



Installation Manual



SANCO₂ Heat Pump Water Heater with Natural Refrigerant(CO₂)

Heat Pump Unit : GS4-45HPC
Tanks : SAN-43SSAQA
SAN-83SSAQA
SAN-119GLBK



※This manual is for TO BE USED by the installing Contractor only.

This appliance is not to be installed by unqualified and unlicensed persons, please read and understand this manual prior to installing and operating the unit.

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PATENTS

This water heater may be protected by one or more patents or registered designs in the name of ECO2 Systems LLC

TRADE MARKS

® Registered trademark of ECO2 Systems LLC

Note: Every care has been taken to ensure accuracy in preparation of this publication.
No liability can be accepted for any consequences that may arise as a result of its application.

Introduction

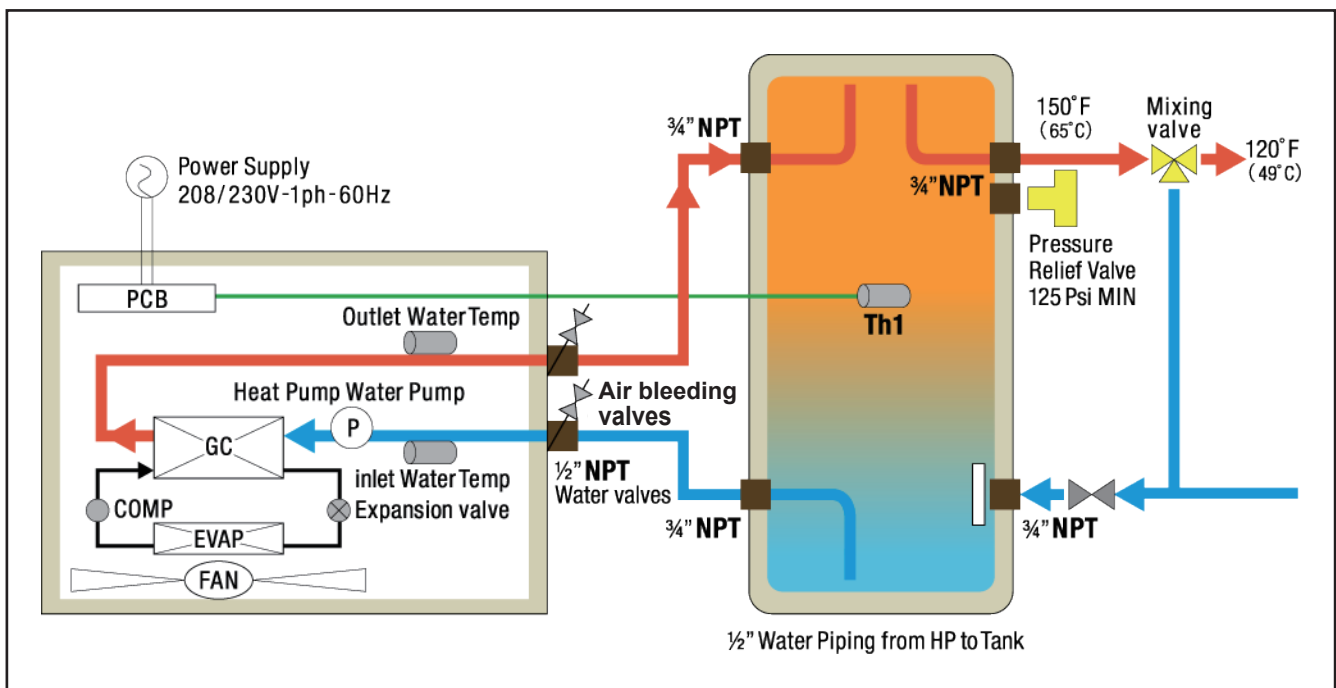
The SANCO₂ Heat Pump Water Heater System has been designed using the latest refrigeration technology to remove the heat from the air to heat water. The refrigerant we use is CO₂ which does not contribute to global warming so it allows us to help keep a clean healthy earth for future generations.

By using CO₂ as the refrigerant, we have produced one of the most energy efficient units currently available. It is even more efficient when connected to demand response power and the noise level is so low it will operate unobtrusively at any time.

How It Works


The SANCO₂ Heat Pump Water Heater System heats water by transferring the heat from the surrounding air to the water using a refrigerant. The refrigerant is heated by a heat exchanger that absorbs heat from the surrounding air (Figure 1).

Figure 1: Heat Pump Water Heater System




Installation Details

This SANCO₂ Heat Pump Water Heater System must be installed by licensed personnel in accordance with local building codes:

- Installing contractor should be licensed by applicable state/province and municipal authorities to install an Electrical & Plumbing product.
- The unit has been designed for heating potable domestic hot water. Any other usage, such as use for DHW in combination with space heating requires both a heat exchanger suitable for local codes to be installed on the system to separate potable and non-potable water and consultation with SANCO₂.
- The unit is designed to operate when connected to the water supply with a maximum operating pressure of 95PSI (655 kPa). To ensure the mains pressure does not exceed this, first check incoming cold water mains pressure, and then a pressure regulating device must be connected to the water supply line.
-  **DANGER** This system delivers hot water exceeding 120 °F (50 °C). Installation of a temperature tempering device is **MANDATORY** to avoid potential scalds and burns.
- The unit must be stored and transported in an upright position. Failure to do so may render the unit faulty. Such failure is not covered under any warranty agreements.

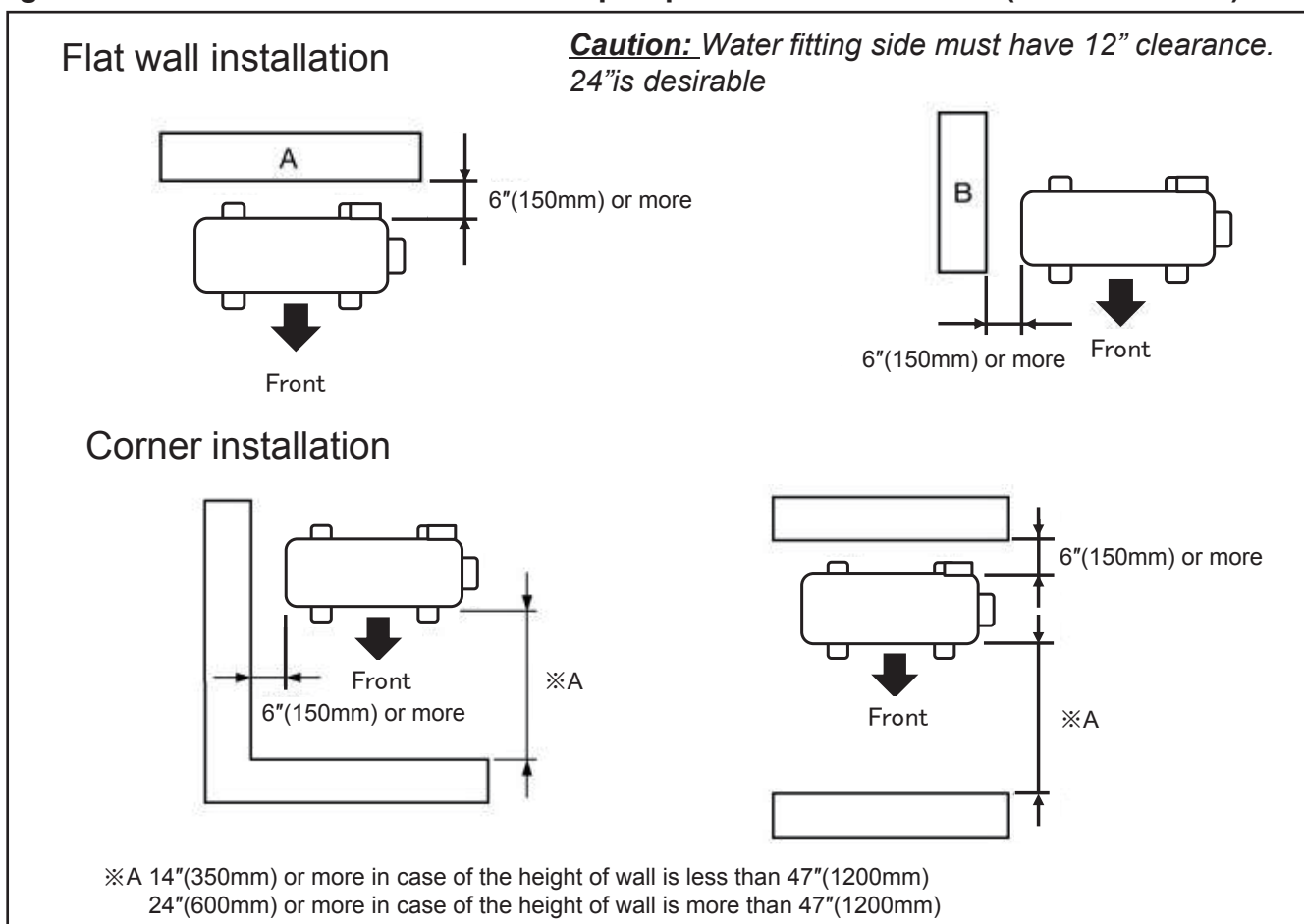
Failure to comply with the above conditions will void the warranty.

-  **California Proposition 65 WARNING**
This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Installation Location

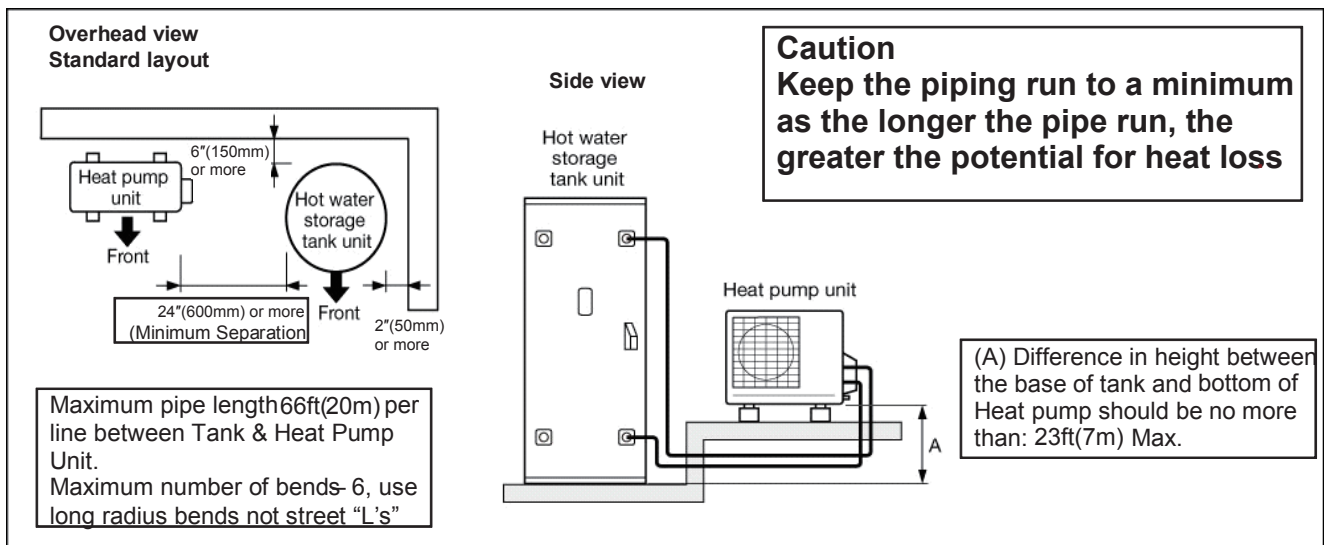
- For the most efficient operation of the heat pump unit, the optimum location is the warmest side of the property and there should be sufficient space for the air to circulate through the unit.
- The tank unit should be located as close as possible to the most frequently used hot water outlet such as a bathroom. It may be located either outside or inside. The heat pump unit must be located outside and as close as practicable to the tank unit but not further than 66ft(20m) away from the tank.
- Ensure sufficient clearance around the heat pump unit to allow air to circulate and provide adequate space for service maintenance of the unit (Figure 2).
- Although the heat pump unit is very quiet, it is preferable to avoid installing it directly below a bedroom window.
- Install the heat pump unit in an area which allows sufficient ventilation. Poor ventilation may cause the unit to short cycle and this could increase power consumption by more than 10%.
- Do not install the heat pump unit in a confined space without making provision for intake or exhaust airflow for the unit.
- If the heat pump unit is installed facing a wall, exhaust air may stain the wall.
- Do not place the unit to an area where leakage of the unit will result in damage.

Figure 2: Restrictions on where the heat pump unit can be installed (overhead view)



- ※ 1 Unit should have a minimum of 12" or 300 mm space above the unit to ensure correct operation
- 2 Discharge Air blowing against a wall/obstacle in front of the unit may stain the wall/obstacle
- 3 If the unit is not able to operate with adequate airflow due to obstacles and reduced clearances, Then heating output will be reduced by approx. 10% and power consumption increased by approx. 10%
- 4 For optimum operation install the unit per the above or in a location with no obstacles

Figure 3: Restrictions on installation with the space between the tank unit and the heat pump unit



Heat Pump Unit Installation

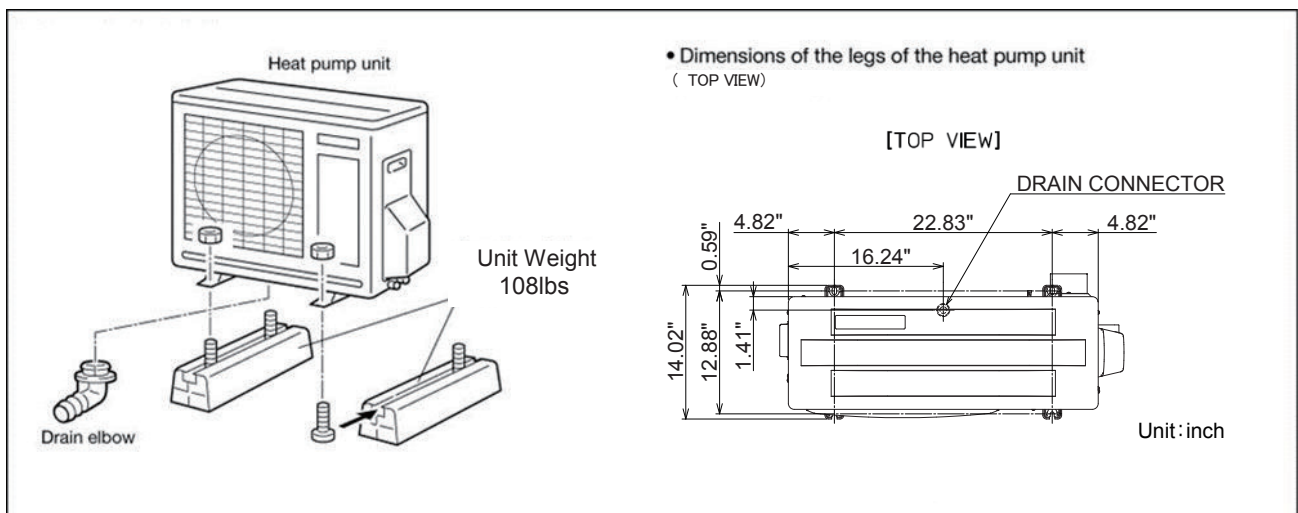
- The surface to which the heat pump unit is installed must be firm, preferably a concrete pad or block. If the surface is firm there is no need to fix the unit to a base surface, unless there is a likelihood of high wind or local vibration. If the heat pump unit and tank unit are to be fixed, appropriate fixing devices for the weight/expected duty should be used. It is permissible to install the Heat Pump on the side of a wall provide an adequate support is used.
Note: For California installation the Tank section water heater must be braced, anchored, or strapped to avoid falling or moving during an earthquake. For Tank size over 52 Gallons (236l) consult your local building jurisdiction for appropriate bracing designs.
Note: For Florida installation the Heat Pump unit should be installed in accordance with all local codes regarding Hurricane winds.
- Appropriately treated lumber or pre-fabricated "pump ups" **MUST** be used to raise the Heat Pump unit 4"-6" from the ground – this will allow defrost condensate to drain. In areas with significant snowfall ensure unit is mounted above the anticipated snowfall depth.
- Wall Brackets and other mounting solutions are also available from ECO2 Systems LLC.
- A Pressure Relief (PR) valve **MUST** be installed during the installation of the tank unit. This is installed in a defined point near the top of the tank unit. The PR Valve must have clear drainage where escaping steam or water can flow freely. PR Valve setting should be 125 Psig.
- The installation site must be well drained so that any water accumulating (such as rain or pipe leakage) will drain away and not enter the heat pump unit and the tank unit.
- Supply water pressure must be a minimum of 29 PSI (200 kPa) to ensure Heat Pump unit operation – If pressure is below 29 PSI install a booster pump to water supply.

Note:

The entire system is set up and fully functional when supplied. Once all the water and electric connections have been made, the system will operate automatically provided that mains power is available.

The only adjustments to the unit are to set the current time on the operation panel under the top housing cover & especially if the block out time setting is desired.

Figure 4: Heat pump installation example and dimensions



- Attach the drain elbow to the drain opening located on the bottom of the heat pump unit. The drain elbow is included in the installation kit for the heat pump unit.
- Attach a drain hose with 5/8 inch (16mm) of inner diameter to the drain elbow to guide the drained water to an appropriate drain.

Water Piping Installation – Heat Pump Unit & Tank

- All piping that connects to the water supply must be installed by a licensed contractor.
- The water supplied to the system must comply with the potable water quality standard. Use of water that does not comply with this standard could result in a malfunction of the system.
- The water supply must have a pressure of 29 PSI (200 kPa) or higher.
- A drain trap must be installed on the drain pipe if water is to be drained to a drain pan.

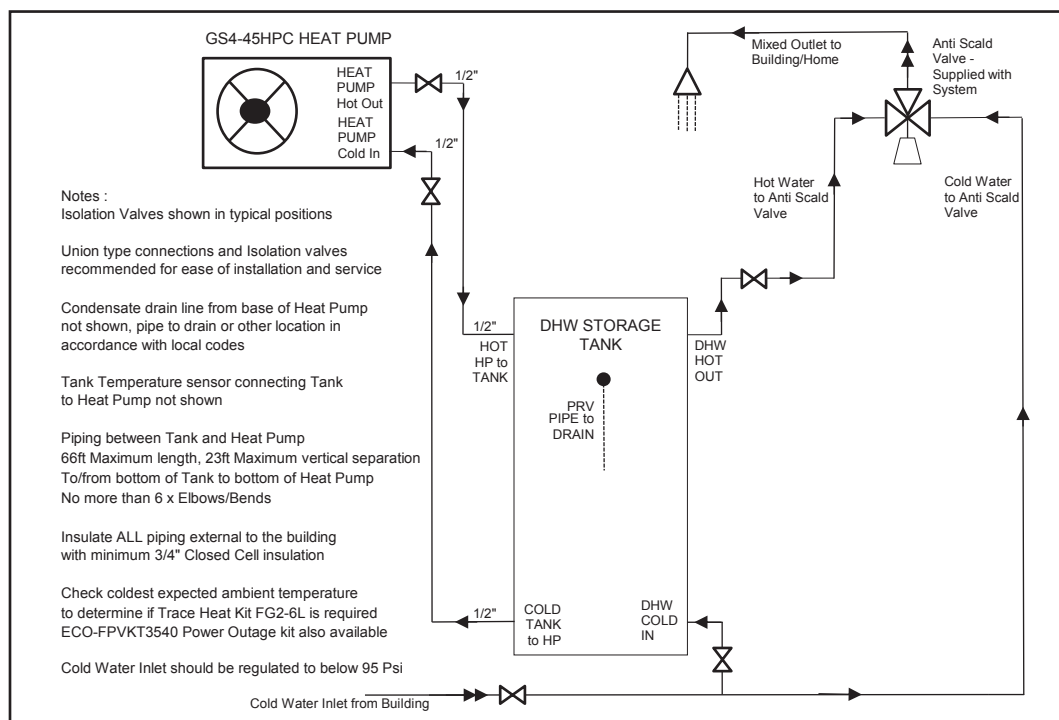
- This product cannot be connected to a solar water heater.
- The piping must be insulated with **MINIMUM** ¾" to 1" closed cell insulation.
- Self Regulating Heat tape (5-8W per foot) must be installed on both Water Lines to the Heat Pump to protect the water piping in areas with design temperatures below 27°F.
- If the piping needs brazing, make sure that all flux and flux splatter is wiped away with a wet cloth. When brazing, ensure connections are protected using a wet cloth.
- As the hot-water supply pipe will expand and contract, use sleeves when penetrating through concrete walls or slabs.
- With buried piping, an outer cover will need to be used that has had both ends sealed to avoid any ingress of rain.
- Use only heat-resistant and corrosive-resistant material to seal the pipe joints.
- Cutting and wrenching the piping material may result in oil and dust adhering to it. After processing, clean the material with a mild detergent before doing any piping work and smooth the edges to remove any scratches and burrs. (After flowing water through it verify whether any debris has accumulated on the filter of the faucet and heat pump unit pipe.)
- When using PTFE sealing tape, ensure that no tape is sticking out of the threads.
- Any heat-resistant PVC piping use is **NOT** recommended due to high outlet water temperature for between the heat pump and the tank as well as the tank and the mixing valve.
- Follow the manufacturer's instruction manual for the type of bond, amount to be applied, curing time, and other specifications.
- If any bond or flux has entered the tank unit and the hot water has a chemical/acrid smell, take the following countermeasures.
 - a) After heating the water in the tank unit, drain it and clean inside the tank unit. Fill the tank unit with 26 gallons (100 litres) of water and exchange twice.
 - b) Clean or change the filter.
 - c) Fill up the tank unit.
 - d) Drain water from the relief valve for one to two minutes.
 - e) Run water from all the hot water supply faucets in the house for about ten minutes to clean inside the pipes.

Heat Pump Unit Water Piping

ALL PIPING BETWEEN HEAT PUMP & TANK SHOULD BE 1/2" NO EXCEPTIONS

- Connect the heat pump unit COLD WATER to the tank unit fitting marked Cold Supply. – 1/2" NPT Connection. (Use 1/2" BSP to 1/2" NPT connection adapter.)
- Connect the heat pump unit HOT WATER to the tank unit fitting marked Hot Return – 1/2" NPT Connection. (Use 1/2" BSP to 1/2" NPT connection adapter.)
- Connect the mains water supply to the lower fitting on the tank unit marked Cold Water Inlet.
- Connect the hot water supply pipe to the top of the tank unit marked Hot Water Outlet.
- Install the PR valve to the fitting on the tank unit marked PR valve, pipe from PR valve directly to a Building drain; do not install any shut off valve between PR valve and Building drain.
- Run water through the pipe(s) to remove any debris inside before connecting the pipe(s).
- After all the piping connections are completed, run water through the system.
- Bleed the air from the system according to the instructions below on Page 17.
- Make sure all the necessary devices are mounted to the pipes as shown in diagram. If the heat pump unit piping is kinked or clogged or the air inside was not bled during the test operation, temperature of the supplied hot water may become inconsistent.

Figure 5: Required System piping (Typical System piping)



Mains Power/Electrical Installation

DANGER

- All Electrical Wiring should be done in accordance with the latest edition of the National Electrical Code (NEC) and all local State/Province and Municipality codes.
- The power requirement for the system is a dedicated 15 amp circuit fitted with a circuit breaker. This circuit may be connected to constant power or off-peak power.
- A local disconnect should be installed adjacent to the Heat Pump unit in accordance to NEC and local codes.
- **Installation of this system must be carried out only by a qualified installation technician (electrical, HVAC or plumbing).**

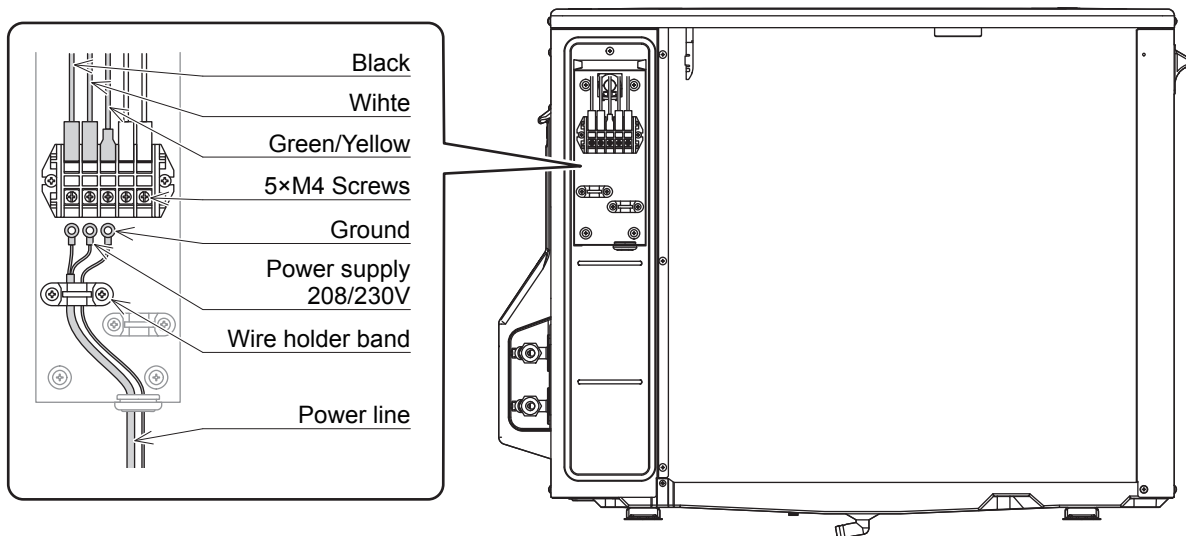
Electrical Connections

- Breaker size and wiring must be sized per NEC rules for the rating plate amperage, MCA and MOP or Max Circuit Breaker.
- **Power Supply is 208/230V-1Ph-60Hz**
- **Verify that the tank unit is full of water and the water shut off valves are open before turning on the power.**

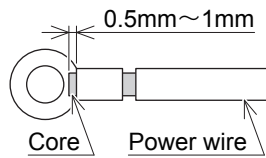
How to Connect Main Power

- Remove the power box cover (Philips head screwdriver required).
- Connect the power wiring to the terminal block per the wiring diagram/manual.
- Ensure ground wire is connected.
- Secure the field power supply wiring below the terminal block with the screw clamp fitting.
- Re attach the power box cover to the heat pump unit.

Figure 6: Main Power Connection



Heat Pump 208/230V Power Wiring must use solid copper wire.
Appropriately sized ring or fork terminals are recommended for easier connection.



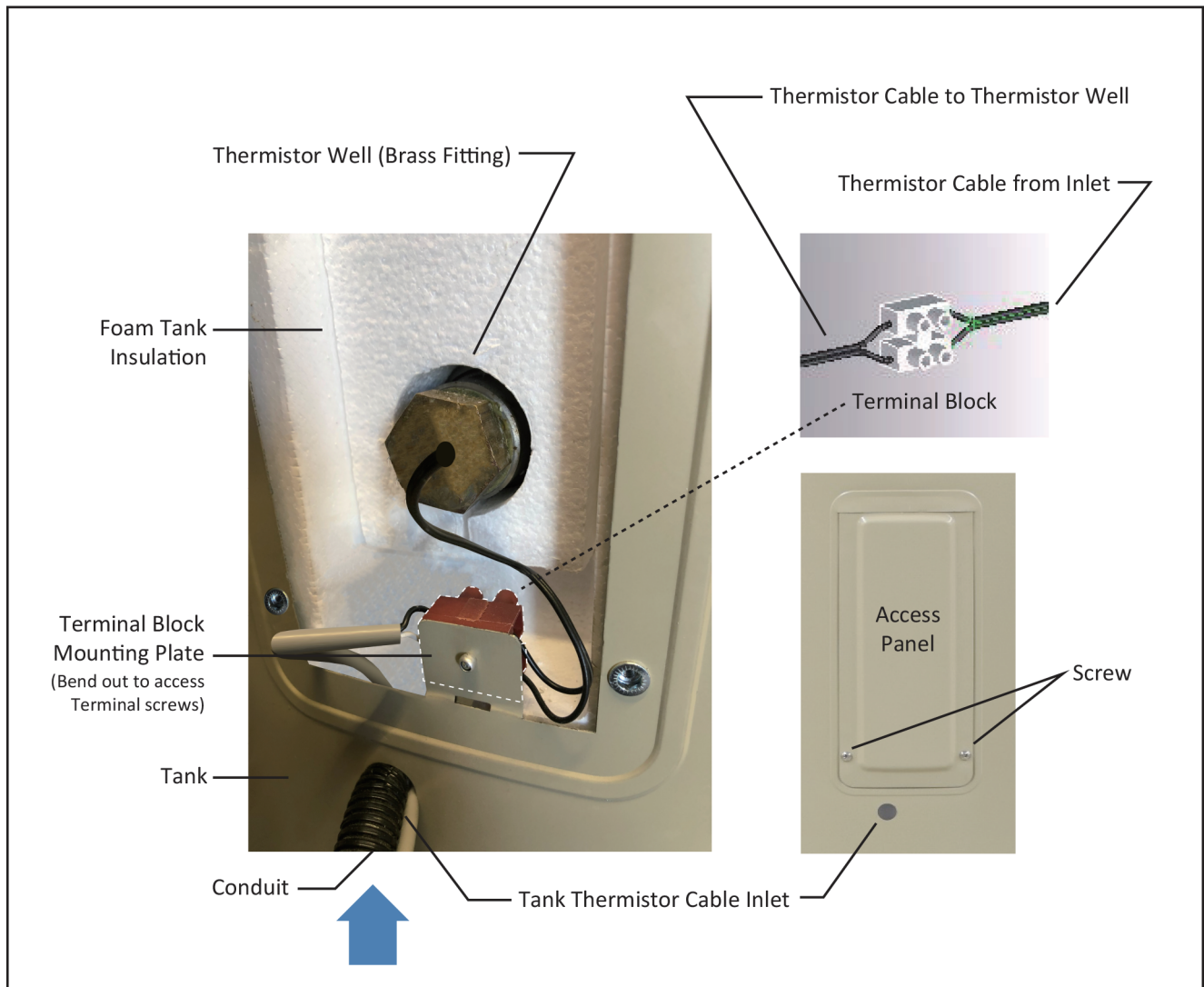
How to Connect Tank Thermistor Cable to Heat Pump Unit

- The thermistor cable and conduit length are provided to cover 16.5 feet between the tank and the Heat Pump.
- If the units are located closer, the thermistor cable and conduit may be cut to the desired length (Figure 7).
- If the units are further apart, the thermistor cable may be extended by connecting an 18-2 AWG Shielded wire to the existing thermistor cable – connections are not polarity sensitive.
- Attach the conduit connector to the conduit end. Push the conduit into the opening on the connector until the conduit does not go any further. Pull the conduit several times to ensure the connector is fixed properly to the conduit.
- Unscrew and carefully remove the terminal block cover on the tank. Do not use unnecessary force to remove the cover as this could pull and break the cable coming out of the tank unit.
- Attach the connector on the end of the thermistor conduit coming from the heat pump unit side to the opening on the bottom of the cover on the tank unit. Confirm the gasket is adhered to the thread of the conduit connector before attaching the connector to the cover. If the gasket is not present, there is a risk of water getting inside the cover and this may result in a malfunction of the terminal block.
- Connect the thermistor cables to the bottom of the terminal block.
Replace the terminal block cover back onto the tank unit and tighten the screws.

Note :

SAN-119GLBK tank does not include an access panel / terminal block.

Figure 7: Connecting tank unit thermistor cable - SAN Tanks shown as example



Note :

SAN-119GLBK tank does not include an access panel / terminal block.

Figure 8: Connecting Heat Pump unit thermistor cable

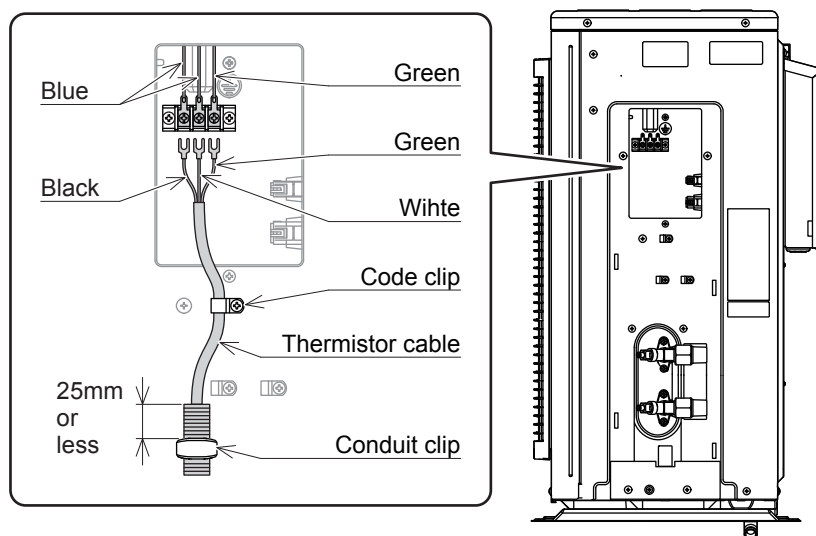
Please note:

All Electrical Wiring should be done in accordance with the latest edition of the National Electrical Code (NEC) and all local State/ Province and Municipality codes.

Electrical Installation

DANGER

- Installation of this system must be carried out only by a qualified installation technician (electrical, HVAC or plumbing).
- Remove the piping cover.
- Connect the thermistor cable line to the terminal block.
- Fix the thermistor cable with the code clip and conduit clip.
- Attach the piping cover back on the heat pump unit.



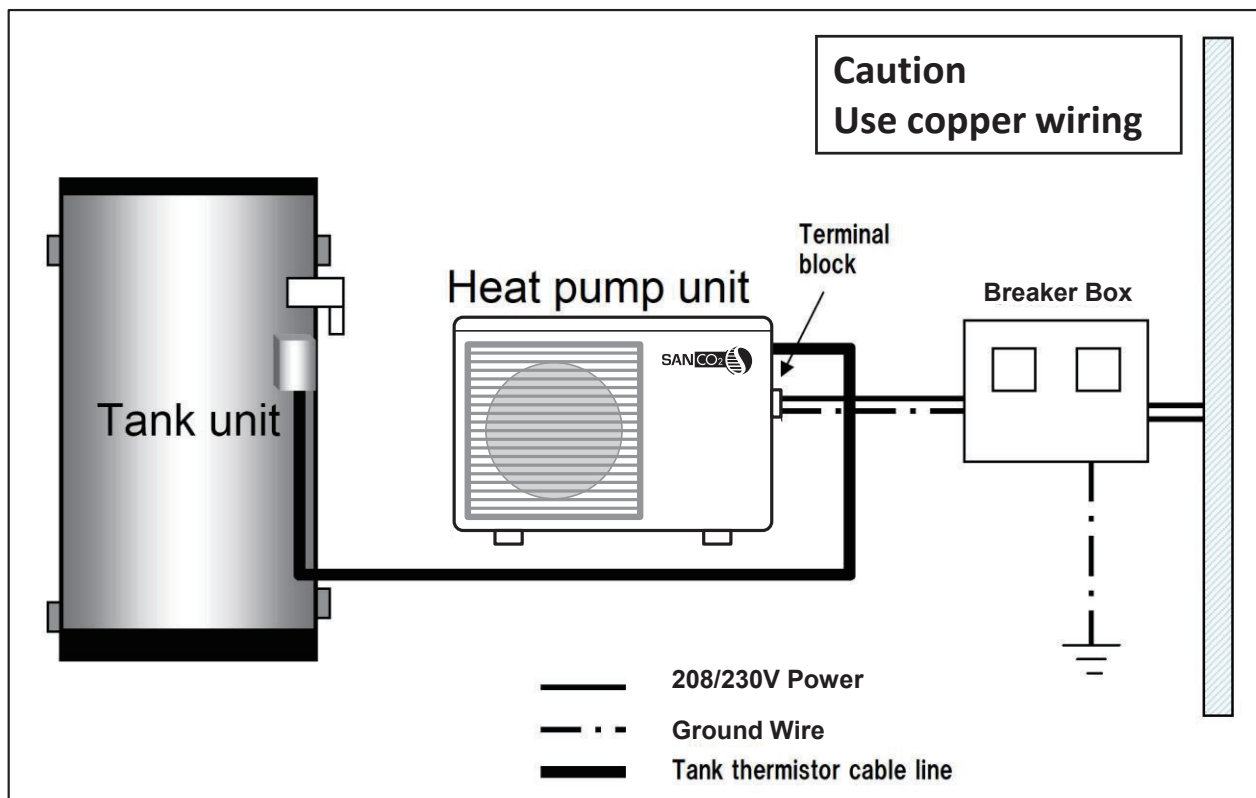
Standard System Operation

- If the block out time function is selected (setting is covered on Page 23) the unit will not operate during the block out times – this function is typically used on installations that have time of use electricity tariffs.
- The system will not run if the power supply is cut off. However, the system will automatically start operation, once the electric power supply is restored.

System Operation If Connected to Dry Contact

- There are no special settings for the Dry Contact input. The system will run once dry contact input is closed and the temperature in the tank drops below the set point of the tank thermistor.
- If the unit is connected to Dry Contact and hot water consumption has been higher than normal, hot water might not be available until the next power supply cycle.
- Daily frequency and amount of hot water consumption may also affect the duration of the heating cycle operation.

Figure 9: Outline of electrical system connections



How to Connect Dry Contact

Dry Contact Purpose

- **UNIT START INPUT**
Allow External ON/OFF switching of the Heat Pump –
Commonly used in Utility programs or other installations where having control of the Heat Pump other than Tank temperature is required.

Note: Even should the unit be in the OFF mode via the Dry Contact the Freeze Protection program may still start the unit depending on Ambient and Water temperatures.

- **ERROR SIGNAL OUTPUT**
Send an error to Utility programs.

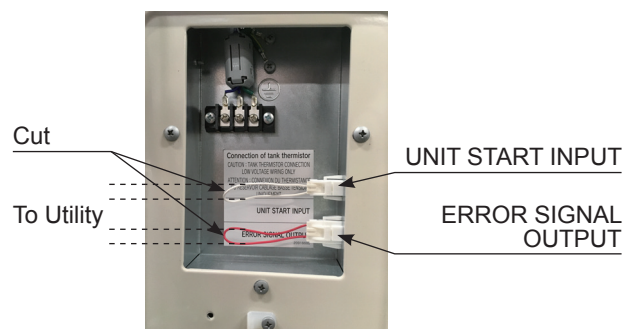
Installation of Dry Contact switching

Remove the pipe cover.

Locate the Dry Contact loop.

Cut the loop and strip wire from the two ends.

Wire to external utility, note the maximum voltage and current requirements.



Contact specification

Voltage	5V
Current	2mA

CAUTION : If voltage is applied to the Dry contact terminal from the outside switch, the equipment will be damaged.

Unit Operation

- **UNIT START INPUT**
When the switch is in the OPEN position the unit is OFF
(Exception – Unit will run if Freeze protection mode is activated)

When the switch is in the CLOSED position the unit is ON
The unit will now be controlled by the Tank Temperature Thermistor
Unit will run if the Tank temperature is below 113°F as sensed by the thermistor
- **ERROR SIGNAL OUTPUT**
When an error has occurred, the switch is open.

The basic system installation is now complete; the unit is now ready for initial water filling, bleeding and then start up
Check the Installation against the Installation Check list provided at the end of this manual

Ensure that the work site is tidy; SANCO₂ International recommends the use of Slim Duct or Fortress product to cover water piping on the outside of the house.

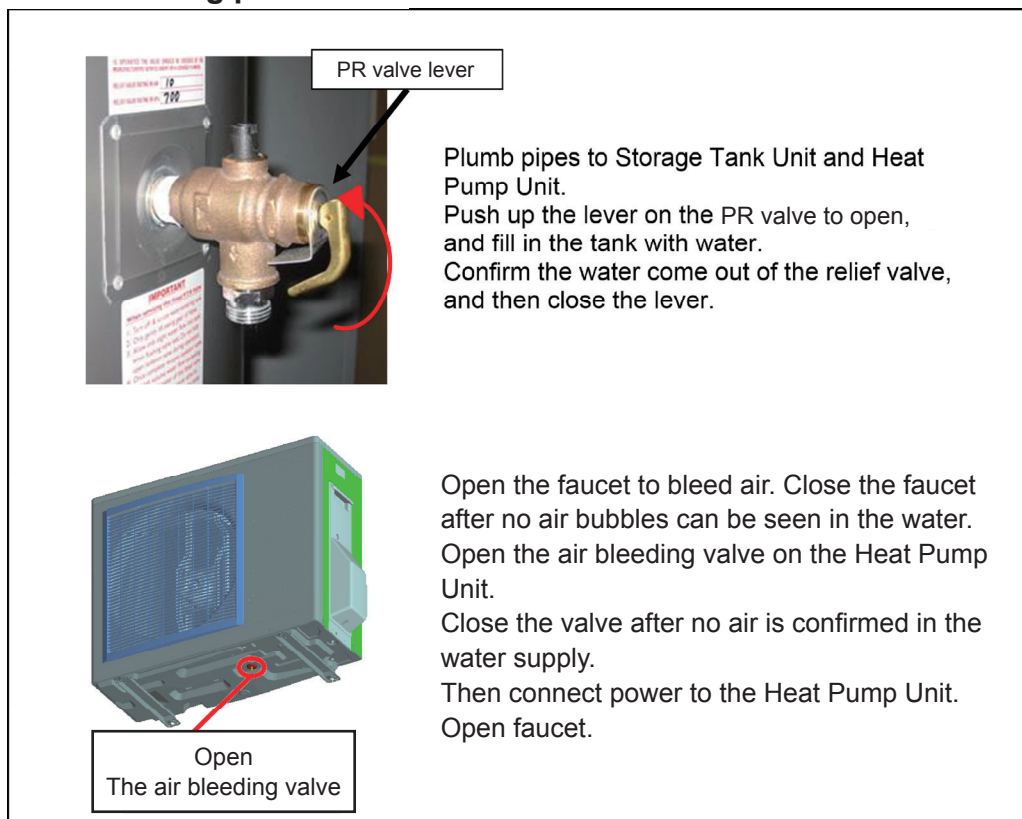
Filling the System & Bleeding Air

The following steps must be taken to ensure all air is bled from the system. Incorrect bleeding of air may cause the water temperature to vary during operation, and lead to possible error codes.

- Ensure that all piping to tank unit and heat pump unit are installed and connections are tight, then open the Cold Water Supply Valve to the system.
- Push up the lever on the PR valve to open, and fill the tank unit with water. Confirm that water comes out of the relief valve, and then close the lever.
- Open the hot water faucets to bleed air from the house piping system.
- Close the faucets after no air is seen in the water.
- Open the water drain plug on the heat pump unit. Close the plugs after no air is seen in the water or a steady stream of water is present.
- Supply power to the heat pump unit.
- Display shows "1200" then "Clock setting mode" is started with operating "Air bleeding process" at the same time.
- In case finish time setting or nothing is operated for 1 minute, "Clock setting mode" is terminated and "APon" will be displayed on the monitor.
- "Air bleeding process" will be done in 5 minutes. Once it's finished, current time will be shown on monitor.
- Leave the hot water faucets open for 3 minutes. Close the faucets after no air can be seen in the water.

CAUTION : Air bleeding valve is located at the bottom of the heat pump unit!

Figure 10: Air bleeding process



Freeze Protection

- Even if the water pipes have been insulated, the piping can freeze if the surrounding temperature falls below freezing (32°F). This could cause damage to the equipment and piping so make sure the appropriate freeze protection measures are taken.
- Follow the instructions in the installation manual provided with the freeze protection heat tape.
- Freeze protection valves can be installed for freeze protection during power outage.
- After completion of the piping, inspect the plumbing for any water leaks from the joints before installing freeze protection.
- Wrap the freeze protection heater around the pipes, up to the water connectors of the Heat Pump unit.
- Ensure the freeze protection heaters are connected to a **24 hours continuous power supply**.
- It is important to fully explain the use and operation of the freeze protection heater to the customer.
- **When turning off the power, because the unit will not be in use, ALL water must be drained from the unit and piping.**



Note: Heat tape that uses the outside temperature to energize, may not maintain the temperature of the pipes correctly. It is important to use a heat tape that directly senses the pipe's temperature.

Figure 11: Details on wrapping thermal insulation around the piping connector

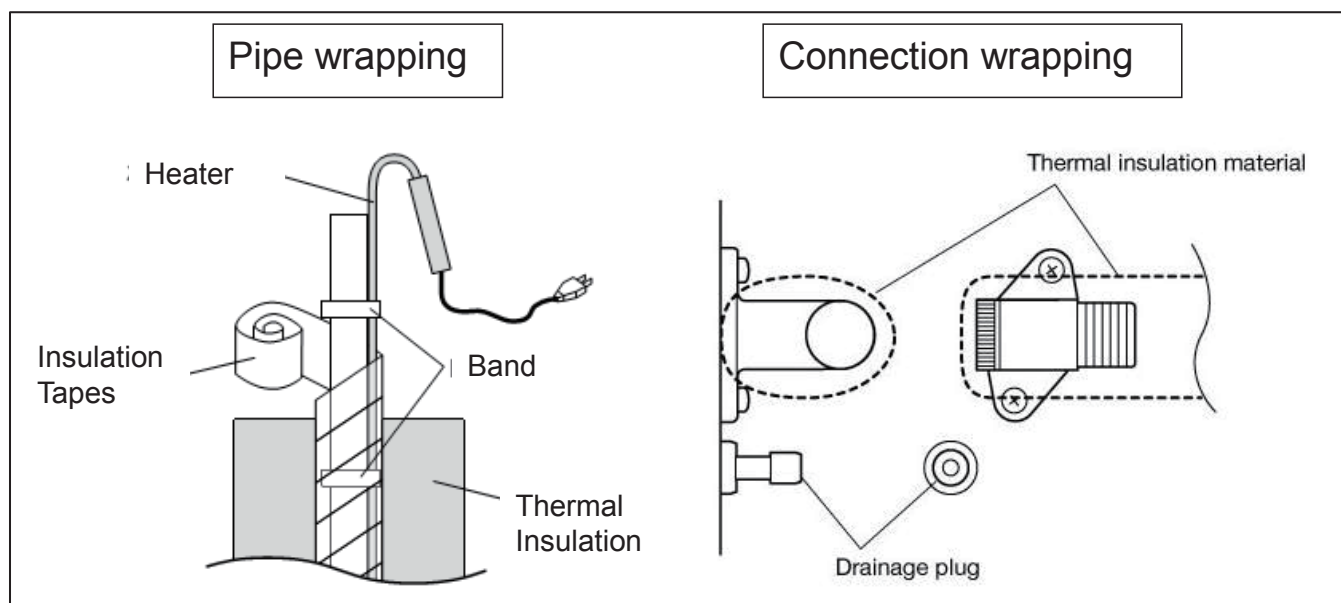
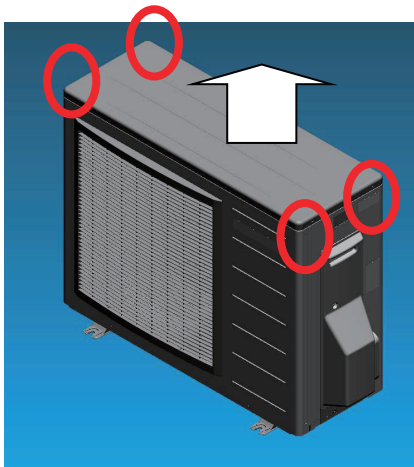
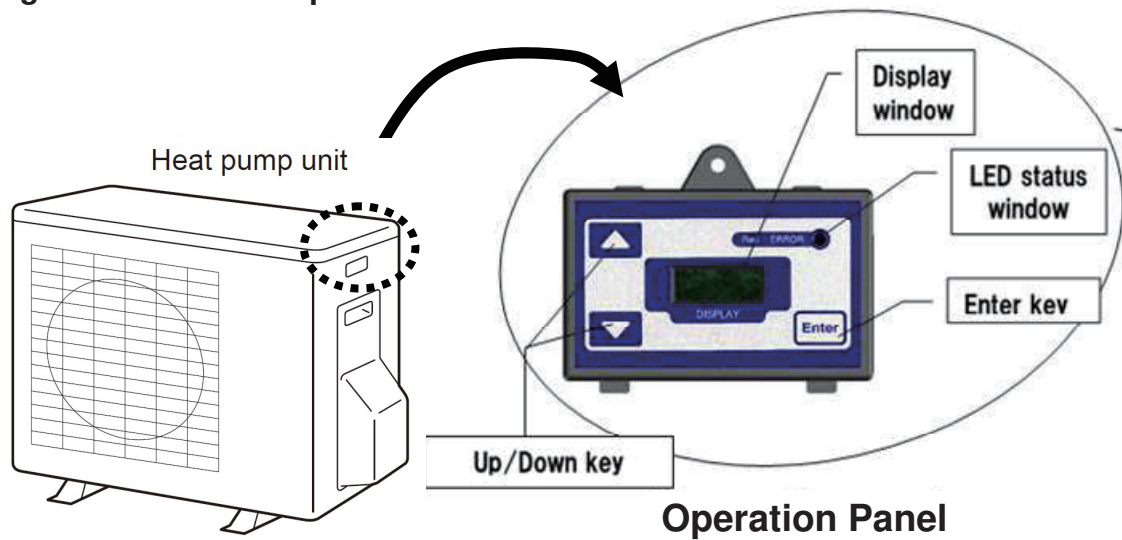
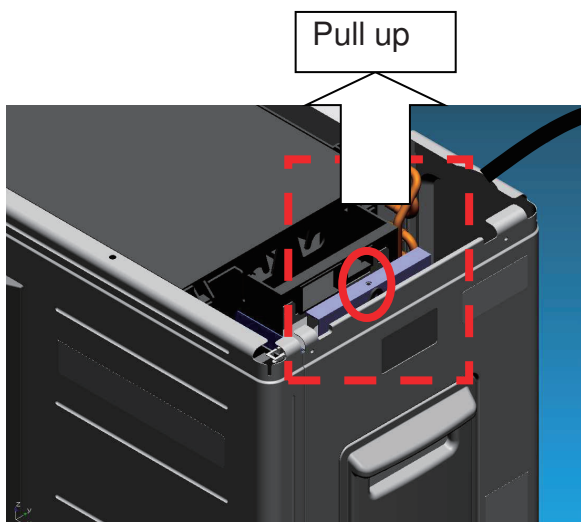


Figure 12 How to operate the controller



How to remove the operation panel

- 1.Remove Top Panel (4 screws)
- 2.Remove the screw
- 3.Pull up Operation Panel



Operation Panel

This product contains a built-in clock.

As part of the water heating cycle logic refers to the current time, it is necessary to set the clock before starting to use the product. The current time can be set in the Clock Setting Mode as described below.

Note:

There is no need to adjust the time setting for the daylight saving period. Even if the installation is conducted during the daylight saving period, the clock setting to the ordinary time (not daylight saving time) is preferable.

1. Switching to Clock Setting Mode
Press the “Enter” key to switch to the Clock Setting Mode.
Time Display starts flashing once the mode is switched.
2. Setting the Clock
The time setting can be adjusted by pressing “Up” and “Down” keys. Fast forward and rewind are available by pressing and holding down either the Up or Down key.
3. Confirming Time Setting
After the clock is adjusted to the current time, press the Enter key to confirm the setting. The time display stops flashing once the setting is finished.

Caution

The setting automatically cancels when no panel operation is performed for more than 60 seconds in the Clock Setting Mode. If this occurs, changes made will not be reflected to the setting. If the clock setting is rewound to a time that is earlier than the time when a heating cycle is triggered, the system will start the heating cycle.

Note:

IF NO BUTTONS ARE PRESSED ON THE CONTROL PANEL FOR MORE THAN 60 SECONDS, THE DISPLAY GOES TO SLEEP AND THE PANEL IS BLANK EXCEPT FOR THE OPERATION STATUS LIGHT

SLEEP MODE IS TURNED OFF WHEN ANY BUTTON IS PRESSED (UP, DOWN or ENTER).

Commissioning Mode

Commissioning mode is a function to check the heat pump unit status and to check and perform other settings. It should generally be assumed that the owner does not operate this function. The following modes can be found in this mode.

Heat setting mode

Set the heating mode to either ON (Unit Runs) or OFF (Unit cannot operate)

Block out time setting mode (Time of use)

Set the block out time

Error history display mode

Check the history of any errors that may have occurred.

Parameter display mode

Check the values measured by the thermistors in the unit.

Air bleeding mode

Set the air bleeding mode.

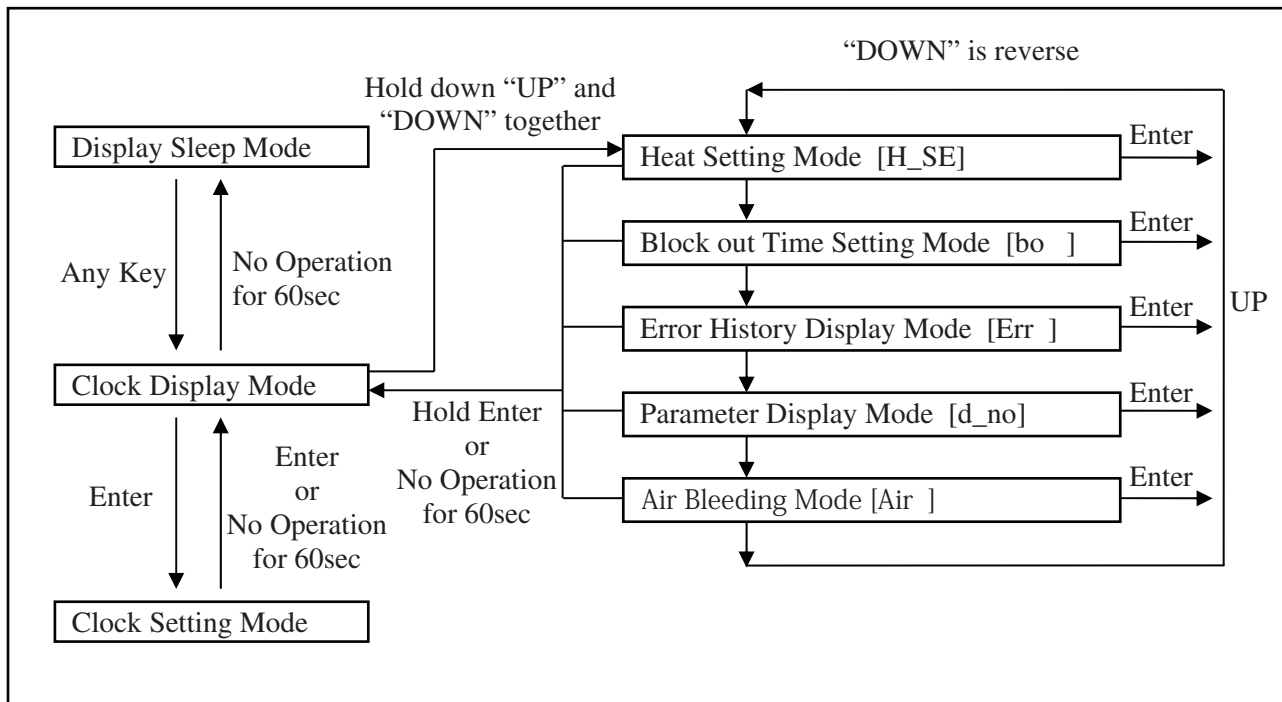
How to Switch to Commissioning Mode

Press and hold down the Up and Down keys together to enter the Commissioning mode.

After the mode is selected, press the Enter key to select an option mode from the five described above.

To exit Commissioning maintenance mode, either press and hold down the Enter key, or do not touch the control panel for more than 60 seconds so it goes to sleep.

Figure 13 Commissioning mode diagram



Heat Setting

Enter into Commissioning Mode

First option is the Heat Setting – Press Enter one more time to access this

Use UP/DOWN arrow keys to toggle between Heat On and Heat Off

Press Enter to confirm choice

To bypass the Heat Setting simply press the UP key to access the next parameter in the Commissioning menu

Block Out Time Setting

Enter into Commissioning Mode

First option is the Heat Setting–

Second option is Temperature Setting–

This mode is used to set the block out time that prevents the heat pump unit operation within the chosen time period.

Change the mode

Press and hold down Up and Down keys together in the clock display mode to go to the block out time setting mode. Once the mode is changed, 'bo' and '00XX' (00 = start time, XX = end time) are displayed. (Initial setting = 00 o'clock for both start and end)

Adjust set block out start time

Press Up or Down key and '00' (start time) in '00XX' starts flashing and 'XX' (end time) illuminates. Now the block out start time can be adjusted. Setting can be performed only in hour increments, not in minutes.

Set block out start time

Press the Enter key to set the desired time setting. After the start time is set, the start time display stops flashing. The end time display starts flashing at the same time.

Adjust block out end time

Set to the desired end time by using Up and Down keys. Setting can be performed only in hour increments, not in minutes.

Set block out end time

Press enter key to adjust the desired time setting. After the end time is set, then it starts to display 'bo' and '00XX' (00 = start time, XX = end time) by turns.

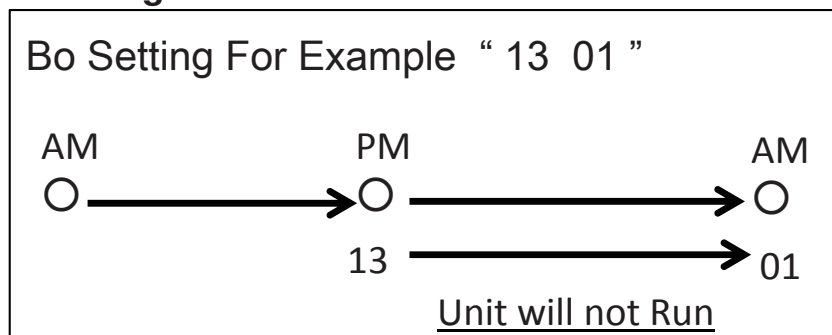
Go back to clock display mode

Hold down Enter key to go back to the clock display mode. It will automatically go back to the clock display mode when no panel operation is performed for more than 60 seconds. Block out time setting mode cannot be set unless the end time setting is confirmed.

Cancel block out setting

To cancel the block out setting, set both start and end times to the same time.

※Example setting



To bypass the Block Out Time, simply press the UP key to access the next parameter in the Commissioning menu

Error History

Enter into Commissioning Mode

First option is the Heat Setting

Second option is Block Out Time–

Press the UP Key to access Error History then Press Enter to access

This records 8 errors that have occurred on the system, this can be used for troubleshooting after an error code has been cleared by cycling the power to the unit.

The most recent error code is displayed first, previous error codes can be seen by pressing the DOWN key

To bypass the Error History simply press the UP key to access the next parameter in the Commissioning menu

Parameter Display

Enter into Commissioning Mode

First option is the Heat Setting

Second option is Block Out Time

Third option is Error history–

Press the UP Key to access Parameter Display then Press Enter to access

This displays all of the values currently measured by the unit's temperature sensors, this can be used for troubleshooting and general unit performance questions.

When first entering this mode the display will cycle between no00 and the actual data value ****, to access the other data points use the DOWN key

No.00	Tank TH A temp
No.01	Outlet water temp
No.02	Inlet water temp
No.03	Factory Default Value
No.04	Factory Default Value
No.05	Factory Default Value
No.06	Ambient temp
No.07	Factory Default Value
No.08	Factory Default Value
No.09	Factory Default Value
No.10	Factory Default Value
No.11	Factory Default Value
No.012~99	Empty

To bypass the Parameter Display, simply press the UP key to return the first option mode in the Commissioning menu

To Exit Commissioning Mode, hold Enter Key or do not press any key for 60 seconds and Control will default to sleep mode and revert to the current time display when awoken.

Air Bleeding Mode

Enter into Commissioning Mode

First option is the Heat Setting

Second option is Block Out Time

Third option is Error history

Fourth option is Parameter Display-

Press the UP Key to access Air bleeding Mode then Enter to access

In this mode pump run for 5 minutes to bleed air inside of piping.

Error Codes

When an error has occurred, a red LED on the operation panel turns on and an error code is displayed on the LED display. The panel does not turn to the display sleep mode while the error code is shown.

Figure 14 Error Code example



After a component is replaced or the inspection is completed, turn the breaker OFF for a period of 3 minutes before restarting to confirm the error does not re-occur.

Below is the list of the error codes. If the corrective action does not solve the error problem, a malfunction of the PCB valve is highly likely.

Error code	Error contents	Corrective action
H9	HP ambient (outdoor) temperature thermistor error	<ul style="list-style-type: none">- Check the thermistor connectors on the main PCB or control PCB in the heat pump unit for any disconnect, fall-off, wire breakage or short circuit.- Measure resistance of the thermistor indicated by the error code.
HC	HP water outlet (outgoing) temperature thermistor error	
J3	HP discharge temperature thermistor error	
J5	HP suction temperature thermistor error	
J6	HP defrost temperature thermistor error	
J8	HP water inlet (return) temperature thermistor error	<ul style="list-style-type: none">- Check the thermistor cable on the terminal block in the heat pump unit for any disconnect, fall-off, wire breakage or short circuit.- Measure resistance of the thermistor indicated by the error code.
H7	Tank temperature thermistor error	
E6	Compressor booting error	<ul style="list-style-type: none">- Check the compressor connector.- Replace the main PCB or heat pump.

H6	Compressor revolution error	<ul style="list-style-type: none"> - Check the supply voltage. - Measure resistance of each thermistors. - Measure resistance of coil of expansion valve to check open or short circuit. - Replace the PCB or heat pump.
U0	Refrigerant leakage error	<ul style="list-style-type: none"> - Measure resistance of each thermistors. - Measure resistance of coil of expansion valve to check open or short circuit. - Replace the main PCB or heat pump.
E1	Main PCB error	<ul style="list-style-type: none"> - Replace the main PCB.
E2 L7	Control PCB error	<ul style="list-style-type: none"> - Replace the control PCB.
F5	Communication error between main PCB to control PCB	<ul style="list-style-type: none"> - Check the communication connector on the main PCB and control PCB. - Replace the main PCB or control PCB.
E8	High inlet current error	<ul style="list-style-type: none"> - Check the installation location. - Check the supply voltage. - Replace the main PCB or heat pump.
H8	Current error	<ul style="list-style-type: none"> - Replace the main PCB.
L4	High temperature of module error	<ul style="list-style-type: none"> - Check the installation location. - Remove foreign objects from the evaporator coil (e.g. fallen leaves, grass, snow) - Check the Fan motor is not flowing by dirt. - Replace the main PCB or fan motor.
L5	High outlet current error	<ul style="list-style-type: none"> - Measure resistance of the discharged thermistor. - Measure resistance of coil of expansion valve to check open or short circuit. - Replace the main PCB or heat pump.
P4	Module temperature thermistor error	<ul style="list-style-type: none"> - Replace the main PCB.
U2	High voltage error	<ul style="list-style-type: none"> - Check the supply voltage.
HJ	Water circuit error	<ul style="list-style-type: none"> - Check the inlet water valve. - Check for any piping bend, blocking, kink or frozen. - Measure resistance of each Thermistor. - Measure resistance of coil of expansion valve to check open or short circuit. - Replace the main PCB or heat pump.
EC	High water outlet error	<ul style="list-style-type: none"> - Check the water circuit is not flowing by air, dirt or scaling. - If the water circulation pump is not working, replace the pump. - Measure resistance of water outlet(outgoing) thermistor. - Replace the main PCB.

E9	Water circulation pump error	<ul style="list-style-type: none"> - Check the water is full fill in the Tank. - If the water circulation pump is not working, replace the pump. - Check the revolution of pump by controller. If the revolution is low, replace the pump. - Replace the main PCB
E7	Fan motor locked	<ul style="list-style-type: none"> - Remove foreign objects around the fan motor. - Check the fan motor connectors on the main PCB. - Replace the main PCB.
F3	Discharged temperature error	<ul style="list-style-type: none"> - Measure resistance of the discharged thermistor. - Replace the main PCB or heat pump.
H0	High water outlet error	<ul style="list-style-type: none"> - Check the water circuit is not flowing by air, dirt or scaling. - If the water circulation pump is not working, replace the pump. - Measure resistance of water outlet(outgoing) thermistor. - Replace the thermostat. - Replace the main PCB.
FA	High pressure side error	<ul style="list-style-type: none"> - Check the heat pump piping for any blockage. - Check for any piping bend, blockage or kink. - Check if the pipes are frozen. - Ensure mains water supply is available. - Ensure all shut off valves are open. - If the water circulation pump is not working, replace the pump. - In areas with hard water ensure Gas Cooler is not scaled up, descale if necessary. - Replace the main PCB or heat pump.
H3	Pressure switch error	<ul style="list-style-type: none"> - Check the thermistor connectors on the main PCB or control PCB in the heat pump unit for any disconnect, fall-off, wire breakage or short circuit. - Replace the main PCB.

Note:

1. After a component is replaced or the inspection is completed, turn the breaker OFF for a period of 3 minutes before restarting to confirm the error does not re-occur.
2. If the corrective actions above do not solve the error problem, a malfunction of the PCB is highly likely.

Water Supply Quality

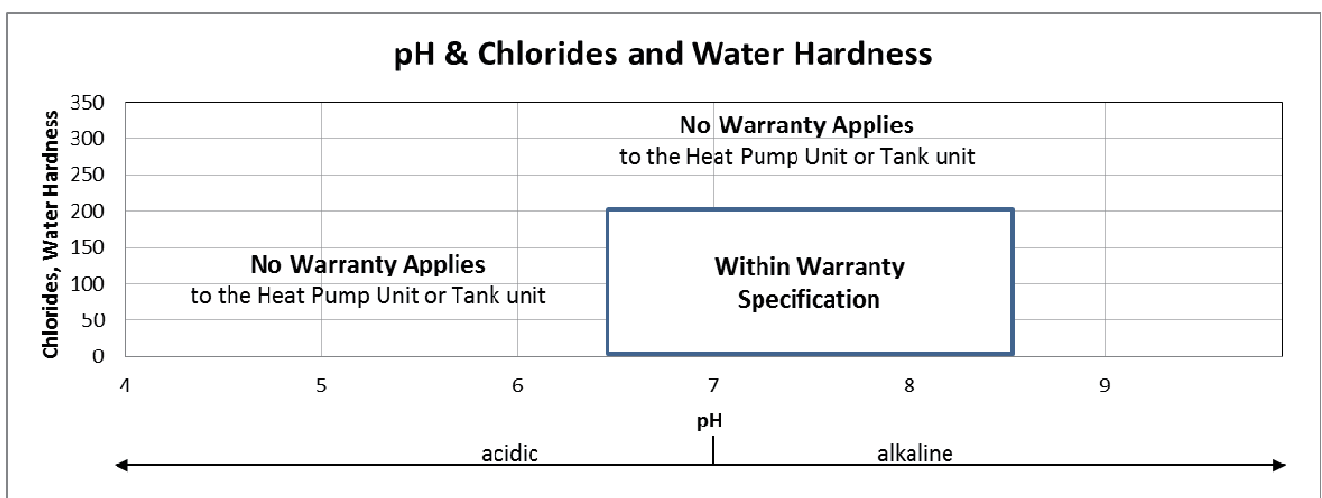
Chloride, Water Hardness and pH

In high chloride water supply areas, the water can corrode some parts and cause them to fail. Where the chloride level exceeds 200 mg/litre or Water Hardness level exceeds 200 mg/litre warranty does not apply to the heat pump unit and tank unit. pH is a measure of whether the water is alkaline or acid. In an acidic water supply, the water can attack the parts and cause them to fail.

No warranty applies to the heat pump unit and tank unit where the pH is less than 6.5 or more than 8.5. The water supply from a rainwater tank unit in a metropolitan area is likely to be corrosive due to the dissolution of atmospheric contaminants.

Water with a pH less than 6.5 may be treated to raise the pH. It is recommended that an analysis of the water from a rainwater tank be conducted before connecting this type of water supply to the system.

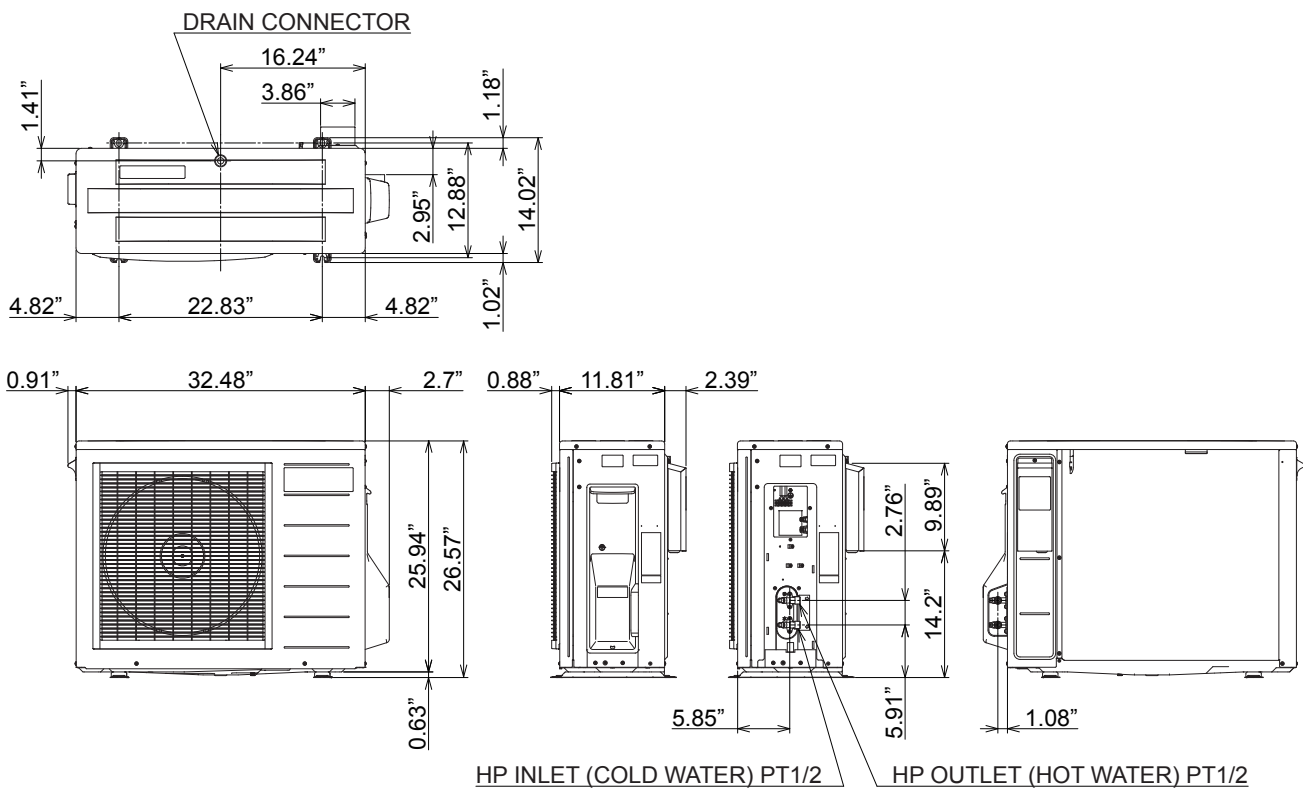
Figure 15



Technical Data

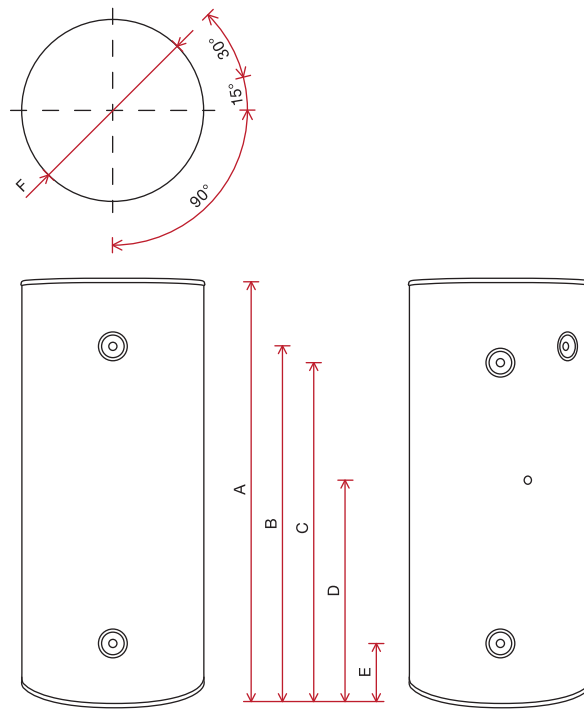
Specifications	GS4-45HPC
Performance	
Energy Factor - 43 Gal System	3.1
First Hour Rating - 43 Gal System	69Gallons
Energy Factor - 83 Gal System	3.75
First Hour Rating - 83 Gal System	115Gallons
Energy Factor - 119 Gal System	TBA
First Hour Rating - 119 Gal System	TBA
Nom Heating Capacity (Btu/h)	15,400Btu/h
Nom Heating Capacity (kw)	4.5kw
Heating COP	5.0
Water Temperature Setting	145DegF
Refrigerant Type	R744 (CO ₂)
Refrigerant Charge (Oz)	25.4oz
Power Voltage	208/230v-1Ph-60Hz
Breaker Size	15A
MCA (Amps)	7.2A
Compressor RLA/LRA (Amps)	5.0A/9.0A
Fan Motor RLA/Watts	0.3A /30W
Pump RLA/Watts	0.6A / 60W
Noise Level (DbA)	37
Weight (lbs)	108lbs
Storage Tank	
SAN-43SSAQA	43 Gallons
SAN-83SSAQA	83 Gallons
SAN-119GLBK	119 Gallons
Tank Connection Sizes	
Cold Water Inlet	1/2" NPT Use connection adapter
Hot Water Outlet	1/2" NPT Use connection adapter
Cold Water to Heat Pump	1/2" NPT
Hot Water Return from Heat Pump	1/2" NPT
Press Relief Valve Setting	125Psig
Pipe Size - Tank to Heat Pump	
Size	1/2" & 1/2"
Max Pipe Length inc	66ft
Max Vertical Separation of	23ft
Certifications	
Safety	ETL & ETLc
Performance	AHRI
ARI Certification reference #	TBA
Warranty - System	3 Years Labor
Heat Pump	10 Years Parts
Tank	15Yrs Limited Lifetime

GS4-45HPC Dimensions



Unit : inch

Stainless Steel Tank Dimensions



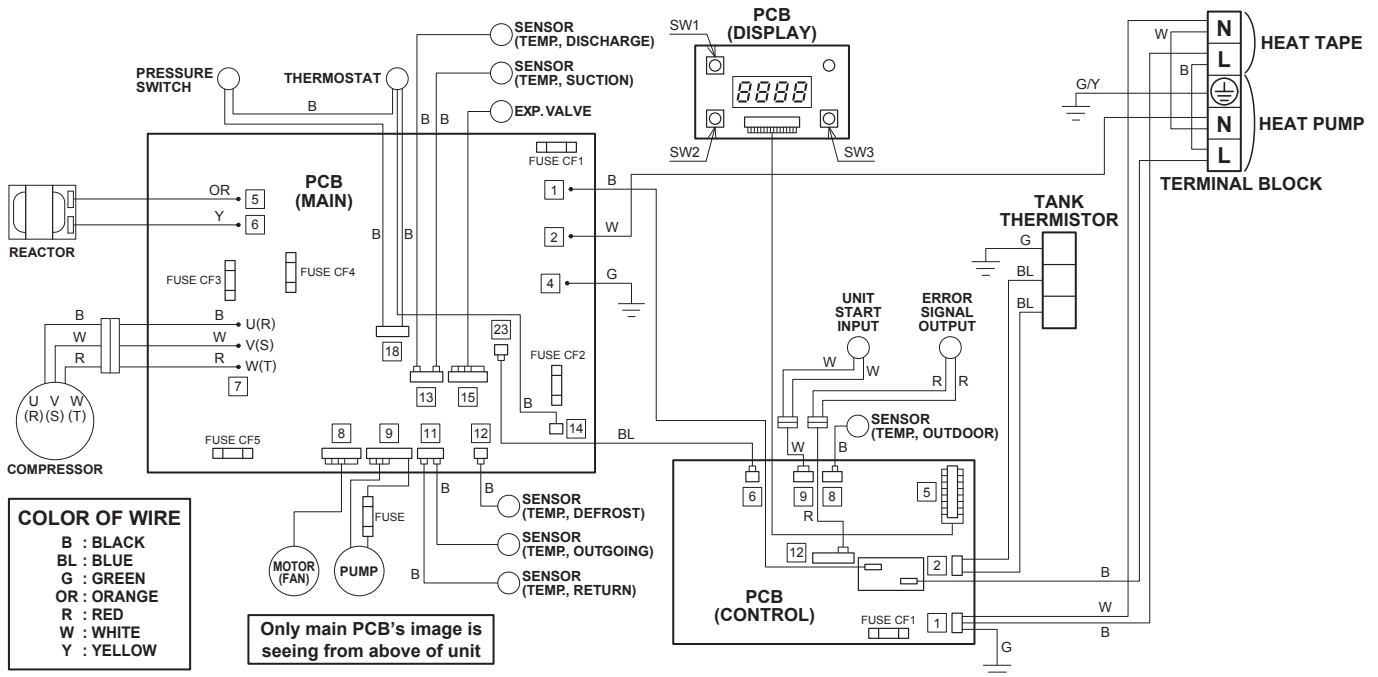
Tank Model No:	SAN-43SSAQA	SAN-83SSAQA	SAN-119GLBK*
A Height	38 ^{-1/8"}	68 ^{-7/8"}	63 ^{-3/5"}
B Hot Water Outlet & PR Valve	29 ^{-1/2"}	60 ^{-1/4"}	56"
C Heat Pump Return	29 ^{-1/2"}	60 ^{-1/4"}	60 ^{-1/4"}
D Sensor Port	9 ^{-3/4"}	40 ^{3/8"}	56"
E Cold Water Inlet / Cold Water to HP	8 ^{-3/4"}	8 ^{-3/4"}	4"
F Diameter	24 ^{-1/2"}	24 ^{-1/2"}	28"
Weight (lbs)	88 lbs	115 lbs	345 lbs
Tank Capacity (gallons)	43 gallons	83 gallons	119 gallons
Warranty	15 years	15 years	10 years*

Connection Sizes	
Cold Water Inlet	3/4" NPT (1 1/2" SAN-119GLBK)
Hot Water Outlet	3/4" NPT (1 1/2" SAN-119GLBK)
Cold Water to Heat Pump	3/4" NPT
Hot Water Return from Heat Pump	3/4" NPT
Pressure Relief Valve Setting (Psig)	125 Psig

*SAN-119GLBK tank is a glass-lined steel tank with a 10 year warranty.

Note: Materials and specifications are subject to change without notice.

Wiring Diagram



⚠ WARNING !

⚡ Electric Shock !

Warning when you fix electric components !

- Don't touch electrically charged parts, as electric shock may occur even if they are switched off.
- Be sure to wait at least 5 min. after turning off the power and to confirm the voltage between the pins between + and - is less than DC10V with a tester before servicing.

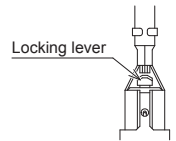


⚠ Caution ⚠ Electric Shock High Voltage

- Do not touch any part of the electric circuit (including the wiring of thermistor and others), as it has high voltage against the ground.
- Pay attention not to damage the insulated wire when you tighten the screw, as the exposed wire may cause electric shock or malfunction.
- Do not ground the oscilloscope when you operate. You might destroy it. Also do not touch any metal part of the oscilloscope while operating.

How to detach locking terminal

Pull off while pressing the locking lever.



Residential Warranty Policy covering the following Model #'s :
Heat Pump : GS4-45HPC
Storage Tanks : SAN-43SSAQA, SAN-83SSAQA, SAN-119GLBK

Warranty Conditions as of December 1st 2020 to the Original Owner Only

1. Warranty period

Subject to the Warranty Conditions and Exclusions stated below, the Eco2 Systems LLC Heat Pump Water Heater System with the corresponding model numbers warranted in Residential / Combi DHW & Heating applications ONLY (For Commercial applications as defined the warranty is covered in a separate document) as follows:

1-1. Residential DHW application ; Heat Pump unit

Eco2 Systems LLC warrants all parts & labor on the SANCO₂ system for a period of 3 years from date of installation and a further 7 years on Parts only excluding shipping costs.

Labor costs are paid per the payment cost schedule published by Eco2 Systems LLC and revised from time to time at Eco2 Systems LLC's requirement (Exhibit A).

Should at any time during the 10 year Parts warranty any component directly part of the CO₂ refrigerant circuit fail, where replacement of that component would require opening of the refrigerant circuit, Eco2 Systems LLC will replace the Heat Pump unit in it's entirety. If this failure occurs in the first 3 years of operation, then Labor costs will be paid per Exhibit A.

1-2. Residential DHW application ; Tank

Eco2 Systems LLC warrants that the SAN-43SSAQA, SAN-83SSAQA tanks will be free from defects for 10 years at 100% replacement, and for a further 5 years under a pro-rated scale, culminating in warranty ending after 15 years from date of installation.

Failure in Year 11:	80% of replacement value
Failure in Year 12:	60% of replacement value
Failure in Year 13:	40% of replacement value
Failure in Year 14:	20% of replacement value

SAN-119GLBK tanks have a warranty of 10 years only at 100% replacement value.

1-3. Combined DHW/Heating application

When used in a Combined DHW/Heating System application providing that the winter design (99%) temperature must be above 22°F and with a single heat pump unit serving a heating load of less than 10,000 Btu/h in addition to a minimum DHW demand of 20 Gallons per day then the warranty period will be amended to that stated below.

1-3.1. Combined DHW/Heating application ; Heat Pump unit

Eco2 Systems LLC warrants all parts & labor on the SANCO₂ combi system for a period of 2 years from date of installation and a further 5 years on Parts only excluding shipping costs. Labor costs are paid per the payment cost schedule published by Eco2 Systems LLC and revised from time to time at Eco2 Systems LLC's requirement.

1-3.2. Combined DHW/Heating application ; Tank

The Storage tank warranty period is unaffected by the usage in a Combined DHW/Heating system and remains unchanged from the warranty period stated previously.

2. Warranty Conditions – All Residential Applications

- 2-1. The Eco2 Systems LLC Heat Pump Water Heater System must be installed in accordance with the installation instructions supplied with the Heat Pump Water Heater System, all relevant industry practices and in accordance with all applicable relevant plumbing codes plus statutory/local requirements of the state/province/municipality of the location where the water heater is installed.
- 2-2. Where a failed component or Heat Pump Water Heater System is replaced under warranty, the balance of the original warranty period will remain effective. The replaced part or complete new Heat Pump Water Heater System does not carry a new warranty.
- 2-3. Warranty period only applies from the verified date of system installation, if such a date cannot be verified then the warranty will be deemed to have started using a date calculated after 2 (two) months have elapsed from the date of unit manufacture.
- 2-4. Where the Heat Pump Water Heater System is installed in a position that does not allow safe operating practices, such as not installing a properly size metal drain pan if installed in an area where leakage from the tank or it's connections would result in damage to the area adjacent to the heat pump or the storage tank.
- 2-5. The cost of accessing the site safely, including the cost of additional materials handling and/or safety equipment, shall be the owner's responsibility.
- 2-6. The warranty only applies to the Heat Pump Water Heater System (heat pump & storage tank) and original or genuine (company) component replacement parts and therefore does not cover any plumbing or electrical parts supplied by the installer and not an integral part of the Heat Pump Water Heater System. Such parts would include but not limited to; pressure regulating valves, isolation valves, solenoid valves, electrical switches, pumps, trace heating, fuses or any other field supplied parts used in the installation of the Eco2 Systems LLC Heat Pump Water Heater System.

- 2-7. The Heat Pump Water Heater System must be sized to the hot water demand in accordance with the guidelines in the current Eco2 Systems LLC Heat Pump Water Heater System literature and application guides and training information.
- 2-8. This warranty is for parts only, any and all labor costs associated with diagnosis, removal of the faulty part and installation of replacement parts will solely be the owner's responsibility except where covered by the labor warranty section of this warranty.

3. Warranty Exclusions

Repair and replacement work will be carried out as set out in the Eco2 Systems LLC Heat Pump Water Heater System warranty. However the following exclusions may void the warranty and may incur additional service charges and/or cost of parts:

- 3-1. Accidental damage to the Heat Pump Water Heater System or any component, including: Acts of God, failure due to misuse, incorrect installation, attempts to repair the water heater other than by an Eco2 Systems LLC accredited service agent or the Eco2 Systems LLC service dept.
- 3-2. On inspection of the failed system or part, and where it is found there is nothing wrong with the Heat Pump Water Heater System; where the complaint is related to excessive discharge from the temperature and/or the pressure relief valve due to high incoming cold water pressure over 75 Psi; where there is no flow of hot water due to faulty plumbing; where water leaks are related to plumbing and not the Heat Pump Water Heater System or its components; where there is a failure of electricity or water supplies; where the supply of electricity or water does not comply with relevant codes or acts or is of the incorrect voltage, phase and amperage as required by the system; Installation of the GS4-45HPC heat pump(s) with other storage tanks that have not been specifically approved in writing by Eco2 Systems LLC.
- 3-3. Where the Heat Pump Water Heater System or its component has failed directly or indirectly as a result of excessive incoming water pressure above 75 Psi.
- 3-4. The factory supplied pressure relief valve or an ASME approved valve with the same pressure specification has not been installed or the valve outlet is blocked or corroded.
- 3-5. Where the heat pump or storage tank has rusted or failed as a result of a corrosive atmosphere.
- 3-6. Where the unit fails to operate or fails as a result of ice formation in the piping to or from the Heat Pump Water Heater System. Suitably sized self-regulating trace heating must be installed around the exposed supply and return piping to and from the heat pump including around the unit connections whenever the Heat Pump unit is installed in a location where the winter ambient temperature will fall below 27°F.

- 3-7. Where the Heat Pump Water Heater System is located in a position that does not comply with the Heat Pump Water Heater System installation instructions or relevant statutory requirements, causing the need for major dismantling or removal of cupboards, doors or walls, or use of special equipment to move the unit to floor or ground level or to a serviceable position.
- 3-8. Repair and/or replacement of the Heat Pump Water Heater System due to scale formation above 200ppm (water hardness) in the waterways or the effects of either corrosive water or water with a high chloride or low PH level when the water heater has been connected to a scaling or corrosive water supply or a water supply with a high chloride or low PH level as outlined in the *Owner's Guide* and *Installation Manual*.
- 3-9. Replacement due to cosmetic reasons, or for reasons of noise, taste, odor; discolored and/or rusty water.
- 3-10. Failure of a Combined DHW/Heat System where the Heating application has been used to provide "construction heat" in an unoccupied unfinished, unfurnished building for the purposes of heating the structure so that other building trades or building processes can be completed.
- 3-11. Internet purchase: Any Eco2 Systems LLC Heat Pump Water Heater Systems purchased on the internet are not eligible for warranty. The system must be purchased from an Eco2 Systems LLC certified distributor/contractor and installed by a licensed plumbing/HVAC contractor.

Subject to any statutory provisions to the contrary, this warranty specifically excludes any and all claims for damage to furniture, carpets, walls, foundations, personal property or any other consequential loss either directly or indirectly due to leakage from the Heat Pump Water Heater System, or due to leakage from fittings and/or pipe work of metal, plastic or other materials caused by water temperature, poor workmanship or other modes of failure. Eco2 Systems LLC shall not be liable by virtue of this warranty or otherwise for damage to any persons or property, whether direct or indirect, and whether arising in contract or in tort.

This warranty gives you specific legal rights, and you may have other rights which vary under the laws of each state. If any provision of this warranty is prohibited or invalid under applicable state law, that provision shall be deemed to be ineffective to the extent of the prohibition or invalidity, but without invalidating the remainder of the affected provision or the other provisions of the warranty.

The publication of this warranty document supersedes all other warranty documents in place as of 12-01-2020.

Exhibit A: Labor Costs

Labor costs are paid per the payment cost schedule published by Eco2 Systems LLC and revised from time to time at Eco2 Systems LLC's requirement.

Labor warranty specifically excludes (unless agreed to in writing prior to service being carried out) costs associated with travel to and from jobsites, distributors or contractors place of business, initial fault diagnosis and subsequent work due to incorrect diagnosis of fault or additional faults due to poor replacement practice of the failed part, delivery costs associated with replacement parts or units, or any other such administrative costs. These costs are to be the responsibility of the owner.

Labor expense reimbursement by part or action (USD) as of 12/01/2020

i. PCB replacement	\$100
ii. Thermistor replacement	\$75
iii. Controller replacement	\$75
iv. Fan motor replacement	\$75
v. Pump replacement	\$100
vi. Expansion valve coil replacement	\$75
vii. Other miscellaneous component replacement	\$100
viii. Fan blade replacement	\$75
ix. Complete unit replacement (Heat Pump or Tank)	\$210

Registration for Warranty

In order to register your system for warranty purposes, please complete the details of your purchase below, detach and mail to

ECO2 Systems LLC
47772 Halyard Dr. Plymouth, MI 48170

Name _____
Mailing address _____ State _____
Postcode _____
Product Details:
Heat Pump Serial Number (from label on right end) _____
Hot Water Tank Serial Number (label on tank) _____
Date of Purchase/Installation ____/____/20____
Suppliers Name _____

You may register your product via email, to '<http://www.sanden.com/>'. Simply send an email containing the same details as shown above

Please Note: Similar registration details will be provided to Sanden by your supplier/installer to validate their claim for warranty support; it is essential that the dates of supply/installation correspond to within one month.

Check Sheet

Safety items

Action	Completed
Fix the legs of the tank unit in place with anchor bolts if necessary.	
The floor has been properly waterproofed and properly drained.	
The earth leakage breaker can be turned off with the test button.	
Earth (ground) work is implemented.	
The tank unit is installed on a level sturdy surface.	
There are no gas containers or flammable materials anywhere near the unit.	
The wiring between the tank unit and the heat pump unit is properly connected.	

Heat Pump & Tank

Action	Completed
A concrete base block is installed (if necessary).	
An inspection space is retained in accordance with the installation manual	

Water Piping

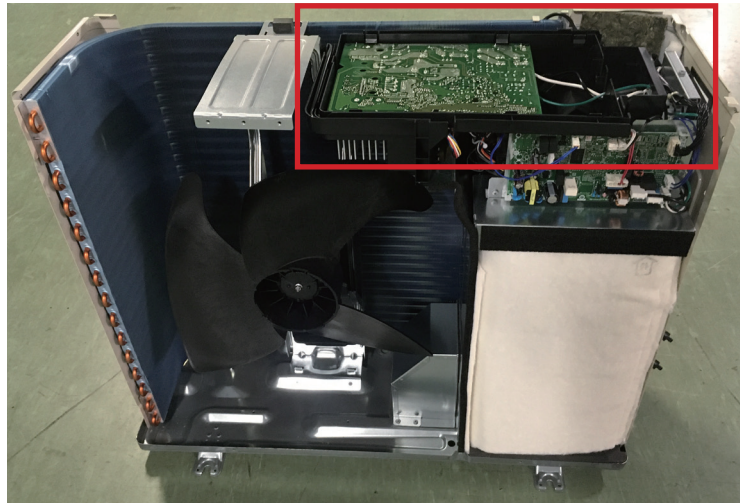
Action	Completed
A dedicated water supply shut off valve is installed	
The piping for the hot water supply has been properly insulated.	
There is no water leaking from the water supply/hot water supply and heat pump pipes.	
In areas subject to snap freezes, protection is provided.	
Union joints are used so that the parts can be easily removed.	
Piping is installed from the drain outlet on both PR Valve & Heat Pump drain	
The filter in the pressure-reducing valve is clean.	
Independent pipes, not a twin tube, are used for the heat pump unit pipes (insulated, UV stabilised)	
Mixing/Anti Scald valve is installed and the setting is correct	
Pressure reduction valve (95PSI) has been fitted to the cold water supply	
During draining of the tank, water does not overflow from the drain.	

Installed By..... Date.....

Inspected By Date.....

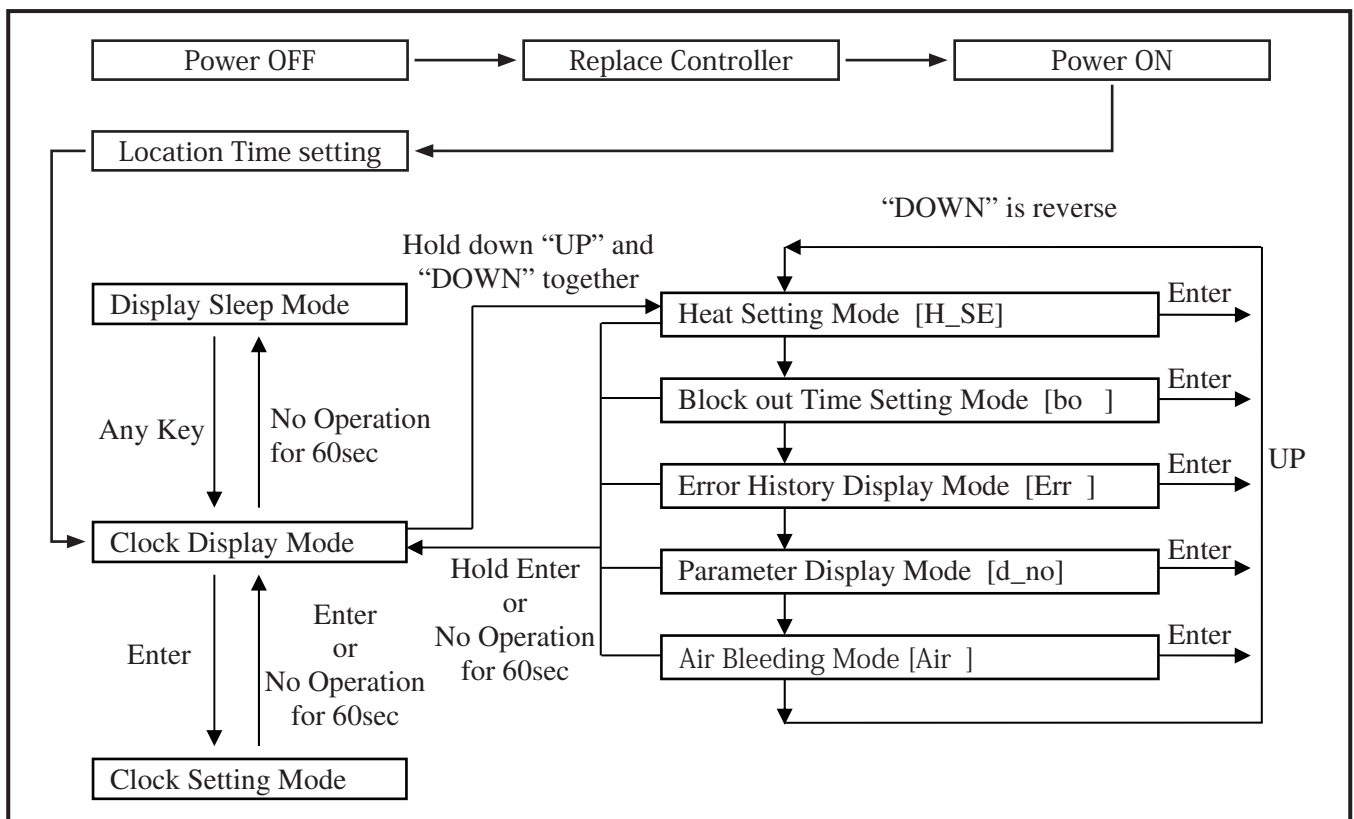
Replace Controller Assembly

Please replace the controller assembly box.



After PCB replace, Panel operation flow

Figure 15 Operation flow



[illegible]

[illegible]

[illegible]