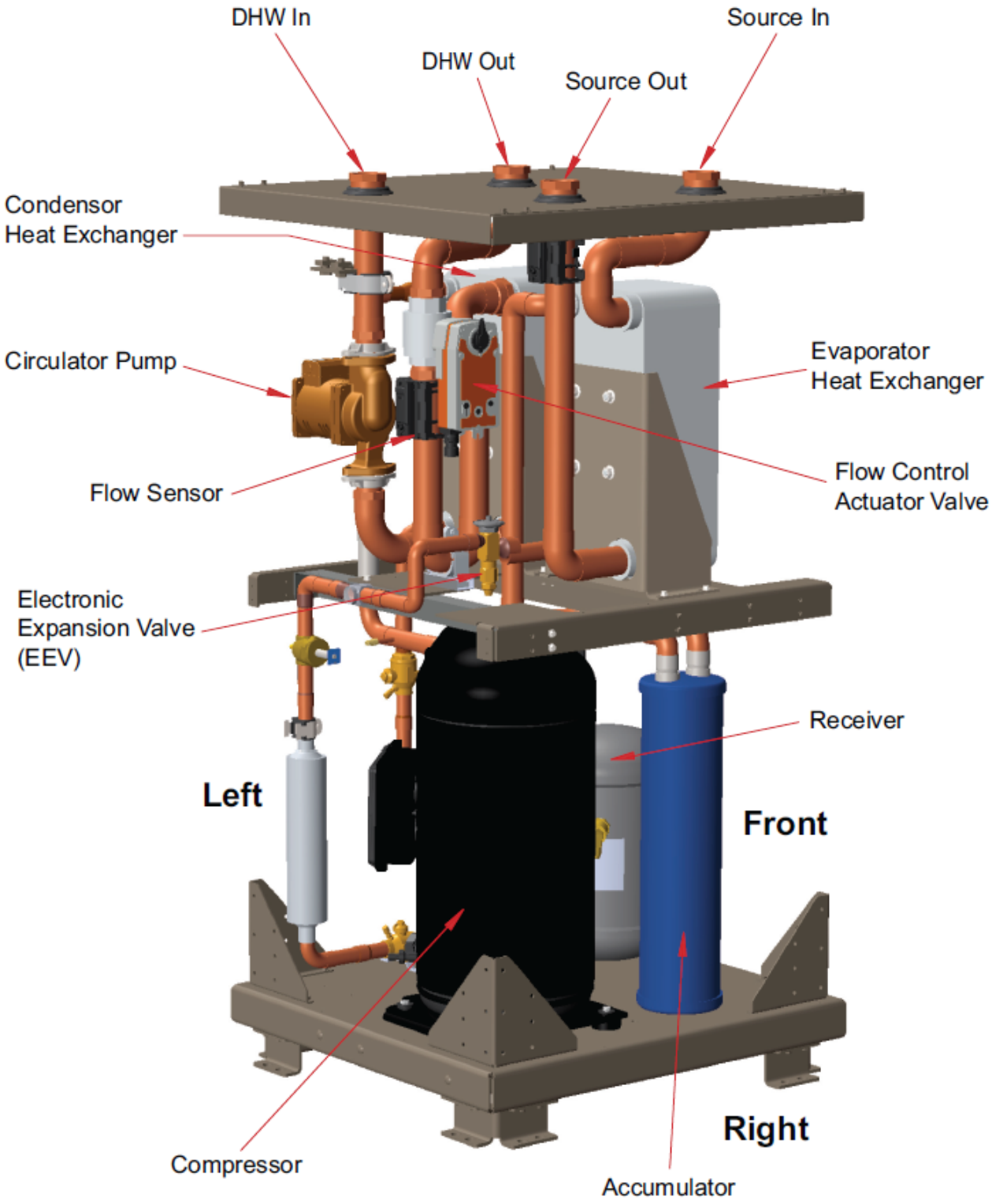
Exterior Installation Considerations

Water source units are intended for indoor installation. It is possible to install them outdoors in mild climates, however, on-board freeze protection is limited. If the unit detects a freeze risk on its water lines, it will operate its pump. This requires the unit to be powered up, to have free flow through the connecting pipes, and it will not be sufficient protection against deep cold exposure. On the source loop side, the heat pump will trigger its pump contacts as a normal demand would to enable flow. However if external flow control devices are not operational, there is no other form of freeze protection on the source side of the unit. Glycol antifreeze for the source side is the best practice for exterior installations in all cases.

This heat pump must be shut down and drained prior to any exposure to temperatures significantly below freezing. Since most climates can experience temperatures that deviate well below typical annual norms, the manufacturer does not recommend installing its water source units outside and provides no warranty against freeze damage that may occur in outdoor installations.

Unit Diagram

Figure 3. T270WM model



Installation

Required Tools and Materials

In addition to the standard tools and material required for any electrical or plumbing installation, specialty tools required to support this installation include:

- Heat transfer compound such as Honeywell part number 107408 or equivalent.
- Electrical switch lock out devices - used to secure disconnect switches/breaker panels while servicing.
- Electronic thermometer with range of 10°F - 210°F (-12°C - 100°C) including:
  - Sensors capable of measuring surface temperatures on water or refrigerant piping
  - Sensors capable of measuring ambient air temperature
- Volt-ohm multimeter - capable of measuring
  - AC voltage up to 600 VAC
  - DC voltage up to 24 VDC
  - Ohms up to 2,000,000 ohms
  - Continuity
  - Amperage up to 200 amps

Rough-in Checklist

Infrastructure must sometimes be installed prior to the installation of the unit. Items to consider for rough-in installation include:

- ☐ Potable water pipes to and from storage tanks, including pipe insulation and heat tracing as necessary.
- ☐ Primary power wiring.
- ☐ Control wiring for alarms, BMS interface, and external accessories. The manufacturer recommends running a minimum of one 18/12 control wire and a CAT- 5e/6 wire to confirm that all likely accessories and control functions can be used.
- ☐ Site prep for mounting the heat pump.

Note: *Refer to the appropriate sections of this manual for the specific details associated with each item.*

Transportation, Placement, Mounting

Important: *Do not remove, cover, or deface any permanent instructions, wiring diagrams, labels, or the rating labels present on the unit. These are important for installation and service.*

When Transporting the Heat Pump

1. Review the physical specifications of the heat pump to confirm equipment used and delivery route is appropriate for the size and weight of the unit.
2. Do not tilt the unit beyond 45 degrees at any time. Prior to fully hoisting the unit, perform a test lift to be certain the unit remains level and balanced at its center of gravity.
3. Do not hoist the unit with chains or straps unless spreader bars are furnished and used as depicted in Figure 4, p. 14. The side panels and roof of the unit are not constructed to handle significant force from the sides or above. Follow all standards and best practices for hoisting and load stabilization.
4. When using a forklift to raise or move the heat pump, take care not to damage the feet on the unit. Follow all standards and best practices for lifting and load stabilization.

Figure 4. Rigging and hoisting unit

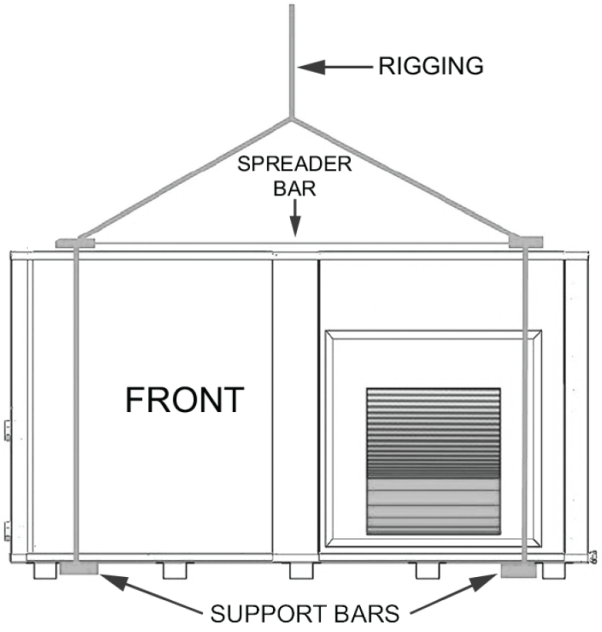


Figure 5. Rigging and hoisting unit — side view

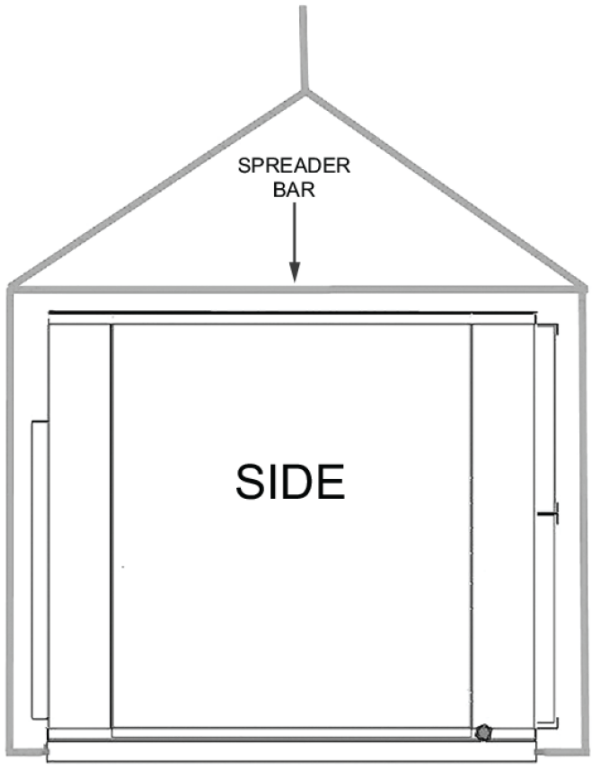
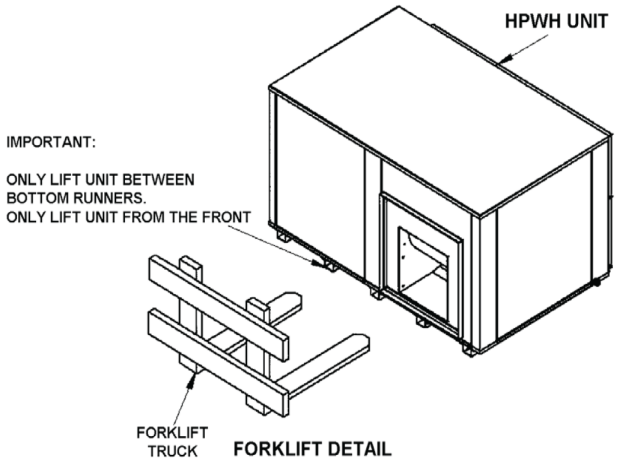


Figure 6. Lifting and moving unit with forklift



Placement Considerations for the heat pump

- Confirm the location meets all requirements for ambient temperature, structural support, unit dimensions, operational and service clearances. Refer to "Performance Specifications and Requirements," p. 7.
- Mounting location must be level and stable.
- Unit location should be easily accessible for visual inspection and for regular service. Placement should allow for possible heat pump removal/replacement in the future.
- Unit Location should be interior, protected space. Exterior locations are possible in very mild climates that do not experience freezing conditions, but they are not recommended See "Exterior Installation Considerations," p. 12 for additional notes on exterior installations.
- Unit location should minimize the risk of water damage in the event of leaks or drainage failure.
- Location of unit should be determined with consideration of operating sound and potential vibration on the surroundings and to avoid these impacts where possible.

Mounting the Heat Pump

The heat pump must be mounted on a solid, level base, typically a concrete pad. Unit should be bolted securely to the base using the supplied attachment points. If the base is not level, then the heat pump itself must be leveled to ensure proper condensate drainage and mounting stability.

Mounting the unit on elevated rails is also possible. Complete structural requirements for rails are beyond the scope of this manual: however, required rail positions and minimum rail widths are specified in Figure 4, p. 14, which will properly support the internal structure of the heat pump.

Seismic Mounting

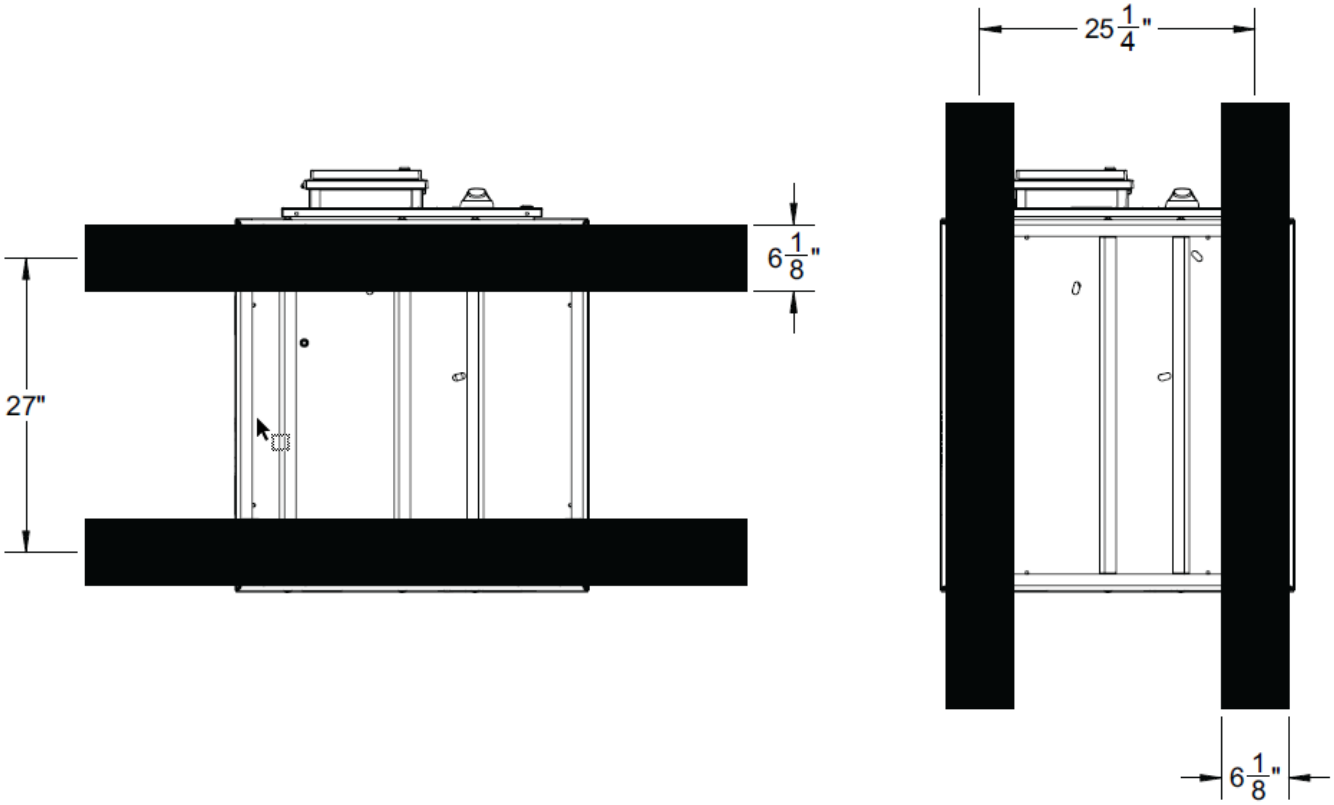
Local area seismic or vibration considerations should be addressed with field supplied, additional equipment as per applicable codes, regulations, and best practice. Seismic mounts and vibration control measures should be evaluated and determined by a qualified engineer.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage due to excessive vibration.
After placing the heat pump, confirm that the unit is level front to rear and side to side.

Figure 7. T270WM mounting rails position and widths



Important: *Prior to fully hoisting the unit, perform a test lift to be certain the unit remains level and balanced at its center of gravity.*

Water Quality

Water quality is an important concern for human health and well being. Confirm DHW supply water is clean and meets all applicable standards for potable water consumption. In addition, water quality can affect longevity and performance of the heat pump water heater on both DHW and source sides of the system. Confirm system water meets, or is treated to meet, the specifications in the table of water quality guidelines in this manual.

⚠ CAUTION

Risk of Illness!

Failure to follow instructions below could result in illness.

Use only components and joining methods suitable for potable water usage and for temperatures in excess of 175 °F on the DHW piping circuit. Use only pure water or food grade additives within the DHW circuit on the heat pump. Any other additives or contaminants in the water circuit can make it unusable for domestic water heating.

Table 6. Water quality specifications

Element	MG/l or ppm
Alkalinity	70-300
Sulfate	<70
HCO3/SO4	>1
Conductivity	10-500 µS/cm
pH	7.5-10
Ammonium	<2
Chlorides	<100
Free Chlorine	<1
Hydrogen Sulfide	<0.05
Free CO2	<5
Total Hardness	60-120
Nitrate	<100
Iron	<0.2
Aluminum	<0.2
Manganese	<0.1

Water Piping — DHW Loop

Heat pump water heaters are designed to be piped to tank water storage in either a single-pass configuration or a multi-pass configuration, depending on the unit that was ordered. These units significantly differ in their operation and are not interchangeable. Confirm the operation methods before ordering the heat pump.

Heat pump water heaters always require storage tanks and are not instantaneous water heaters.

Piping Considerations

Check Valves — All heat pumps have internal control valves that can be configured to be open or closed when the unit is off. External check valves are not necessary on heat pump piping. Single-pass units, which can modulate flow to vary flow velocities, cannot use check valves on the heat pump supply or return piping.

Pipe Sizing and Care — All connected piping must be sized for the design flow rates, appropriate velocity, and available head pressure for the heat pump in use. Refer to the performance specifications for this information. Confirm that pipes are clean and protected from intrusion of dirt or other contaminants during the installation.

Pressure Testing and Purging — All connected pipes and components should be pressure tested with air before filling with water. A thorough fill and purge process is required to remove any air bubbles from the lines before starting up the unit. Failure to purge piping of air bubbles can damage the internal circulator. Install purge valves in the connected piping to facilitate this process.

Tank Selection — Temperature stratification is necessary to the proper operation of single-pass systems, and usable volume is very important for multi-pass systems. For optimal system operation, vertical tanks are preferred for commercial heat pump domestic water heating systems, as they typically maintain usable volumes and stratification better than horizontal tanks.

⚠ WARNING

Risk of Expansion!

Failure to properly accommodate expansion could result in equipment failure, nuisance callbacks, injury, or death.

All hot water systems require accommodation for fluid expansion when heated. Confirm the expansion devices such as expansion tanks or compression tanks are specified and sized by a qualified engineer. T and P valves are required on primary storage tanks and are sized for the total maximum BTU capacity of all attached heat sources.

⚠ WARNING

Burn Hazard!

Failure to follow instructions below could result in scalding injuries or death.

Commercial water heating is typically done at storage temperatures that are dangerous for human contact. Per manufacturer's recommendation, all water heating systems must install mechanical temperature limiting devices, such as tempering valves, between storage volumes and the building's plumbing fixtures.

Typical Water Piping Process

1. Rough-in any pipe/insulation/heat trace in areas that will not be accessible or traversable during the final installation. 2.
2. Install all water piping and components.
3. Pressure test the water side components with air to a pressure less than 150 PSI or the pressure rating on the storage tank pressure relief valves. The manufacturer recommends testing to 80-100 PSI or 1.25x the standing pressure of the system, whichever is higher, for a minimum of two continuous hours.
4. Find and rectify any leaks.
5. Install heat tracing and pipe insulation after the piping is determined airtight.

   Note: *This may require a standalone pressure test of rough-in piping so insulation and heat tracing can rough-in with the pipes.*
6. Isolate the building piping from the heat pumps and storage, then use purge valves to fill the heat pump and storage system.
7. Purge lines by continuing to fill through isolated flow paths until fill water exits a far point drain valve in a clean and continuous stream without stuttering or foaming.
8. After the system has operated for 24 hours incluing several heat/cool cycles of the heat pump, perform a final check for water leaks.

Single-pass with Swing in Series Piping

Single-pass units deliver water at a variable flow rate, at a fixed temperature, to the top of a stratified temperature storage tank. Water is pulled from the cold, bottom portion of the tank. Flow rates through the heat pump will vary depending on inlet water temperature, outlet target water temperature, and ambient temperature.

To maintain stratification in the primary storage tank, as well as minimum temperature rise requirements at the heat pump, circulating loops from other sources, such as

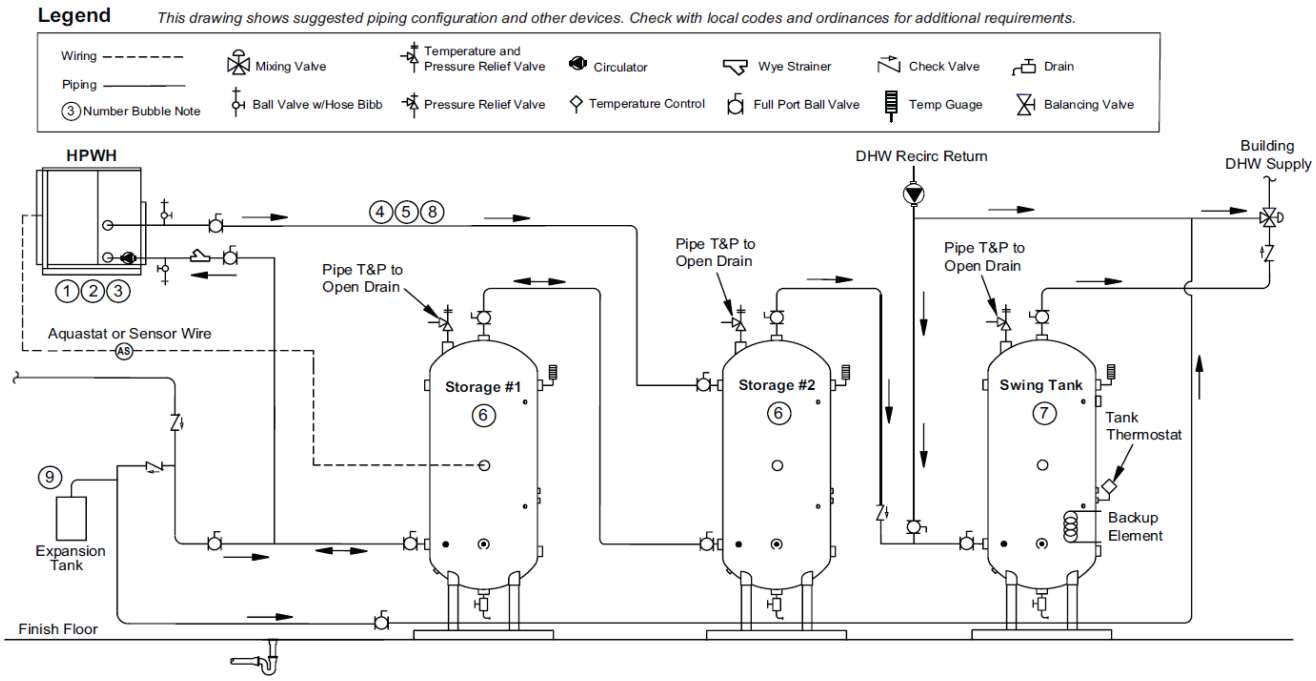
building recirculation loops or boiler backup heat, must be handled with a separate swing tank, which is fed by the heat pump storage tank in series during domestic hot water demands.

Important: *Recirculation loops are NOT returned to the primary storage in single-pass systems.*

The swing tank is heated by a secondary heat source to handle recirculation losses when demands are not present and can provide a convenient way to provide backup heat to the system as well. Swing tanks are typically kept at a slightly lower temperature than the primary storage to maximize the contribution of the heat pump to overall energy demand.

These systems feature the smallest storage and heat pump capacity requirements and are typically the most efficient method as well.

Figure 8. Single-pass piping concept



Notes:

1. *Exterior water piping requires insulation in all cases. Heat tracing is required on all pipes that could be exposed to freezing conditions. UV jacketing is recommended for pipes exposed to sunlight. Insulate as per applicable energy codes, ambient conditions, and heat trace manufacturing requirements.*
2. *Slope exterior run pipes down toward a drain location. This allows manual draining of exterior lines in an emergency.*
3. *Do NOT install check valves on piping to or from a single-pass HPWH.*
4. *All piping between heat pump and storage should be sized for appropriate pressure drops and velocities. Refer to performance specifications for available pressure and flow rate requirements.*
5. *Pump circulation between heat pump and storage tanks is required as a part of freeze protection in some conditions. Any external solenoids or zone valves must be interlocked with the unit to open when the pump is triggered.*
6. *Confirm storage and/or swing tanks are rated for potable usage, have adequate volume for the design, have tappings at required locations, and are approved to handle system flow rates without fitting erosion.*
7. *Swing tank must have backup heat installed sufficient to cover at least the recirc system heat losses. Backup heat can be installed in the tank itself or piped to it from an external heater.*
8. *Air venting is recommended at the high point of the hot water supply piping from the water heater. Use only air vents suitable for open systems. Confrim the air vent is installed in an interior, protected space.*
9. *Expansion tank must have a direct pipe run with no opposing check valve to the swing tank and to the HPWH.*

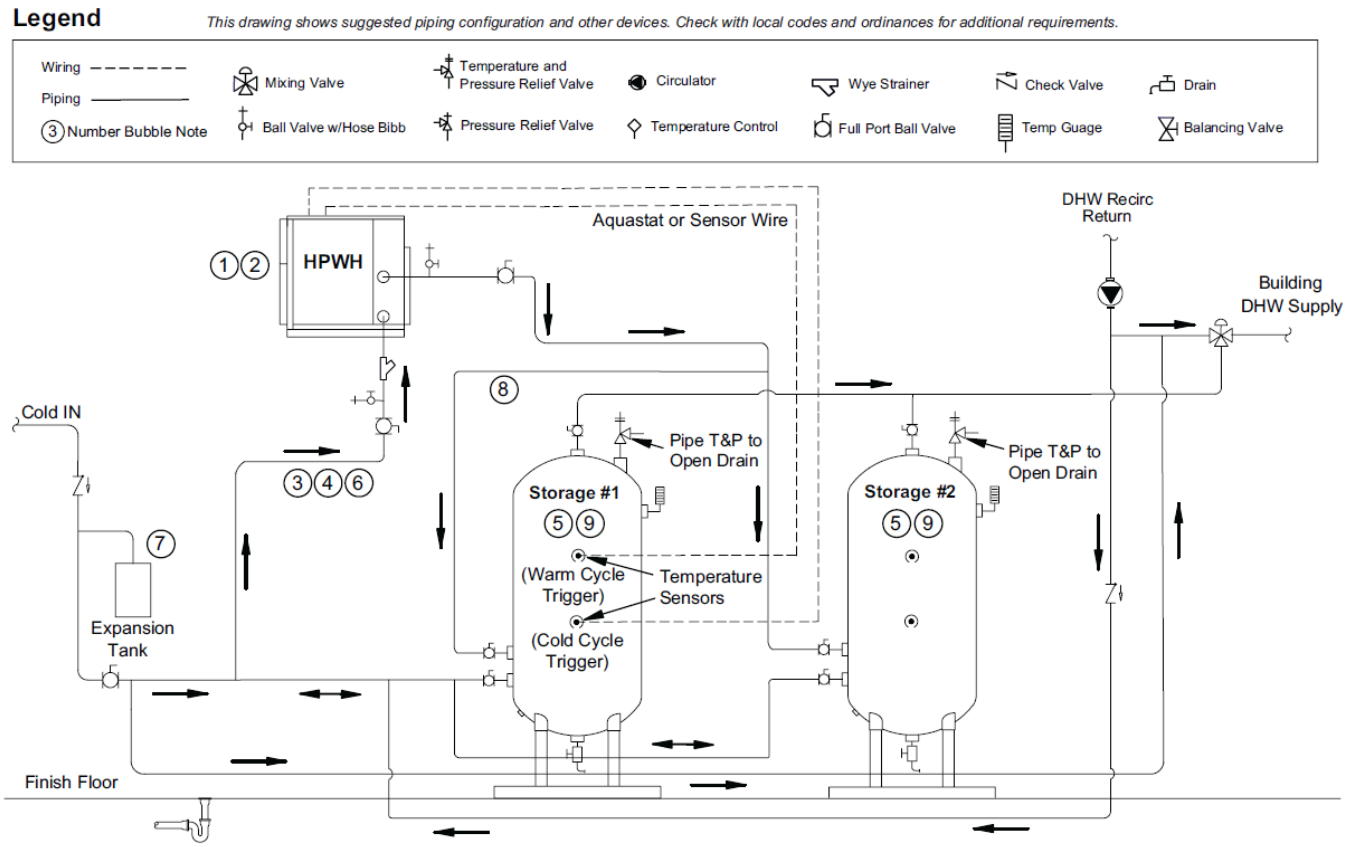
Multi-pass Piping

Multi-pass units deliver water at a fixed rate, at a variable temperature, with leaving water temps several degrees higher than incoming water temp. These systems do not stratify their tanks, and water is taken from the colder bottom portion and returned slightly higher in the tank, similar to traditional boiler-driven systems. Multi-pass

systems do not require swing tanks, and building recirculation will typically return directly to the primary storage tanks. They require significantly more storage and heat pump capacity than single-pass systems, but can be more efficient for systems with large recirculation loads that would otherwise require backup boilers or electric resistance heating.

Multi-pass units can also be used to heat swing tanks in single-pass systems, instead of electric resistance or fossil fuel backup.

Figure 9. Multi-pass piping concept



Notes:

1. *Exterior water piping requires insulation in all cases. Heat tracing is required on all pipes that could be exposed to freezing conditions. UV jacketing is recommended for pipes exposed to sunlight. Insulate as per applicable energy codes, ambient conditions, and heat trace manufacturing requirements.*
2. *Slope exterior run pipes down toward a drain location. This allows manual draining of exterior lines in an emergency.*
3. *All piping between heat pump and storage should be sized for appropriate pressure drops and velocities. Refer to performance specifications for available pressure and flow rate requirements.*
4. *Pump circulation between heat pump and storage tanks is required as a part of freeze protection in some conditions. Any external solenoids or zone valves must be interlocked with the unit to open when the pump is triggered.*
5. *Confirm storage and/or swing tanks are rated for potable usage have adequate volume for the design, have tappings at required locations, and are approved to handle system flow rates without fitting erosion.*
6. *Air venting is recommended at the high point of the hot water supply piping from the water heater. Use only air vents suitable for open systems. Confirm the air vent is installed in an interior, protected space.*
7. *Expansion tank must have a direct pipe run with no opposing check valve to the primary storage tank.*
8. *Multiple storage tanks must be piped reverse-return: first in, last out, with equal branch runs to all units off of a common header with consistent pipe sizing. Do not step down the header pipe after the first tank takeoff. Balancing and isolation valves are also required.*
9. *If multiple tanks are used, a single temp sensor can pick any tank to trigger heating operation. However, the main control accessory can be used to add averaging of multiple tank sensors, which is more ideal for multiple, multi-pass tank systems.*

Water Piping — Source Loop

Source water piping is similar to DHW water piping, and requires all the same considerations for water quality, expansion, pipe sizing, pressure testing and purging. Review the "Water Piping — DHW Loop," p. 18 section regarding those topics.

Key differences from DHW water piping are described in the following sections.

Glycol and Freeze Protection

Evaporator discharge water can be significantly colder than the source water temperature. In any application that is likely to see source loop temperatures fall below 45°F, an antifreeze additive such as inhibited propylene glycol must be used. The manufacturer recommends targeting a freeze protection rating at least 20° below the coldest inlet temperature or exposure temperature expected for the source loop, whichever is lower. Use only antifreeze products formulated for use in hydronic systems: automotive antifreeze or other such products are not appropriate.

NOTICE

Heat Pump Damage!

Failure to follow instructions below could cause source loops to freeze and result in catastrophic heat pump failure and damage to attached pumps and piping.
DO NOT operate the heat pump on source loops that fall below 45°F without appropriate freeze protection additives.

The source loop design flow rate includes a safety factor appropriate for up to 30% blends of ethylene or propylene glycol: no adjustment to design flow rates are required for glycol mixtures. However, pressure drops through the heat pump are affected in accordance with the following table:

use these corrected values instead of the standard design pressure drop for the source loop, if glycol is used in the loop. Greater than 30% concentration of glycol additives requires evaluation by qualified engineers.

Table 7. T270WM source pressure drops for glycol antifreeze

	10% Mix	20% Mix	30% Mix
Propylene Glycol (Ft. Hd.)	10.5	11.8	13.9
Ethylene Glycol (Ft. Hd.)	11.2	12.8	14.9

Non-Potable Applications

Most source loops are not potable water. In non-potable applications, any piping capable of handling the temperature and pressure requirements of the source water loop can be used, without regard for its suitability in potable systems, in accordance with local codes. Careful consideration should be given to plastic pipes that run outdoors that may be exposed to and damaged by UV light.

Pumping and Flow Control

The source side of the water source units do nothave integral circulators. Therefore, circulators and control devices are field-supplied and must be sized and controlled appropriately to provide design flow rates for the heat pump. Failure to reach design flow rates can result in lockouts, under-performance, and creates a potential freeze risk in non-glycol systems.

Confirm pumps are sized properly for design flow and pressure drops. heat pumps need individual source loop pumps, or fast-acting control valves to avoid nuisance flow alarm lockouts. The source pump contacts on the heat pump can be used as a control signal for source loop pumps and/or flow controls.

Power Wiring

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

Heat pump water heaters are voltage-specific, and require proper planning to provide the electrical support appropriate to each unit. Refer to "Electrical Specifications," p. 8, specific product submittals, project documentation and the requirements, and the following installation instructions.

Power Requirements

- Voltage is correct to within +/- 5% of ratings and within +/-2% between phases.
- Power is clean, reliable, and well grounded.
- Wire and breakers are appropriately sized for the load and equal to or larger than wire sizes in the wire specifications below.
- Wire and breakers are properly specified for the environment they are installed in.
- Backup generators should include line conditioning suitable for running electronics.
- Follow the manufacturer's torque specifications for all power wire equipment by others.
- Install service disconnects on incoming power feeds at the heat pump location.
- All power wiring to the unit must be rated for 600V.

Power Wiring Installation

Electricians must create their own entry into the T270WM heat pump. There is a point on the top panel that requires the creation of an access hole, marked with a Knock Out Hole Here sticker, see Figure 10, p. 23. All holes should be weather tight when installation is completed.

1. Open the electrical enclosure access door.
2. Locate the Electrical Connection - Knock Out Hole Here sticker.
3. Drill or knock out the sticker location.
4. Run conduit to/through the knockout with appropriate, weather tight connections, and pull wire into the enclosure.
5. Make the power wire and ground wire connections in accordance with Figure 11, p. 23. Use 375 foot-pounds of torque on heat pump wire terminal connections.

Figure 10. Power wiring knockout location

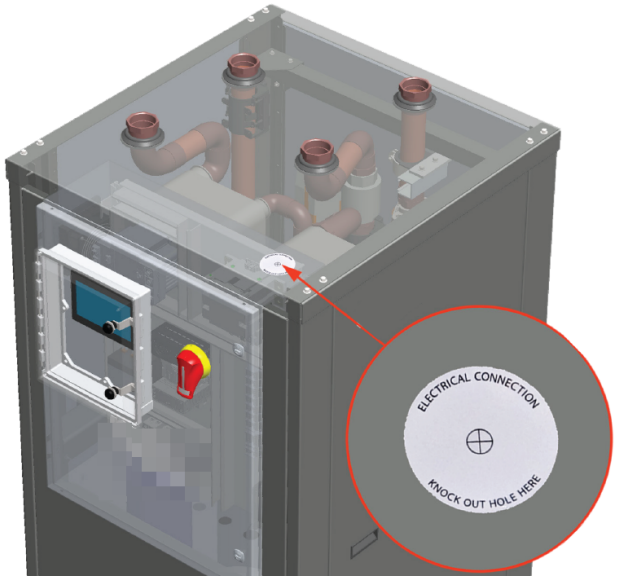
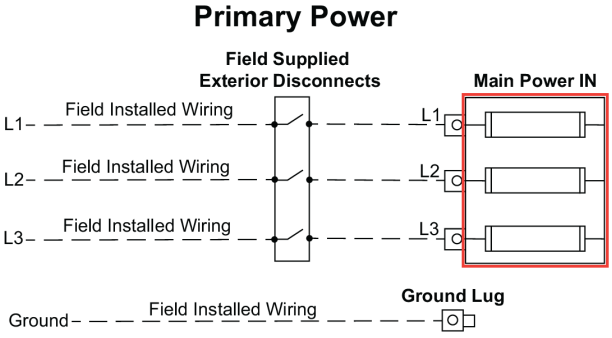


Figure 11. Power wire connections



Control Wiring

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

Heat pumps have several contact points for field wiring of external controls. More contacts can become available with the installation of various field accessories, and details on those accessories are shown in their respective installation instructions.

The manufacturer recommends running enough conductors to use all available contacts if the installation site would make wire retrofits challenging, even if those contacts are not intended for use during the initial installation. This allows changes and reconfiguration to happen seamlessly in the future. Additional conductors to allow for wire breakage, and/or the addition of future accessories, is also recommended.

The following drawing and notes provide a quick reference of the available contacts on the base heat pump, and what they are used for. For more advanced configuration guidance, see the Configuration section of this manual and/or instructions for any relevant accessories.

Do not steal power from powered contacts for external devices. Follow all ratings and wire types for the contacts as described in the following instructions.

Control Wiring Installation

1. Ensure the heat pump is powered down when making electrical connections.
2. Identify a control wire access point on the T270WM. Often, the best choice is through the panel where the pipes enter and exit the heat pump. Do not obscure service or removable panels with wire or conduit.
3. Run all external sensor wires and/or control wiring for field accessories through the access point.
4. Open the electrical enclosure. The top of the enclosure has several cable glands and/or knockouts available. Control wires may use any available entry point into the enclosure not running line voltage wiring. Wires will traverse the compressor cabinet to access these entry points.
5. Once in the enclosure, wires can be entered into the electrical raceways to get to the appropriate termination locations. See “Power Wiring Installation,” p. 23 for specific wire runs.
6. Tug test the new connections, and then close the electrical enclosure.
7. Restore power to the heat pump.

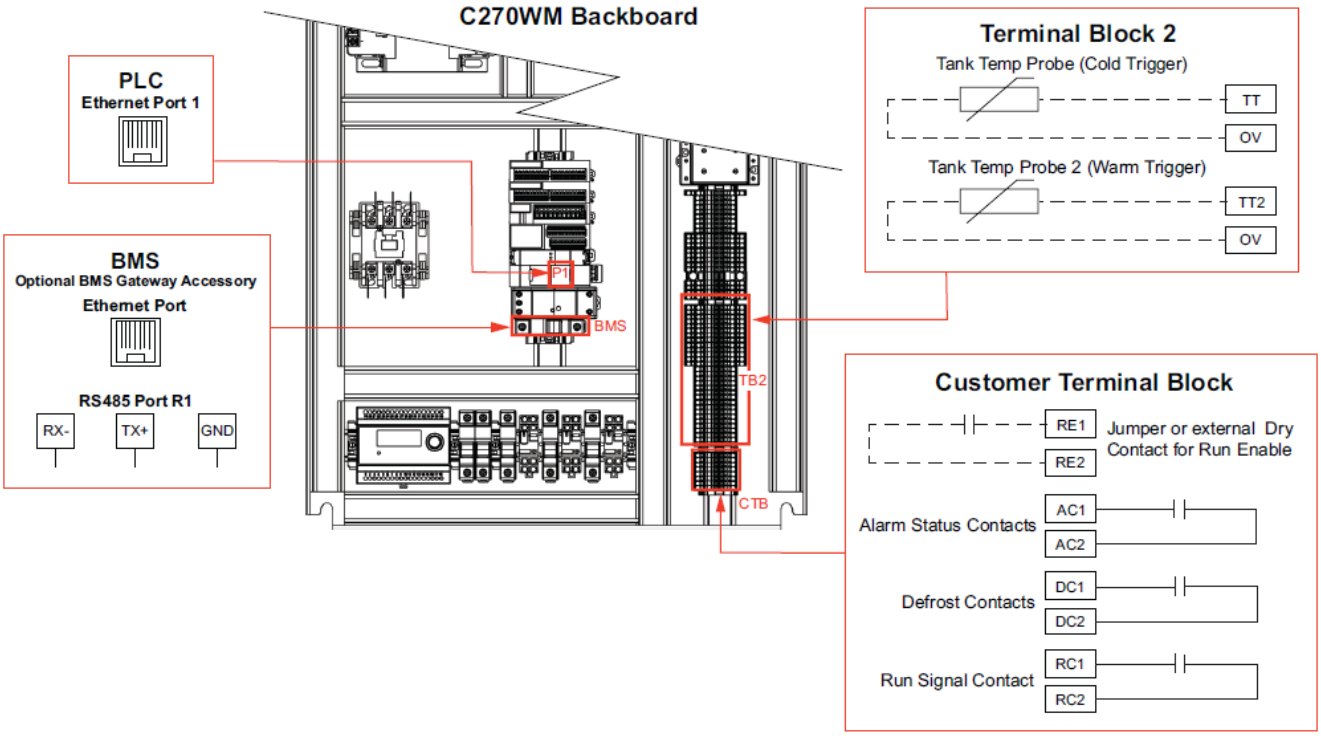
NOTICE

System or Equipment Damage!

Failure to follow instructions below could result in equipment damage and system failure due to applying power to a powered contact.

Contacts labeled Dry are intended to switch power from external sources. Do not apply external power to any contact that is not Dry. Follow all power specification for each contact.

Figure 12. T270WM control wiring



Field Wiring Control Points

Alarm Status Contacts: This dry set of contacts close whenever the compressor will not run because of lockout. Backup heat sources can use this as an enable trigger.

BMS: The Ethernet or serial connection is used to connect to building automation systems. See appropriate accessory documentation for details on these contacts.

Defrost Contacts: This dry set of contacts close whenever defrost functions are active.

Ethernet: Ethernet cable is not necessary for standalone operation. Ethernet is used for connecting the optional Control Panel, various accessories, and service laptop connections, and will be necessary for future products and functionality. Roughing in a CAT-5 or CAT-6 cable at installation is recommended.

Remote Enable: When Remote mode is enabled during configuration, these terminals will place a heat demand on the heat pump when an external controller closes a set of dry contacts. No tank sensor is wired to the heat pump in this mode.

In Tank Sensor mode, these contacts can be jumped, or this can be used as a permission signal by external dry contact controls to allow/disallow compressor operation.

Note: *A unit in Tank Sensor mode will not run without a jumper or closed contact between the remote enable terminals*

Remote enable contacts ship with a factory installed jumper.

Run Signal Contact: This dry set of contacts close whenever the internal circulator is engaged. External devices that need to run in response to the heat pump can use this as a trigger, such as louver motors and/ or booster pump relays.

Tank Temp: This sensor input allows the heat pump to monitor and control the tank temperature. Take care that the Tank sensor is installed in accordance with the sensor diagrams appropriate to the type of heat pump in use, single- or multi-pass. Tank Temp will serve as the cold trigger in multi-pass systems. See Tank Sensor detail sections following this section.

Tank Temp 2: This is the Warm trigger sensor in multi-pass systems.

Table 8. Control wiring specifications

Contact	Location	Terminals			Wire Type	Power
Alarm Status	CTB	AC1	AC2	–	Any	Dry[a]
Defrost Status	CTB	DC1	DC2	–	Any	Dry[a]
Remote Enable	CTB	RE1	RE2	–	Any	Dry[a]
Run Signal	CTB	RC1	RC2	–	Any	Dry[a]
Service Mode[b]	TB2	i7	24v	–	Any	24Vdc
Tank Temp	TB2	TT	0v	–	Stranded/Shielded	24Vdc
Tank Temp[c]	TB2	TT2	0v	–	Stranded/Shielded	24Vdc
BMS	COM	A1	B1	SC1	Stranded/Shielded	Variable
Ethernet	PLC	[d]	–	–	CAT-5 or CAT-6	–

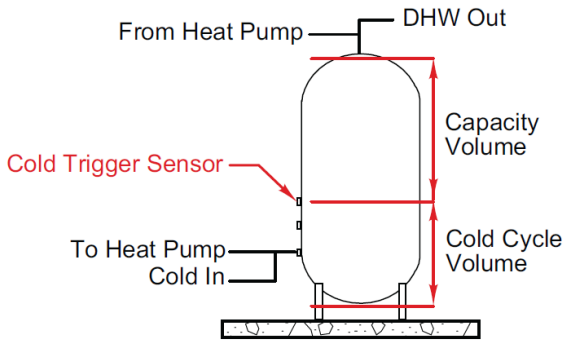
[a] All CTB Dry contacts are rated for 6A/250VAC, or 6A/30VDC maximum.
[b] Service Mode enables access to the Diagnose screen. Jump terminals for access.
[c] Reserved terminals used by optional accessories and/or internal wiring. See accessory instructions.
[d] Ethernet Port on internal PLC controller .

Single-pass Tank Sensors

Single-pass systems require a trigger sensor or aquastat relatively low in the tank to initiate a demand when very cold incoming water is detected. This is typically mounted at or near the Minimum Cold Cycle Volume for the heat pump, as measured from the piping inlet on the tank from which the heat pump will draw its cold water, typically as close to the bottom of the tank as possible. Tank volume above the trigger sensor is called the Capacity Volume, which is the minimum amount of stored hot water needed to make it through peak demand periods.

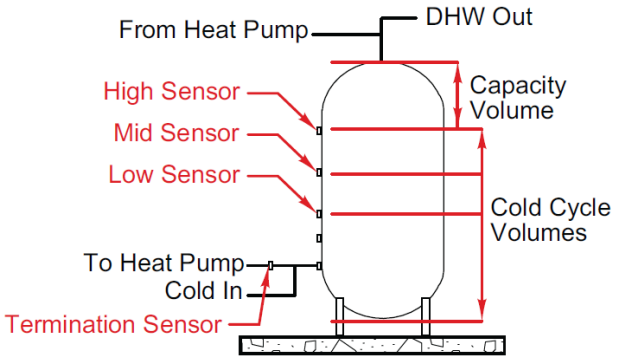
A separate termination sensor is used to end the demand when water that is sufficiently hot is detected. This can be an internal water temperature sensor on the heat pump or a dedicated sensor on the common pipe to the heat pump inlets as typically used in multiple heat pump systems using a central controller. Staging is achieved with additional sensors in the storage tank to track the movement of the stratified hot water layer. For small arrays, a typical staging strategy would include sensors for a single stage, a sensor for 50% of available stages, and a sensor for all stages to run. The heat pumps require the use of external controllers for staging and provide a controller for this purpose as an optional accessory.

Figure 13. Single-pass tank sensor location



Note: *Minimum CCV is listed in the heat pump specifications.*

Figure 14. Single-pass, multiple heat pumps with central controller



Notes:

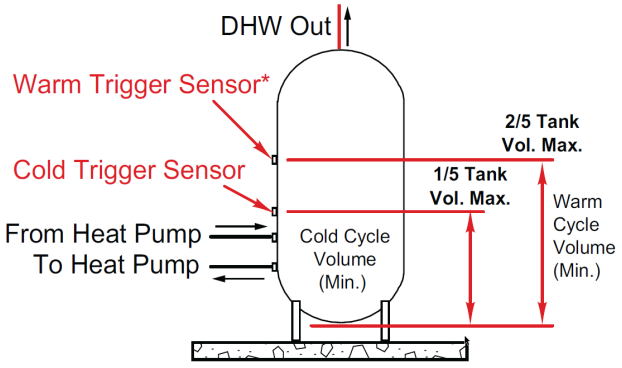
- *Minimum CCV is listed in the heat pump specifications.*
- *Multiply minimum CCV by the minimum number of heat pumps to operate simultaneously for each sensor position.*
- *Confirm high sensor point allows for adequate capacity volume above the sensor.*

Multi-pass Tank Sensors

Cold Trigger Sensor

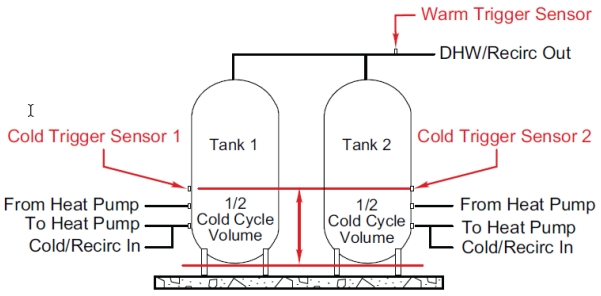
Multi-pass systems require a cold trigger sensor low in the tank to activate on incoming cold water temperature, but not at recirculation return temperatures. This allows the fastest response possible during demands without short cycling. This sensor also determines when heat demands are satisfied when it reaches the tank target temperature.

Figure 15. Multi-pass, single tank sensor locations



*Warm Trigger set above recirc return temp.

Figure 16. Multi-pass, multiple tanks with central controller



Notes:

- *CT sensors mounted at a maximum of 1/5 of total tank height.*
- *Minimum CCV are in the heat pump specifications: confirm enough CCV is included for the minimum number of heat pumps to run simultaneously.*

Cold Trigger Sensor Placement Rules

- The cold trigger sensor must allow for a minumum cold cycle volume for the heat pump below the sensor.
- The manufacturer recommends a maximum of one-fifth of the total tank volume be below the cold trigger sensor.
- Both volumes are the volume of water from the sensor position to the bottom of the tank.

Warm Trigger Sensor

- The warm trigger sensor must allow for a minimum warm cycle volume for the heat pump below the sensor.
- The manufacturer recommends a maximum of two-fifths of the total tank volume be below the warm trigger sensor
- Both volumes are the volume of water from the sensor position to the bottom of the tank.
- In multiple-tank, multiple-heat pump applications, the warm trigger sensor may move to a common hot water outlet pipe, and it becomes a minimum outlet temperature sensor to signal a maximum stage event is necessary. See Figure 16, p. 27

Configuration

NOTICE

Equipment Damage!

Failure to follow the instructions below could result in equipment damage or major component failure.

Confirm all checks are performed before operating the heat pump compressor. Complete the pre-startup checklist before pressing the ON button in the control interface.

Setting configuration options for the heat pump requires active main power. While activating the main power for programming is safe, turning compressor operation on at this stage is not.

This manual addresses configuration of individual heat pump water heaters. For projects with centralized controllers connected to multiple heat pumps, or BMS control systems, be sure to refer to additional instructions for the configuration of those accessories.

Heat Pump Controller Screens

These products come with a full color touchscreen mounted on the front of the cabinet under a weatherproof enclosure. Whenever 120v power is available from the heat pump's internal transformer, the controller will be active. These are the primary screens that may be used during installation and typical operation.

Home Screen: This is the default display screen, and features a variety of indicators related to the current operation of the unit.

Config Screens: Most user-configurable options are available on these screens. However, the installation of a service jumper between terminals 24v and i7 on the TB2 terminal block is required to access the configuration pages.

Diag Screen: Operating information specific to troubleshooting and diagnostics are available here, as well as selected diagnostic and/or commissioning tools. More detail on the Diagnose screen items is available in the Troubleshooting section of this manual.

Alarms Screen: This screen displays currently active alarms. More detail on alarms is available in the Troubleshooting section of this manual.

Error Log Screen: This screen displays a navigable record of the alarm history for the unit.

Configurable Modes

C series heat pumps can be single-pass or multi-pass, and each type has its own configuration requirements.

Important: *Confirm that the heat pump configuration matches the installation typ, and is configured properly for proper operation.*

In addition to the system type, C series heat pumps can be configured to run in Tank Mode, or in Remote Mode. Each mode changes operation and configuration in several ways:

In **Tank** mode, the heat pump expects to have its own sensors wired directly to the storage tanks. In this mode, the heat pump determines when heat demands should start and stop based on those sensor readings as well as the additional safeties and sensors built into the heat pump. Tank mode will monitor the Remote Enable terminals, which must have a jumper or closed set of contacts across them to enable, or allow, operation in tank mode.

In **Remote** mode, a device other than the heat pump determines when heat is needed, and it passes a heat demand to the heat pump, either over a BMS connection using the BMS accessory option, by a dry contact closure on the heat pump's Remote Enable input, or by direct connection to a central controller. In this mode, the heat pump responds to heat demands on the basis of entering and leaving water temperatures at the heat pump. The heat pump is not involved directly with the tank temperature logic, and does not have its own sensors wired to the tank, it only responds to demands for heat presented by the external controller.

This gives 4 major configuration sets for C series heat pumps: single- or multi-pass operation, and Tank or Remote mode.

Universal Configuration Options

The following additional items are configurable on the second configuration page, and are applicable to all operating modes:

Flow Verification Timers: The amount of time the unit will wait to verify flow for the evaporator (source loop) or condenser (DHW loop). Adjustable to accommodate external control devices with variable motor times.

Max Purge Time: If the Purge Cut Out is not reached, the post purge will stop after this much time.

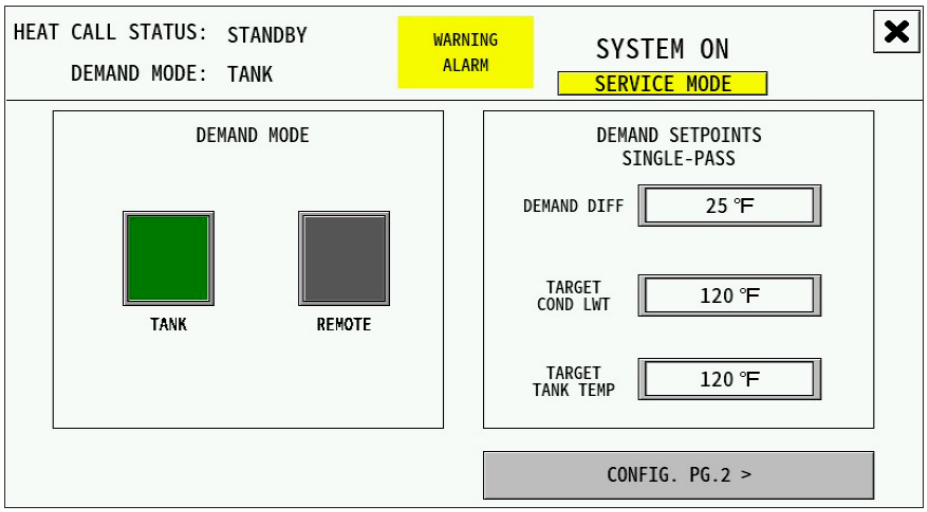
Purge Cut Out: At the end of a heat demand, the pump will continue to run to purge heat from the heat pump, until this temperature is detected as the leaving water temperature from the heat pump.

Source Fluid: Selector for whether the source loop is water or a treated glycol mixture to resist freezing. This affects the lowest operable source temperatures of the heat pump.

Standby Flow Valve Position: Whether the internal flow control valve is open or closed when the heat pump is not actively heating.

Single-pass Mode — Tank

Figure 17. Single-pass configuration page



Tank Mode Sequence of Operation for Single-Pass

1. When the tank sensor detects a temperature below (**Target Tank Temp - Demand Diff**), and there is a closed circuit between the Remote Enable contacts, demand begins.
2. Heat pump begins heat cycle, closes its Run Signal Contacts, and begins modulating its output water temperature to **Target Cond LWT**.
3. When the heat pump entering water temp sensor detects water at (**Target Tank Temp - Demand Diff**) temperature, demand ends.
4. At demand end, internal circulator will continue to run until **Purge Cut Out** temperature is reached, or **Max Purge Time** is reached, whichever comes first.
5. Run Signal contacts open when circulator stops operation.

Tank Mode Programming for Single-Pass

On the **Config** screen:

1. Set the Demand Mode to **Tank**.
2. Set the Target Tank Temp value to the desired primary storage temperature. In commercial systems, this is typically 140° F.
3. Set the **Demand Diff**. This is the value below Tank Set which will start or end a heat demand.
   - For single pass systems, Tank Temp Diff should be 25° or greater, depending on the Tank Set value.
   - Heat demands should trigger below 115° F sensed temperature, so a Tank Set above 140° will need greater than 25° Tank Temp Diff.
4. Set **Target Cond LWT** to the desired target water temperature from the heat pump
   - This must equal or higher to the Tank Set value. Typically it's equal, but in some piping and tank systems, a small amount of temperature drop can occur from the heat pump outlet to the tank sensor, which may necessitate raising the heat pump LWT slightly to reach desired storage temperatures.
   - Do not set above 175° F.
5. Verify that there is a jumper or an external permission controller on the Remote Enable terminals.

NOTICE

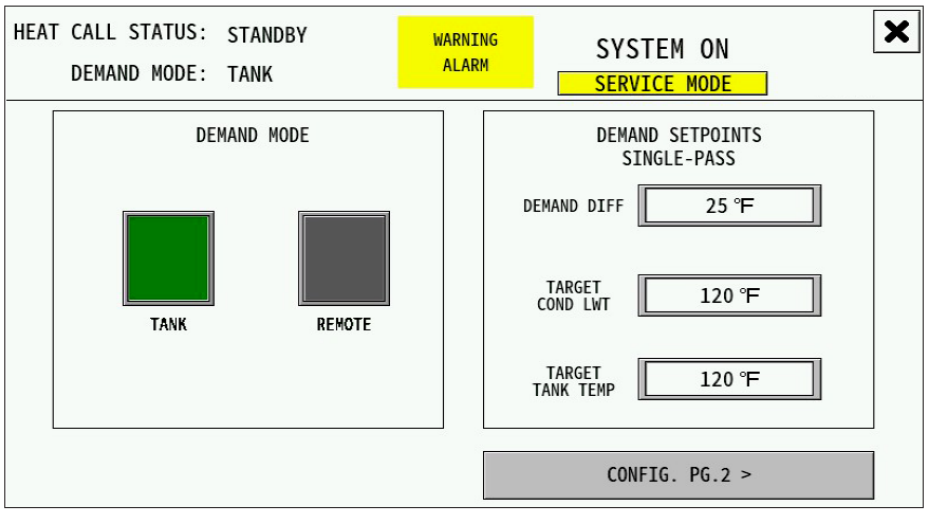
Equipment Damage!

Failure to follow instructions below could shorten the compressor life and void the warranty.
Do not set the domestic hot water heat pump to target temperature above 175°F.

The heat pump will allow itself to exceed the target outlet temperature if incoming water is too hot, flow is too low, and/or during high capacity conditions, up to its maximum operating temperature for the current ambient conditions.

Single-pass Modes — Remote

Figure 18. Single-pass configuration page



Remote Mode Sequence of Operation for Single-Pass

1. Demand begins when an external device (BMS, Central control, or controller wired to Remote Enable contacts) starts a heat demand.
2. Internal circulator begins operation, and will not stop operation until demand condition is removed by the external control, regardless of compressor status. Run Signal Contacts close.
3. Heat pump begins heat cycle, modulating its output water temperature to **Target Cond LWT**.
4. When the heat pump entering water temp sensor detects water at (**Target Cond LWT - Demand Diff**) temperature, compressor operation will stop.
5. If the heat pump entering water temperature drops below (**Target Cond LWT - Demand Diff**) temperature, and the compressor time delay times out, compressor operation will resume.
6. Demand ends when the demand condition is removed by the external control device.
7. At demand end, internal circulator will continue to run until **Purge Cut Out** temperature is reached, or **Max Purge Time** is reached, whichever comes first.
8. Run signal contacts open when circulator stops.

Remote Mode Programming for Single-pass

On the **Config** screen:

1. Set the **Demand Mode** to **Remote**.
2. Set **Target Cond LWT** to the desired target water temperature from the heat pump.
   - In commercial systems, this is typically 140° F.
   - This will determine the maximum storage temperature the tanks can achieve. Ensure that external controls will be satisfied at this temperature.
   - Do not set above 175° F.
3. Set the **Demand Diff**. This is the value below Target Cond LWT, which will stop compressor operation.
   - For single pass systems, cut out should occur at 115° or lower, so for a typical 140° F LWT system, this should be set to 25° or higher.

NOTICE

Equipment Damage!

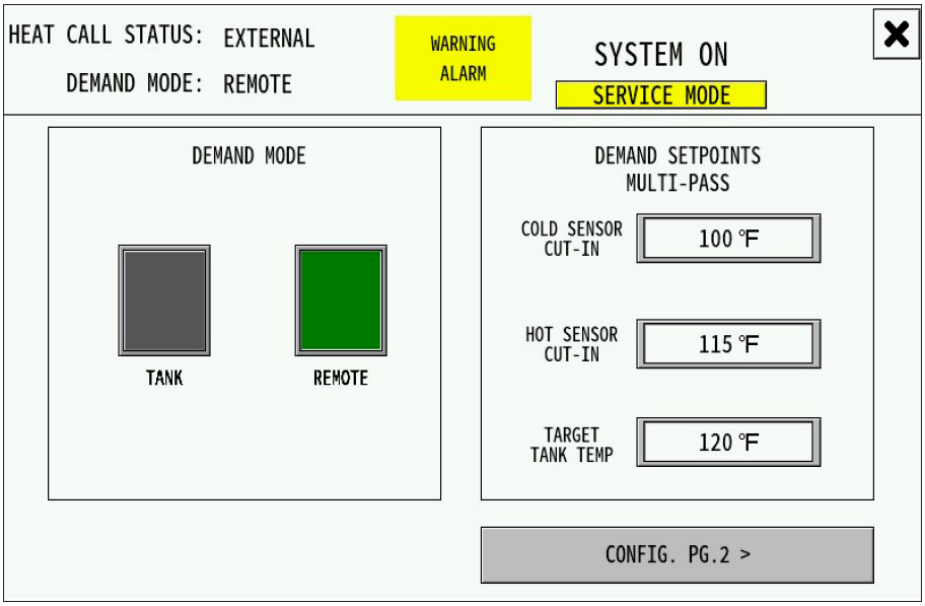
Failure to follow instructions below could shorten the compressor life and void the warranty.

Do not set the domestic hot water heat pump to target temperature above 175°F.

The heat pump will allow itself to exceed the target outlet temperature if incoming water is too hot, flow is too low, and/or during high capacity conditions, up to its maximum operating temperature for the current ambient conditions.

Multi-pass Modes Tank

Figure 19. Multi-pass mode configuration page



Tank Mode Sequence of Operation for Multi-pass

1. When the cold or warm tank sensors detect a temperature below their respective cut-ins, and there is a closed circuit between the Remote Enable terminals, demand begins
2. Heat pump begins heat cycle, heating water at a temperature rise dictated by flow rates and current capacity of the unit. Run Signal Contacts close.
3. If Current LWT is below 100° F., the internal flow control valve will reduce flow rates to maintain a minimum LWT of 100° F, resuming full flow at
4. higher LWT conditions.
5. When the Cold trigger sensor detects water at Target Tank Temp temperature, demand ends.
6. At demand end, internal circulator will continue to run until Purge Cut Out temperature is reached, or Max Purge Time is reached, whichever comes first.
7. Run signal contacts open when circulator stops.

Tank Mode Programming for Multi-Pass

On the **Config** screen:

1. **Set the Target Tank Temp** value to the desired storage temperature.

- In commercial systems, this is typically 140° F.
- Do not set this above 140° F. in multi pass systems with the domestic hot water heat pump, as this can result in unacceptably high leaving water temperatures.
- This temperature will determine when the heat demand ends.

NOTICE

Equipment Damage!

Failure to follow instructions below could shorten the compressor life and void the warranty.

Do not set the domestic hot water heat pump to target temperature above 175°F.

2. Set the **Cold Sensor Cut-In**. This is the temperature that will initiate a heat demand at the cold (Low) sensor position.

- It should be set below the expected temperature of any recirculation loop returns. Typically, 100° F. or lower is recommended.

3. Set the **Warm Sensor Cut-In**. This is the temperature that will initiate a heat demand at the warm (High) sensor position.

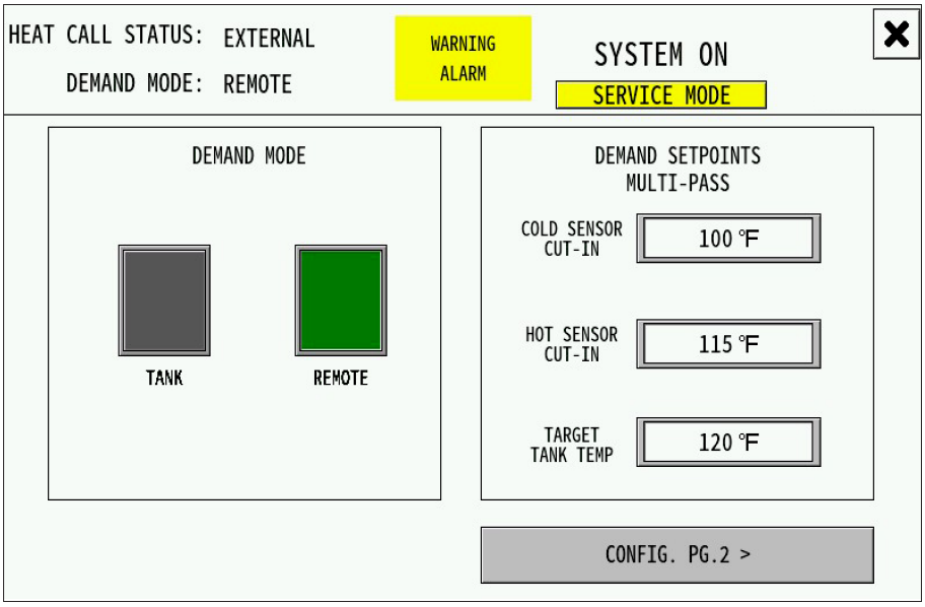
- It should be set above the expected temperature of any recirculation loop returns for single tank configuration.
- In multiple tank configurations where this sensor is a common pipe outlet sensor, it should be set above the minimum temperature allowed to go to the mixing valve. Typically, 125 Deg F. or higher is recommended.

4. Verify that there is a jumper or an external permission controller on the Remote Enable terminals.

Note: *Multi-pass systems in Tank mode can function without the warm trigger sensor. However, it becomes very difficult to ensure good performance at different tank conditions. Best practice for single sensor multi-pass will double required storage volumes to protect against under performance. If recirc return loops are present single sensor Multi-pass systems should not be attempted without proper engineering and application design support.*

Multi-pass Modes — Remote

Figure 20. Multi-pass mode configuration page



Remote Mode Sequence of Operation for Multi-pass

1. Demand begins when an external device (BMS, Central control, or controller wired to Remote Enable contacts) starts a heat demand. Run Signal Contacts close.
2. Internal circulator begins operation, and will not stop operation until demand condition is removed by the external control, regardless of compressor status.
3. Heat pump begins heat cycle. If the leaving water temperature is below 100° F., flow will be reduced to maintain a minimum LWT of 100° F.
4. If the heat pump entering water temp sensor detects water at 142° F, compressor operation will stop.
5. If the heat pump entering water temperature drops below 142° F., and the compressor time delay times out, compressor operation will resume.
6. Demand ends when the demand condition is removed by the external control device.
7. At demand end, internal circulator will continue to run until Purge Cut Out temperature is reached, or Max Purge Time is reached, whichever comes first.
8. Run signal contacts open when circulator stops.

Remote Mode Programming for Multi-pass

On the **Config** screen:

1. Set the **Demand Mode** to **Remote**.

Remote mode in multi-pass does not modulate water temperature or flow rates other than at low LWT conditions, and does not generate heat demands internally. Therefore, there are no water temperature targets to set on the unit. The heat pump will simply run in response to demands until demand is satisfied or high temp safeties are reached.

Pre-Startup Checklist

The following checklist is provided for reference, to assist in preparing for the eventual startup of the equipment. Please contact the manufacturer's representative more than one month from the intended startup date. The following checklist items will be reviewed for compliance before a final startup is scheduled with a factory authorized commissioning agent.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage or failure and void the warranty. Do not start the heat pump before a factory authorized commissioning agent is on site and ready to assist.

Placement and Physical Checks

- ☐ Unit is level, stable, and securely mounted.
- ☐ Unit has all appropriate service clearances, and access panels are not obstructed by pipes, wires, or other obstacles.
- ☐ Unit is adequately protected from falling objects, vehicles, or other potential damage.
- ☐ Open the heat pump and inspect the cabinet around the refrigeration piping and compressor for any signs of leaks or oil. If any signs of refrigerant leak are present, DO NOT START THE UNIT. Leaks need to be identified and fixed, and refrigerant charge weighed, before startup can occur safely.
- ☐ Perform a tug test on all wires in the electrical enclosure, to ensure all wires remain firmly seated after shipping. Ensure all power feeds are powered down for this testing.

Important: *Damage to the compressor due to startup with visible leak indication is not covered by warranty.*

Secure Loop Checks

- ☐ Pumps and control valves are wired, powered, and active.
- ☐ Source piping is insulated and freeze protected as appropriate.
- ☐ Source piping is pressure tested, filled, and purged of air.
- ☐ Source water quality is acceptable for operation.

DHW Water and Piping Checks

- ☐ Exterior water piping is insulated, freeze protected, pitched toward drain points.
- ☐ All water piping has been pressure tested and verified leak free.
- ☐ All water piping has been filled with water and actively purged of air.
- ☐ Pressure relief valves are piped to the floor, drain, or reservoir as per local codes.
- ☐ Water quality has been determined to be acceptable for operation and potable use.
- ☐ Verify tank temperature probe or aquastat is installed as per the tank sensorsfor single or multi-pass operation, as appropriate.

Electrical Checks

- ☐ Main power wires are securely attached to the heat pump and active.
- ☐ All control and communication wires are securely attached, and connected equipment is in place and ready to operate.
- ☐ Verify jumper or controller is installed on Remote Enable terminals if the heat pump is in tank mode.
- ☐ Verify jumper is NOT installed on Remote Enable terminals if the heat pump is in external control mode.

Final Checks

- ☐ All panels and enclosures are securely closed and affixed.
- ☐ All ball valves in the piping systems are open, including valves on expansion tanks, storage tanks, condensate drains and swing tanks.
- ☐ Turn on the main power to allow the heat pump to warm up. DO NOT engage any functions on the control interface.

Startup Procedure

NOTICE

Compressor Damage!

Failure to follow warm up time recommendations could result in compressor damage.

Heat pumps must be on active power for at least six hours before pressing the On button to enable operation. Activate the main power feeds, and confirm the system is Off at the control interface during this period.

The products to be started up by factory authorized commissioning agents ONLY.

Startup dates are to be requested through the manufacturer's representative more than one month before the intended startup.

Pre-Startup checklists must be submitted and completed more than five days before the startup date.

Troubleshooting

Use the following lists of startup issues, alerts, and faults to assist with the diagnosis and troubleshooting of some common problems.

Note: *If major components end up damaged or defective, the user MUST obtain assistance and approval from the manufacturer to authorize warranty replacement, before the components are removed from service.*

Relevant Screens for Troubleshooting

The interface on the heat pump has information available to assist with troubleshooting, on the Main display page and on the Diagnostic pages. See Diagram 10 and Diagram 11.

In addition to the informational interface pages below, the user can access the Alarms and “Error Log pages from the main screen. The Alarms page displays currently active alarms, and the Error Log displays a record of alarm conditions that the heat pump has experienced. If alarms or problems occur, please refer to Table 9 on page 32 to help guide the troubleshooting response.

Figure 21. Main interface page

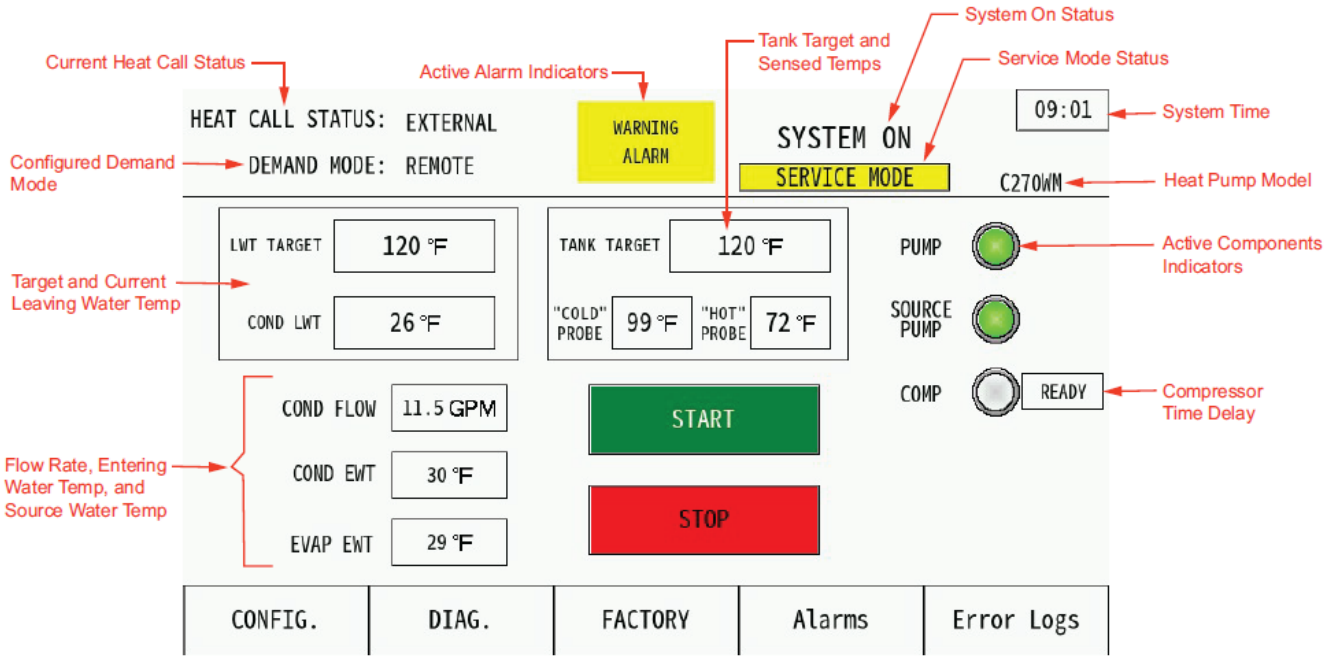


Figure 22. Diagnostic interface page

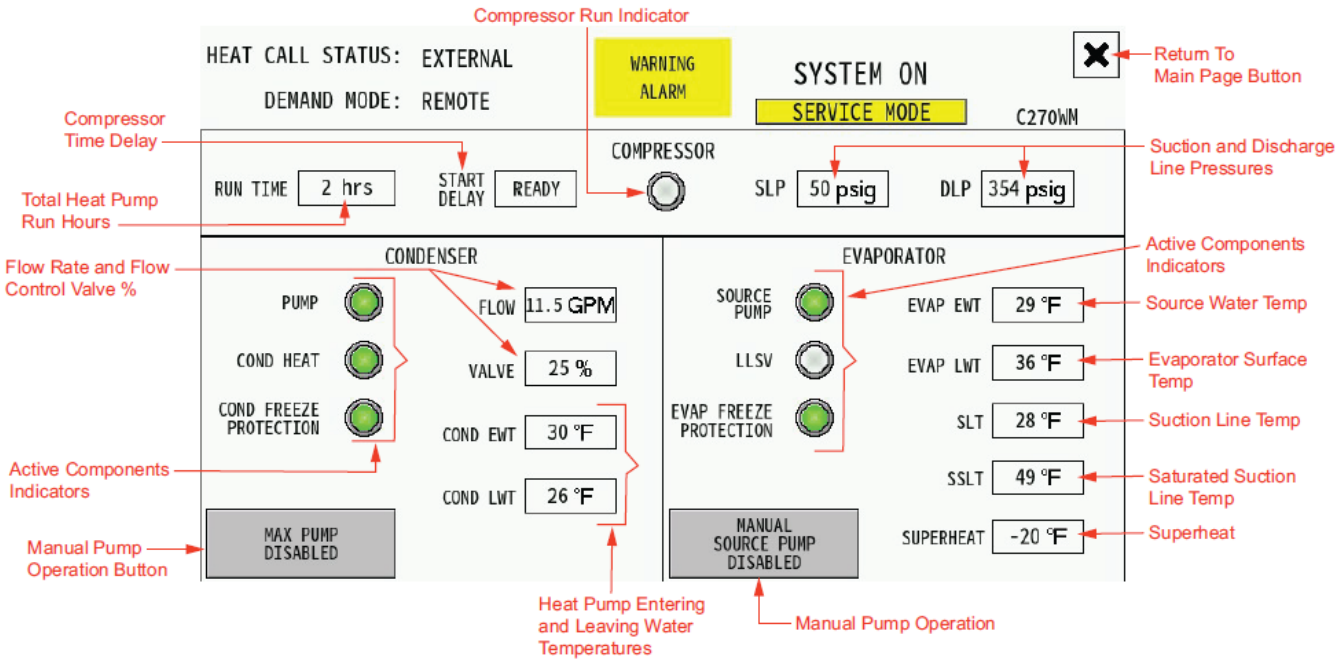


Table 9. Troubleshooting

Problem	Check
Display screen is dark	Main power is active at breaker and input terminals.
	Transformer is providing 120V power.
	Control screen is receiving power.
Cannot access diagnose screens	Service jumper is installed and secure.
Heat pump will not run	Primary power is active.
	No alarms or alerts present on control screen.
	System parameters would create a demand.
	System is turned "On" at control screen.
	System is "Enabled" by BMS.
Pump runs, but not compressor	No Alarms are present.
	Heat pump is not in post purge.
	Compressor Time Delay (CTD) is zero.
	EWT is not too hot for selected mode.
Unit runs, but water temperature is insufficient	Tank and/or outlet temps are set correctly.
	Single-pass: Internal control valve is working properly.
	Outlet temp is allowed by current ambient temps.

Table 10. Alerts and faults

Alert/Fault	Trigger	Check
High pressure	Refrigerant pressure is too high	All Outlet Flow checks are good.
		Ambient temperature is not too high.
		Inlet water temperature is not too high.
		Wye strainer is clean.
		Refrigerant charge is not too high.
		High pressure sensor and wiring are good.
Low pressure	Refrigerant pressure is too low	Source water flow is adequate.
		Source water temp is not too low.
		Inlet water temp is not too low.
		Single pass: Control valve is modulating flow.
		Refrigerant charge is not too low.
		Low pressure sensor and wiring are good.
Condenser or evaporator flow	Water flow rate is too low on load side or source loop side	External valves are open.
		Single Pass control valve is opening.
		Piping is not air-bound.
		Pump is operating w/sufficient pressure.
		Internal heat exchanger is not fouled/scaled.
		Wye strainer is clear.
		Flow sensor and wiring are good.
ESTOP	Central control has sent an emergency stop signal	Central control is actually in ESTOP
Modbus comm	Modbus communication detects errors or failure	Wiring between PLC and BMS module is good
		PLC and BMS modules are operational
Oil pressure	Compressor oil pressure is low	Compressor Oil Level is good.
		Oil Pump is good.
		No evidence of oil around compressor base.
Power fault	Primary power out of phase or voltage spec.	Primary power wiring correct and secure.
		Power Monitor adjusted to building voltage.
		Building is not experiencing power problems.
		Building voltage is in spec.
		Power Monitor and wiring are good.
Pump down safety	Pump down has not successfully reduced system pressure	LLSV is operational.
		Compressor is operational.
		Low Pressure sensor is operational.

Table 10. Alerts and faults (continued)

Tank probe	Tank Probe is not detected (TT1 or TT2)	Tank Sensor and wiring are good.
		In Multi-pass Mode, TT2 is connected.
		In remote mode, external controller is connected.
		System is configured in tank mode if no BMS.
Sensor (various)	Specified sensor is out of range or not detected	Specified sensor is wired and operational
M protection	Electrical or Temperature problem with compressor	Power Monitor and wiring are good.

Routine Maintenance

Like all modern equipment, heat pumps require routine maintenance for efficient, safe, and reliable operation. Confirm that a maintenance schedule is created and adhered to and that all personnel involved with maintenance are informed and educated on their role in supporting the system.

Following are suggesting timelines and maintenance items typically associated with heat pump water heater installations. It is not possible to foresee all possible system configurations, accessories, or site conditions, so this list should be considered advisory only. Final maintenance schedules are the responsibility of the service/maintenance personnel on the project, and should be adjusted in accordance with best practices and observed conditions.

Weekly Checks

- ☐ Visually inspect heat pump for wear or damage to unit exterior or interior.
- ☐ Inspect for ice or water buildup around the heat pump.
- ☐ Check screens and/or BMS portals for alarms.
- ☐ Verify the system is within normal operating parameters for water temperatures.

Biannual Checks (Spring and Fall)

- ☐ Inspect and clean cabinet interior as necessary.
- ☐ Inspect and operate all source side flow control devices.
- ☐ Isolate, inspect, and clean any wye strainers on the heat pump DHW and source piping.
- ☐ Inspect all attached piping for water leaks and/or uncontrolled condensation.

Annual Checks

- ☐ Confirm flow rate using the Max Purge button on the control interface, and verify that flow is at or above maximum design flow for the unit.
  - ☐ Descale heat exchanger if necessary (low flow unsolved by purging/pipe/pump inspection).
- ☐ Operate all relief valves and inspect for signs of weepage or leaking.
- ☐ With the unit off, disconnect the main power leads on the compressor. With a dielectric tester (megger), test and record resistance on each set of windings. Store this information for future reference. Reconnect the main power leads to the compressor.
- ☐ For systems with glycol antifreeze, test antifreeze efficacy, and water pH levels for excessively corrosive conditions.

Limited Warranty

The manufacturer extends the following LIMITED WARRANTY to the original owner of this commercial heat pump water heater subject to the terms, conditions and disclaimers stated below:

1. **Compressor**

   If the 5-Year Extended Compressor Warranty is purchased, and if within FIVE (5) years after delivery of this heat pump water heater the compressor shall prove, upon examination by the warrantor, to be defective, the warrantor will provide a replacement compressor.

2. **All Other Parts**

   If within 18 months after delivery or 12 months after commissioning of this heat pump water heater any other part or portion shall prove, upon examination by the warrantor, to be defective in material or workmanship, the warrantor will repair or replace such part or portion at its option. This warranty also extends to any factory supplied accessories.

3. **Conditions and Exceptions**

   Refrigerant, filters, refrigerant driers, and fan belts are not covered under this limited warranty. The warranty on all replacement parts, including the compressor, will be limited to the unexpired term of the original warranty. This warranty shall apply only when the heat pump water heater is installed in accordance with local plumbing and building codes, ordinances and regulations, the warranter's printed instructions provided with it and good industry practices.

   a. This warranty shall apply only when the unit is:

      i. used at temperatures not exceeding the maximum system temperatures printed in the instructions provided;

      ii. filled with potable water, free to circulate at all times and free of damaging water sediment or scale deposits;

      iii. used in a non-corrosive and not contaminated atmosphere;

      iv. in its original installation location, and under original ownership;

      v. in the United States, its territories or possessions, Canada, South America, Caribbean and Mexico;

      vi. sized in accordance with proper sizing techniques for commercial heat pump water heaters;

      vii. bearing the original rating label which has not been altered, defaced or removed, except as required by the warranter;

      viii. energized at the proper voltage and phase as stated on the rating label;

      ix. maintained in accordance with the instructions printed in the manual included with the heat pump water heater;

   b. Any accident to the water heater, any misuse, abuse (including freezing) or alteration of it, any operation of it in a modified form, will void this warranty.

4. **Service Repair and Expense**

   Under this limited warranty the warranter will provide only a replacement heat pump water heater or part thereof. The owner is responsible for all other costs. Such costs may include but are not limited to:

   a. Labor charges for service, removal, repair, or re installation of the water heater or any component part;

   b. Shipping, delivery, handling, and administrative charges for forwarding the new heater or replacement part from the nearest distributor and returning the claimed defective heater or part to such distributor;

   c. All cost necessary or incidental for any materials and/or permits required for installation of the replacement heater or part.

5. **Limitations on Implied Warranties**

   Implied warranties, including any warranty of merchantability imposed on the sale of this heater under state law are limited to 18 months after delivery or 12 months after commissioning duration for the heater or any of its parts. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Service Log

Issue Description	Date	Servicer

Notes

Trane - by Trane Technologies (NYSE: TT), a global innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

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