



**SANDEN**

Delivering Excellence

# Installation manual



**Sanden Heat Pump Water Heater with Natural Refrigerant (CO<sub>2</sub>)**

Covering model numbers for residence

## Heat Pump Unit GS3-45HPA-US

※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 Sanden International (USA), Inc.

## TRADE MARKS

® Registered trademark of Sanden International (USA), Inc.

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

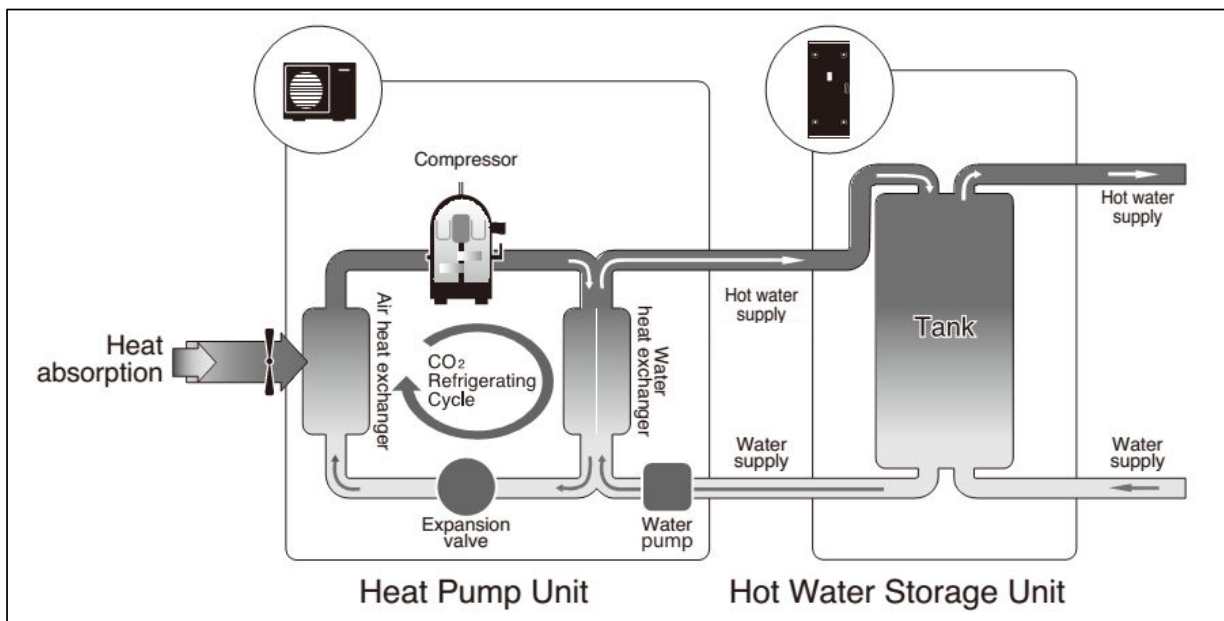
The Sanden SANCO<sub>2</sub> Heat Pump Water Heater System has been designed using the latest refrigeration technology to remove the heat from the air to heat water. The refrigerant we use is CO<sub>2</sub> which does not contribute to global warming so it allows us to help keep a clean healthy earth for future generations.

By using CO<sub>2</sub> 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 Sanden SANCO<sub>2</sub> 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**




**Note:**

The unit must have a minimum of 5 hours continuous power available at all time to allow the unit to operate without affecting reliability.

## Installation details

This Sanden SANCO<sub>2</sub> Heat Pump Water Heater System must be installed by licensed personnel in accordance with local building codes:

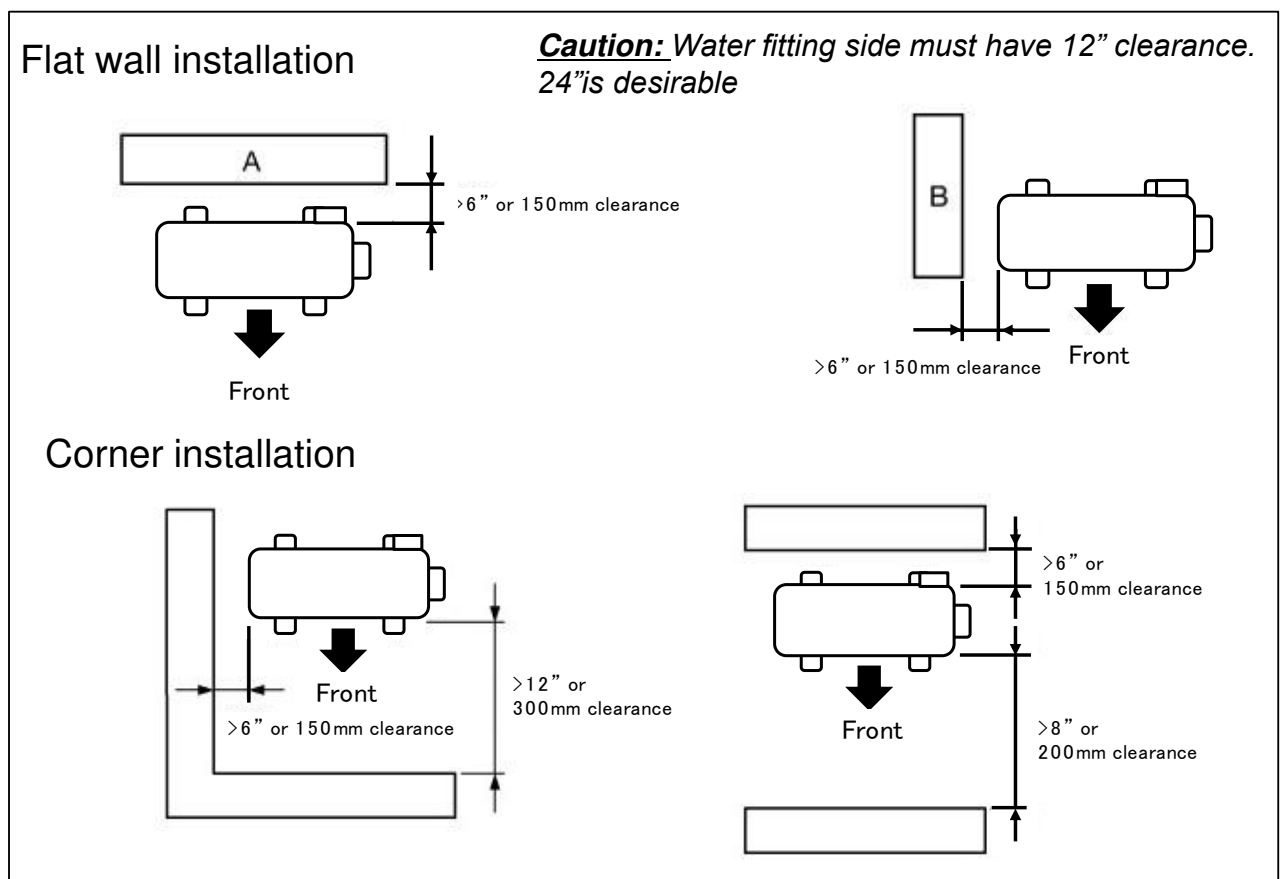
- Installing contractor should be licensed by applicable state/province and municipal authorities to install an Electrical & Plumbing product.
- The unit has been designed for heating potable domestic hot water. Any other usage, such as use for DHW in combination with space heating requires both a heat exchanger suitable for local codes to be installed on the system to separate potable and non-potable water and consultation with Sanden.
- 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.**

## Installation location

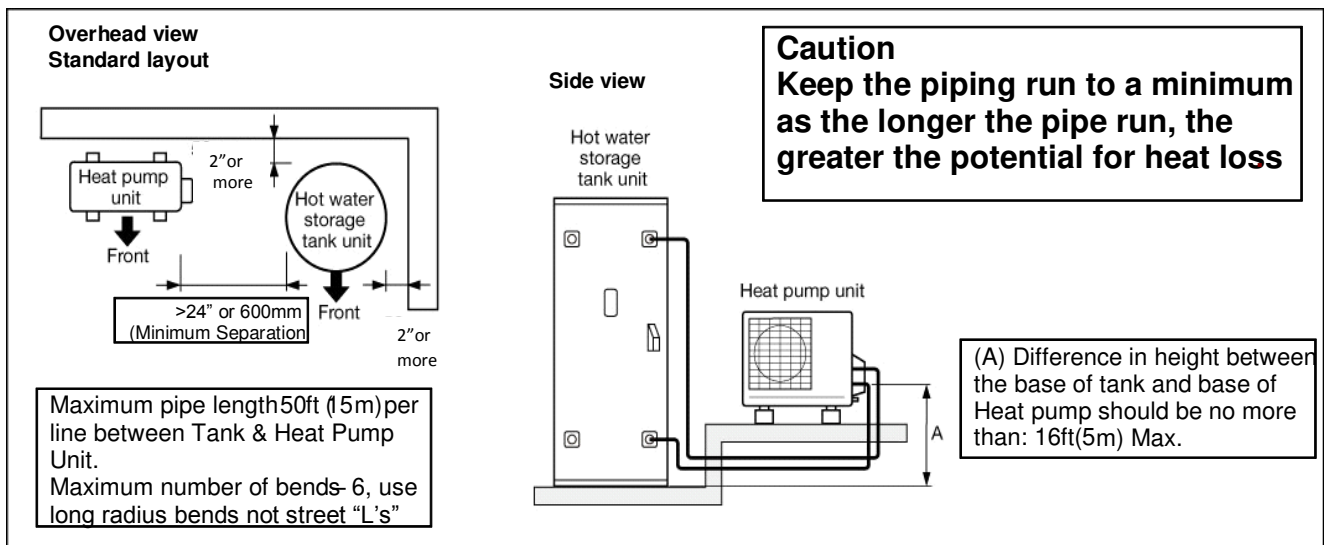
- For the most efficient operation of the heat pump unit, the optimum location is the warmest side of the property and there should be sufficient space for the air to circulate through the unit.
- The tank unit should be located as close as possible to the most frequently used hot water outlet such as 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 50ft (15m) 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 3).
- 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.

**Figure 3: Restrictions on where the heat pump unit can be installed (overhead view)**



- ※ 1 Unit should have a minimum of 18" or 500mm 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 4: 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.

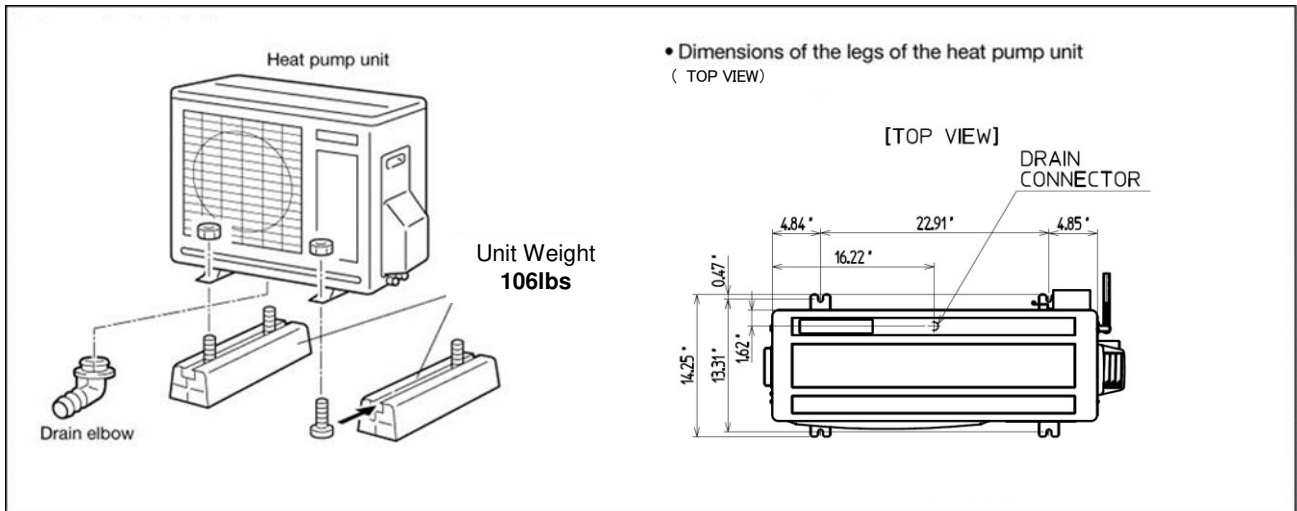
Note: For Florida installation the Heat Pump unit should be installed in accordance with all local codes regarding Hurricane winds.
- Use appropriately treated lumber or pre-fabricated "pump ups" to raise the Heat Pump unit 4"-6" from the ground – this will allow defrost condensate to drain. In areas with significant snowfall ensure unit is mounted above the anticipated snowfall depth.
- 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 100 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 desired hot water supply temperature & set the current time on the operation panel under the top housing cover, especially if the block out time setting is desired. See Set point adjustment, current time setting, and block out time section on page 19.

**Figure 5: 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.

Description	PH	TDS (Total Dissolved Solids)	Total Hardness (calcium ion concentration)	Aluminium	Chlorides	Copper	Iron	Manganese	Zinc
Maximum Levels	6.0 to 9.0	Up to 500 ppm	Up to 200ppm or 12 grains hardness	Up to 0.2 ppm	Up to 200 ppm	Up to 1.0 ppm	Up to 0.3 ppm	Up to 0.05 ppm	Up to 5 ppm

- 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 (3-5W 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.

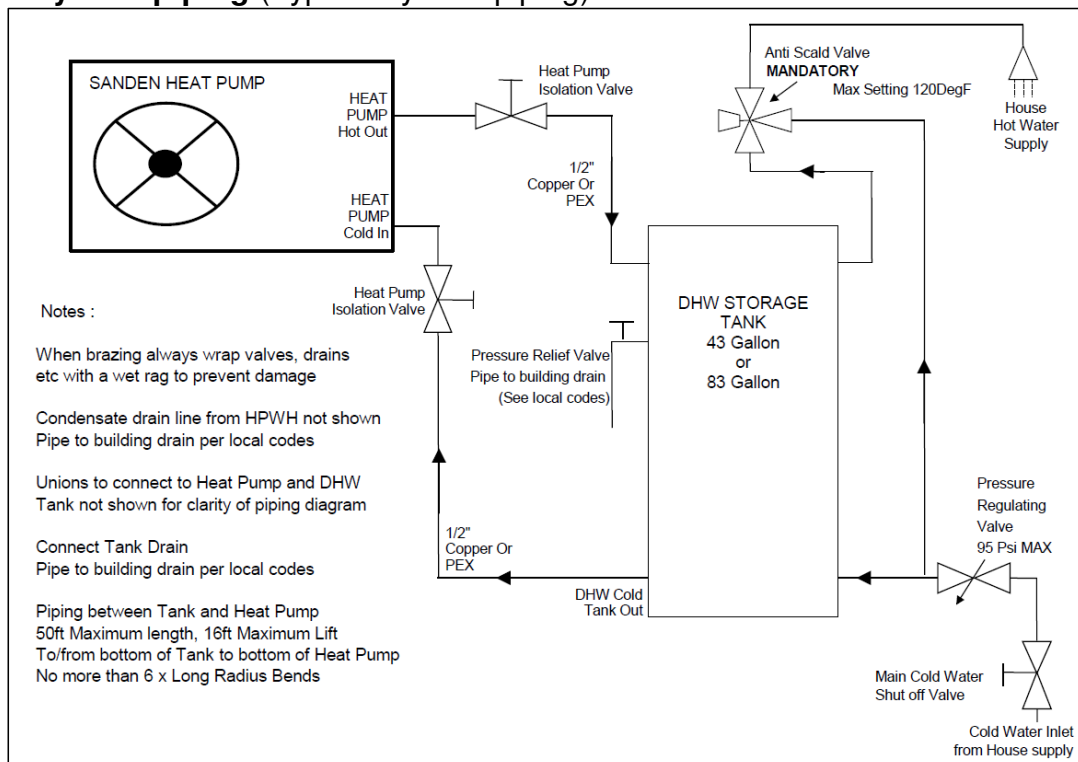


## Heat Pump Unit Water piping

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

- Connect the heat pump unit COLD supply to the tank unit fitting marked Cold Supply. – 1/2" NPT Connection (Certain early units may use 1/2" BSP connections).
- Connect the heat pump unit HOT return to the tank unit fitting marked Hot Return – 1/2" NPT Connection (Certain early units may use 1/2" BSP connections).
- 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.
- Remove the air from the system according to the instructions below on Page 15.
- 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 removed during the test operation, temperature of the supplied hot water may become inconsistent.

**Figure 6: 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).**

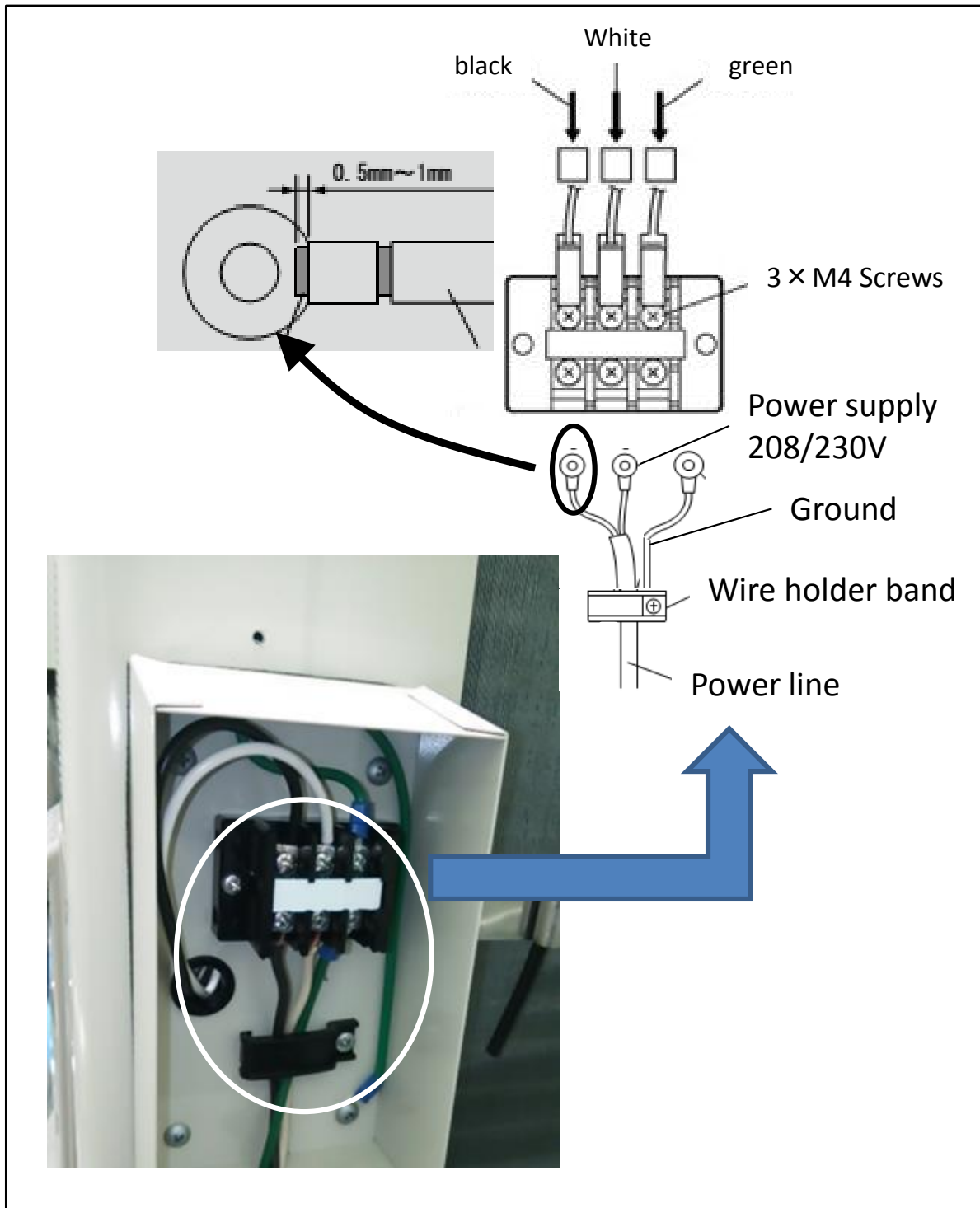
## Electrical connections

- 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 terminal block 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 terminal block cover to the heat pump unit.

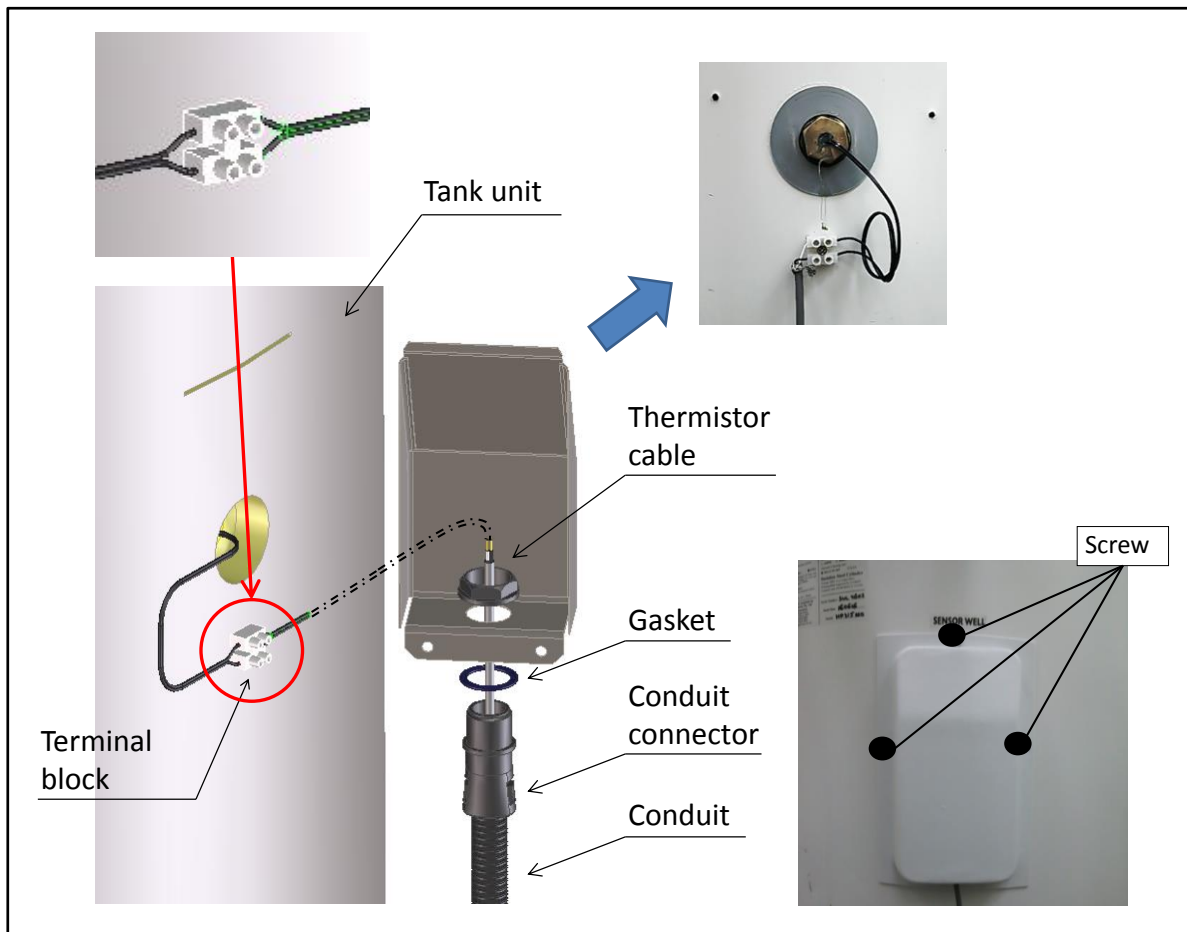
**Figure 7: Main Power Connection**



## 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 8).
- 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.

**Figure 8: Connecting tank unit thermistor cable – GAUS Tanks shown as example**



## **System operation using continuous Power Supply**

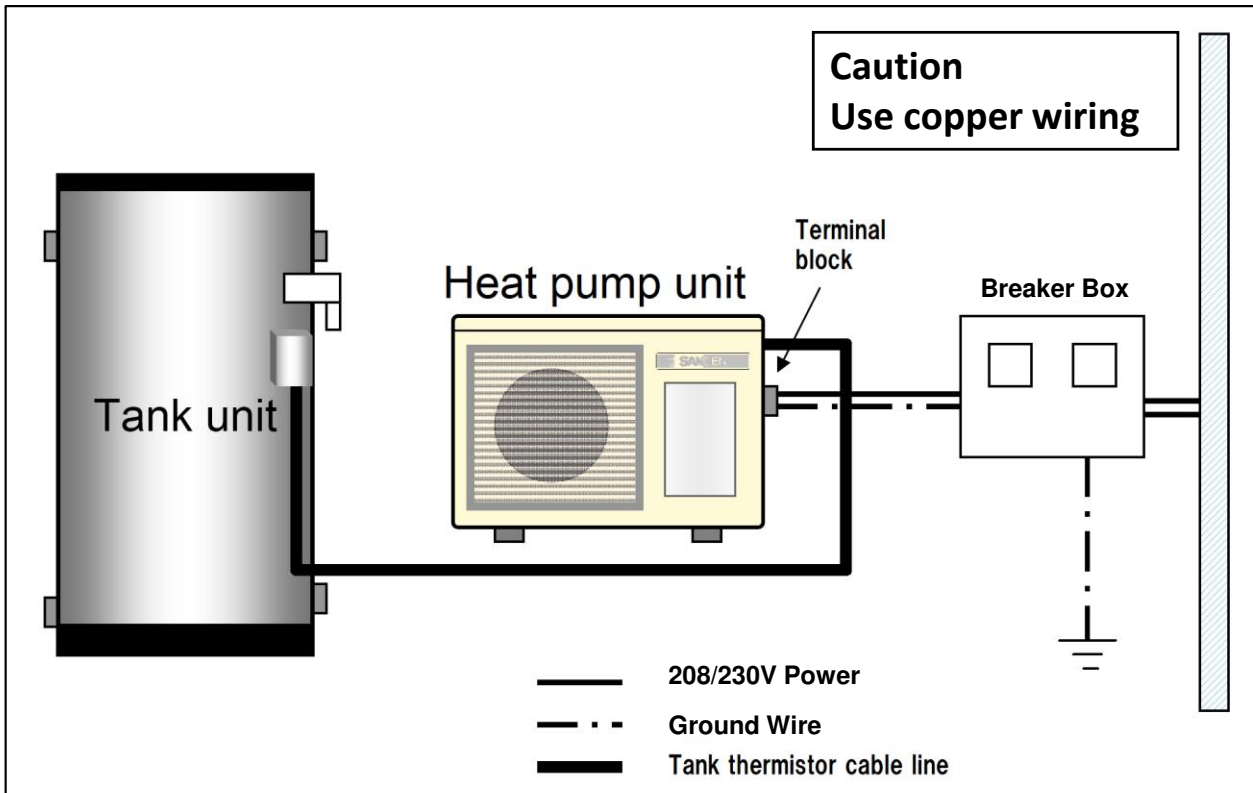
- If the block out time function is selected (setting is covered on Page 18) the unit will not operate during the block out times – this function is typically used on installations that have time of use electricity tariffs.
- The water heating cycle operation starts automatically when the residual hot water in the tank unit is less than 40 gallons (150 litres).
- The system will not run if the electrical power supply is cut off. However, the system will automatically start operation, once the electric power supply is restored.

## **System operation if connected to Demand Response Power**

- There are no special settings for the Demand Response. The system will run once power becomes available and the temperature in the tank drops below the set point of the tank thermistor.
- If connecting the unit to Demand Response power ensure that the power supply provides a minimum of 5 hours continuous power, as it can take at least four hours to fill the tank unit with hot water.  
If the ambient temperature is lower than 50°F (10°C) this can be longer.

- If the unit is connected to Demand Response power 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**



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

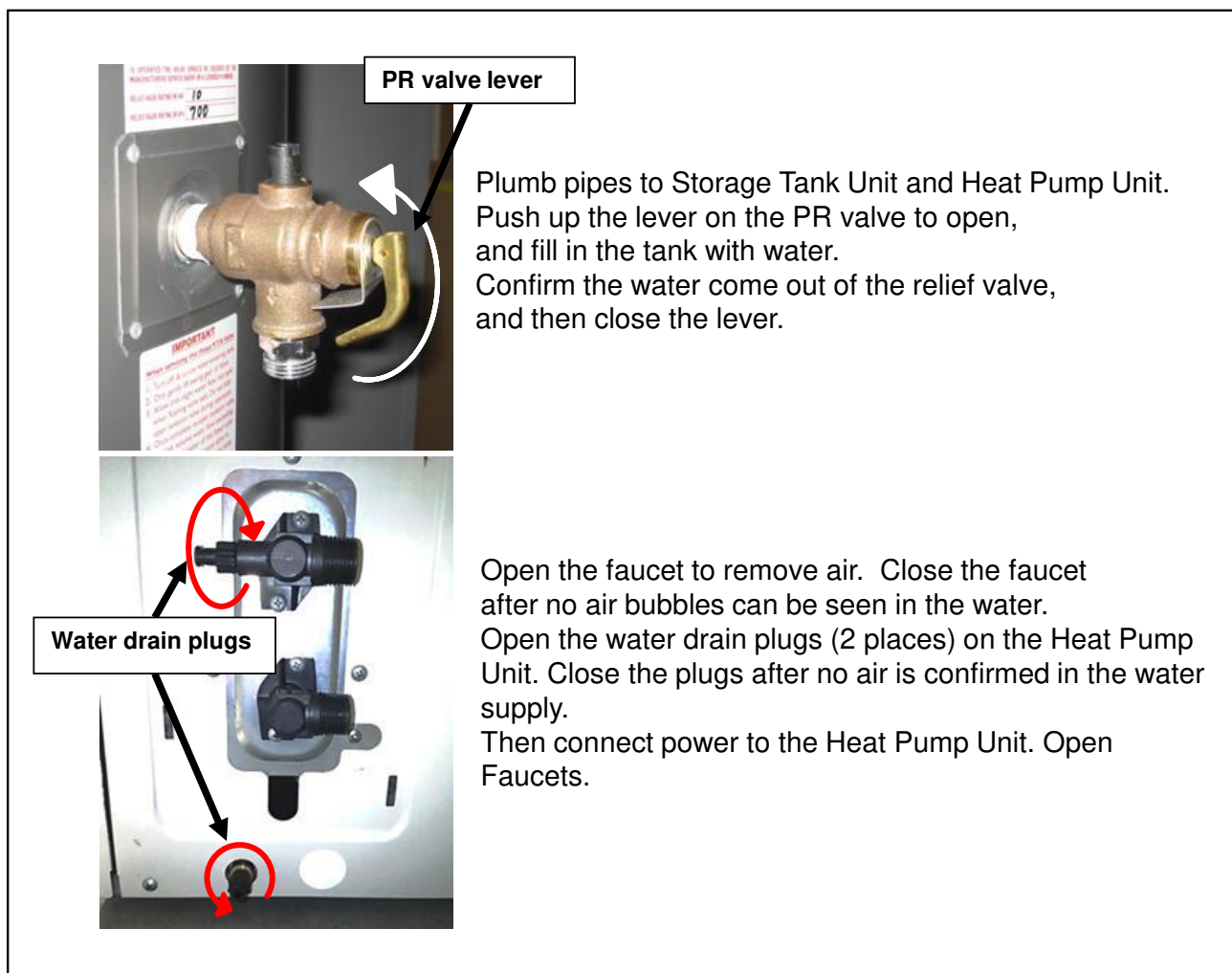
Ensure that the work site is tidy; Sanden International recommends the use of Slim Duct or Fortress product to cover water piping on the outside of the house.

## Filling the System & Purging Air

The following steps must be taken to ensure all air is removed from the system. Incorrect purging 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 remove air from the house piping system.
- Close the faucets after no air is seen in the water.
- Open the water drain plugs (two places) 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 and leave the hot water faucets open for 3 minutes. Close the faucets after no air can be seen in the water.

**Figure 10: Air removal process**



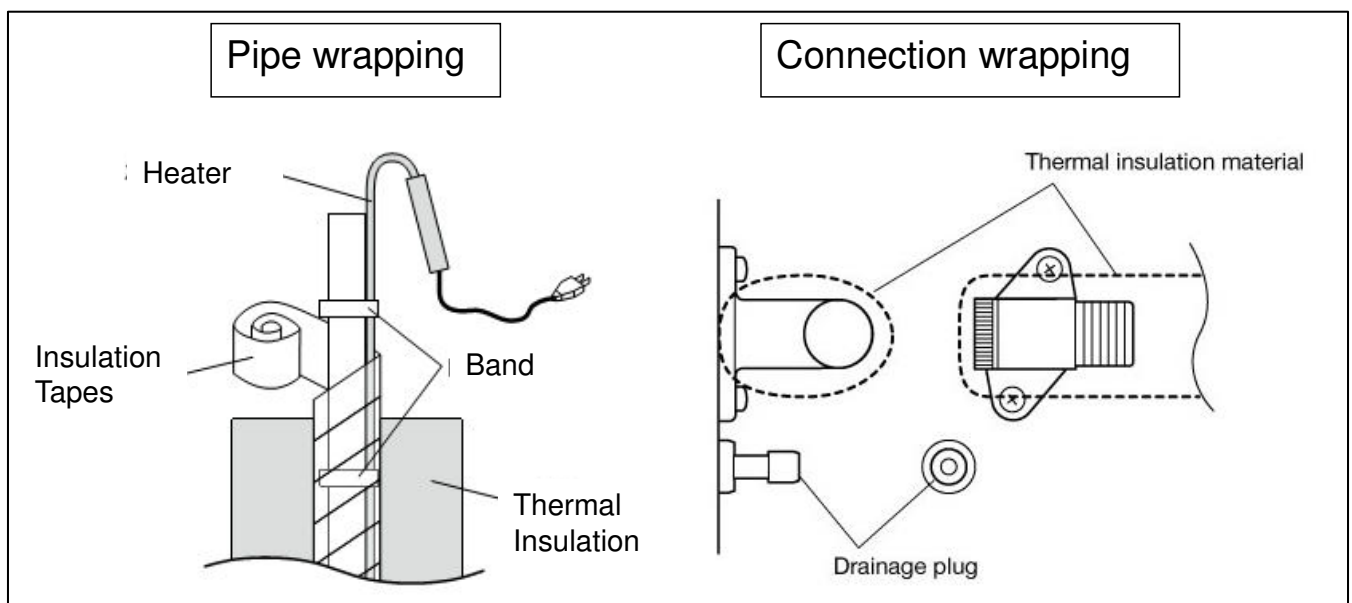
## Freeze protection

- 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.
- 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**





# Unit Operation

## Time setting

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

With the display reading 000X (X being the time elapsed from starting the unit)

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

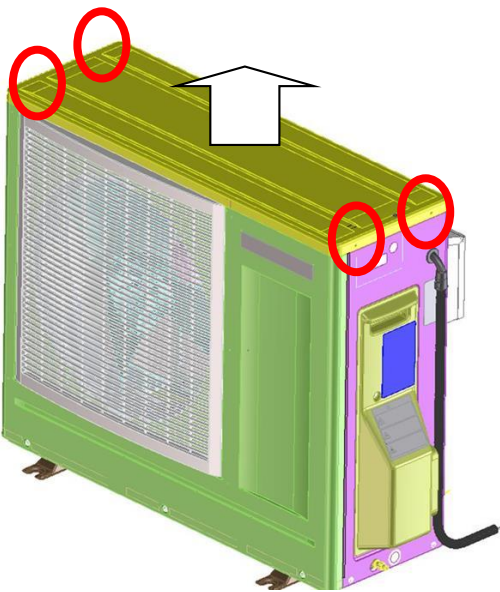
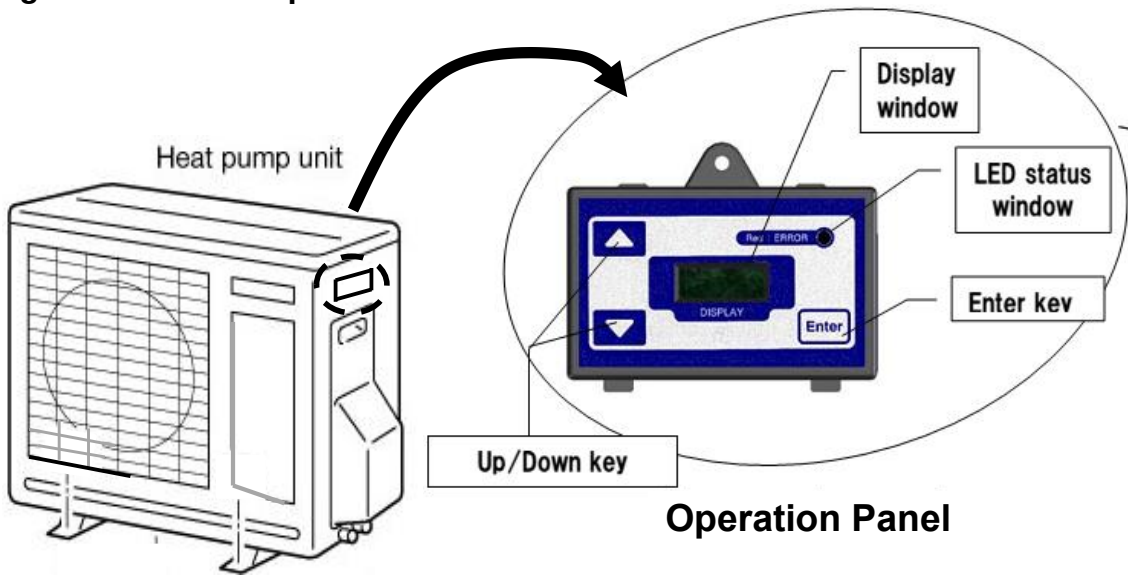
The setting automatically cancels when no panel operation is performed for more than 60 seconds in the Clock Setting Mode. If this occurs, changes made will not be reflected to the setting. If the clock setting is rewound to a time that is earlier than the time when a heating cycle is triggered, the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

Note:

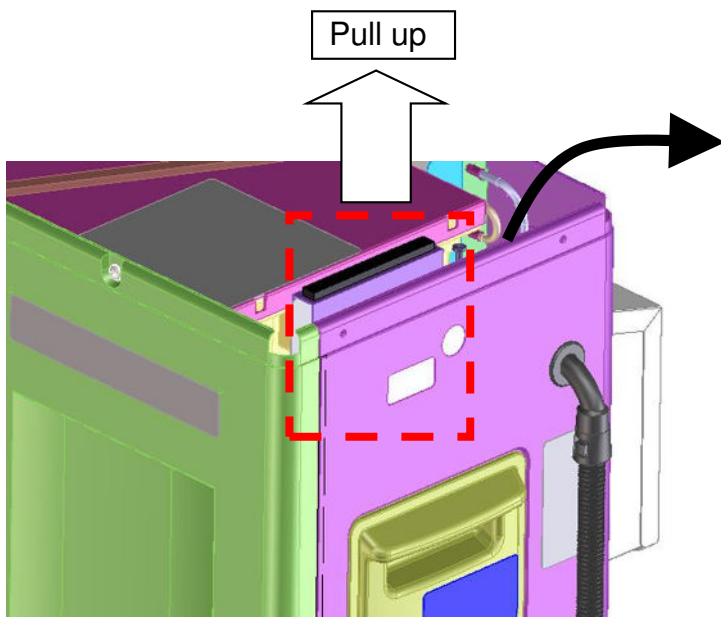
**IF NO BUTTONS ARE PRESSED ON THE CONTROL PANEL FOR MORE THAN 60 SECONDS, THE DISPLAY GOES TO SLEEP AND THE PANEL IS BLANK EXCEPT FOR THE OPERATION STATUS LIGHT GREEN IS NORMAL, RED IS AN ERROR**

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

Figure 12: How to operate the controller



- How to remove the operation panel
1. Remove Top Panel (4 screws)
  2. Pull up Operation Panel



Operation Panel

## 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)

Outlet water temperature setting mode

Set the Outlet Hot water temperature 130~175°F

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.

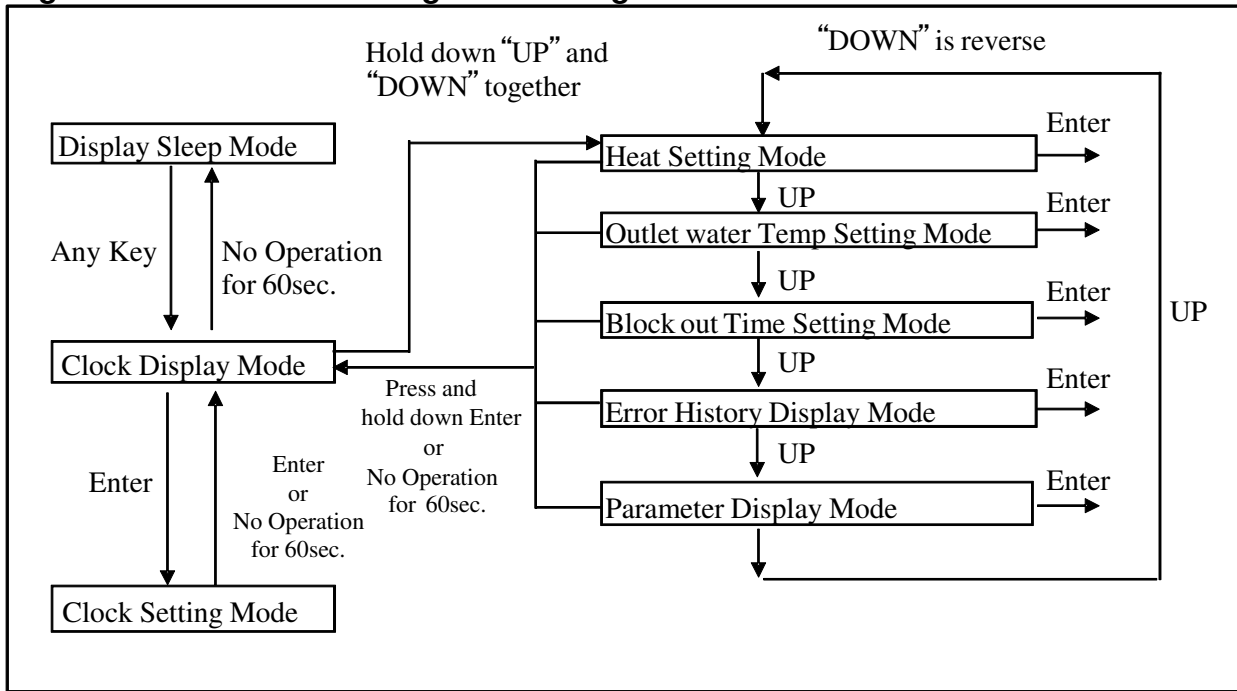
## How to switch to Commissioning Mode

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 six 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

**Temperature Setting**

Enter into Commissioning Mode  
 First option is the Heat Setting –  
 Press the UP Key to access Temperature Setting then Press Enter to access  
 Use UP/DOWN arrow keys to toggle between the various Temperature Settings  
 Press Enter to confirm choice

Settings available 130, 140, 150, 160, 165, 175°F

To bypass the Temperature 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–

Press the UP Key to access Block Out Time then Press Enter to access

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

Block out times are used if the customer has a time of use tariff or wants to take advantage of Solar PV production

'bo' and '00XX' (00 = Out Beginning time, XX = Out end time) are displayed. (Initial setting = 00 o'clock for both start and end)

Adjust set block out Beginning time

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

Set block out Beginning 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 NOW starts flashing.

**THIS TIME WILL BE THE TIME WHEN THE HEAT PUMP IS FIRST PREVENTED FROM OPERATING EVEN IF THE TANK IS COLD**

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. Time is displayed in Military time not AM/PM

Set block out end time

Press enter key to set the desired time setting. After the end time is set, the start time and end time are displayed for two seconds, then it starts to display 'bo' and '00XX' (00 = start time, XX = end time) sequentially.

**THIS TIME WILL BE THE TIME WHEN THE HEAT PUMP IS NOW ALLOWED TO OPERATE BASED ON TANK TEMPERATURE**

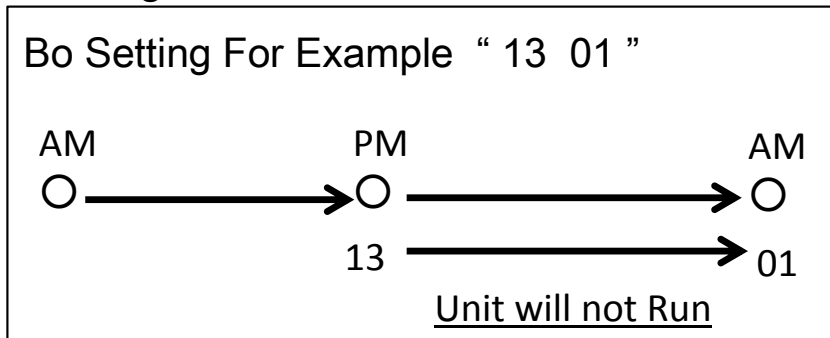
Go back to clock display mode

Press 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 beginning and end times to '00'. Setting to other than '00' (01 ~ 23) will be interpreted as a setting error and the end time will flash. Make sure to set both times to '00' when cancelling the block out time setting.

## ✘ 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 Temperature Setting

Third option is Block Out Time –

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

This records all 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 Temperature Setting

Third option is Block Out Time

Fourth 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.

All values will be in °C and will displayed 10 x larger than the actual value e.g. 58°C will be displayed as 0580 (°F conversion  $\times 1.8 + 32$ )

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.04	Outlet water temp
No.05	Inlet water temp
No.07	Ambient temp

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

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

## 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 revert 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 is highly likely.

Error code	Error contents	Corrective action
E001	HP water outlet over temperature 1	<ul style="list-style-type: none"> <li>- Check the heat pump piping for blockage/debris</li> <li>- Check for any piping bend, blockage or kinking</li> <li>- Check pipes are not frozen</li> <li>- Ensure mains water supply is available</li> <li>- Ensure all shut off valves are open</li> <li>- If the water circulation pump is not working, replace the pump</li> <li>- In areas with hard water ensure Gas Cooler is not scaled up, descale if necessary</li> </ul>
E002	HP water outlet over temperature 2	
E003	HP outlet temperature thermistor detection error	<ul style="list-style-type: none"> <li>- Check if the thermistor is out of the mounting pocket on the water outlet pipe</li> </ul>
E004	HP discharge over temperature 1	<ul style="list-style-type: none"> <li>- Replace the discharge temp thermistor</li> <li>- Reconnect the expansion valve PCB connector, check to ensure connection</li> <li>- Replace the expansion valve (together with PCB), or the entire heat pump unit</li> </ul>
E005	HP discharge over temperature 2	
E006	HP discharge temperature Thermistor detection error	
E007	High pressure side error	<ul style="list-style-type: none"> <li>- Check the heat pump piping for any blockage</li> <li>- Check for any piping bend, blockage or kink</li> <li>- Check if the pipes are frozen</li> <li>- Ensure mains water supply is available</li> <li>- Ensure all shut off valves are open</li> <li>- If the water circulation pump is not</li> </ul>



		working, replace the pump - In areas with hard water ensure Gas Cooler is not scaled up, descale if necessary
E008	High ambient temperature defrost drive error	- Remove debris from the evaporator coil (e.g. leaves, grass, snow) - Replace the ambient temperature thermistor - Replace the defrost thermistor
E009	HP defrost thermistor detection error	- Check if the thermistor is mounted in position on the evaporator - Replace the defrost thermistor
E011	HP inlet temperature thermistor wire break	- Check the thermistor connectors on the main PCB in the heat pump unit for any disconnect, wire breakage or short circuit - Measure resistance of the specific thermistor indicated by the error code
E012	HP outlet temperature thermistor wire break	
E013	HP discharge temperature thermistor wire break	
E014	HP defrost temperature thermistor wire break	
E015	HP ambient temperature thermistor wire break	
E016	Tank thermistor wire break	
E021	HP inlet temperature thermistor wire short circuit	
E022	HP outlet temperature thermistor wire short circuit	
E023	HP discharge temperature thermistor wire short circuit	
E024	HP defrost temperature thermistor wire short circuit	
E025	HP ambient temperature thermistor wire short circuit	
E026	Tank thermistor short circuit	
E031	Fan motor locked	
E032	Fan motor revolution error	- Ensure Fan Blade is not caught on debris or snow/ice build-up inside the unit - Replace the fan motor
E034	Water circulation pump locked	- Check the heat pump piping for blockage or kinking - Confirm that the connector for the water circulation pump is connected to the PCB correctly - Replace the water circulation pump - In areas with hard water ensure piping is not scaled up, descale if necessary
E040 ~ E082	System control error	Replace the PCB (In the case of E080, check the heat pump piping for blockage/debris, any piping bend, blockage or kinking and pipes are not frozen )

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 (Supplemental)

### Chloride and PH

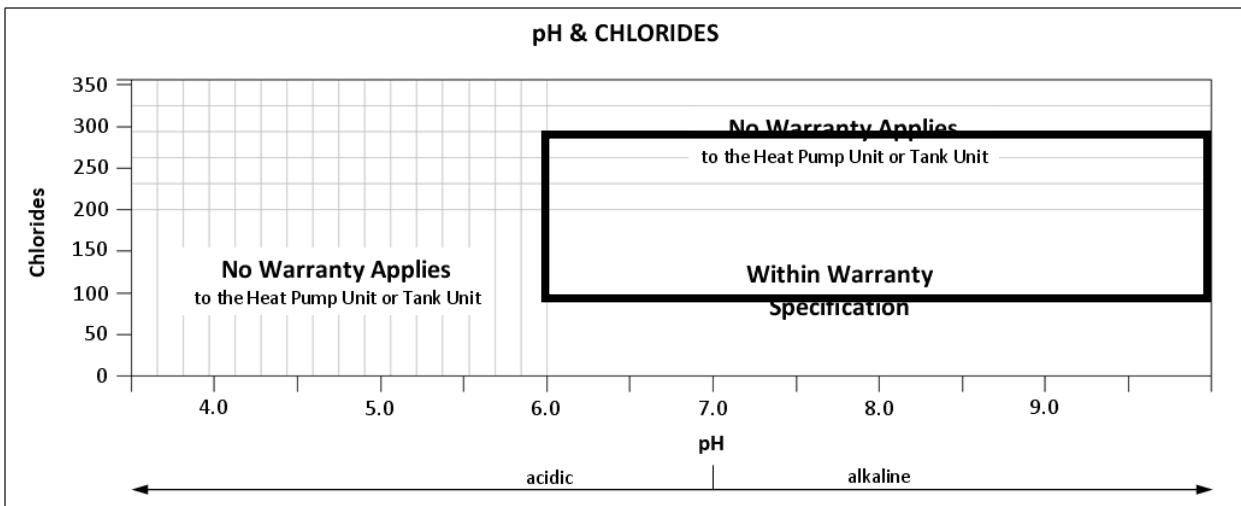
In areas with a high concentration of chloride in the water, that water can cause corrosion and subsequent failures. Where the chloride level exceeds 0.1 ounces per gallons (200 mg/litre), the warranty is no longer valid on to the heat pump unit and tank unit.

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 coverage is given on the heat pump unit and tank unit where the PH is less than 6.0.

Supply Water with a PH less than 6.0 may be treated to raise the PH. It is recommended that an analysis of the Supply Water be conducted before connecting the Heat pump unit to the system.

Figure 15



## **Change of water supply**

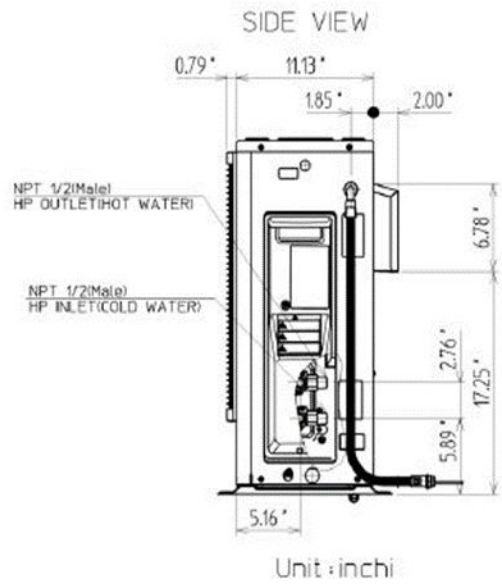
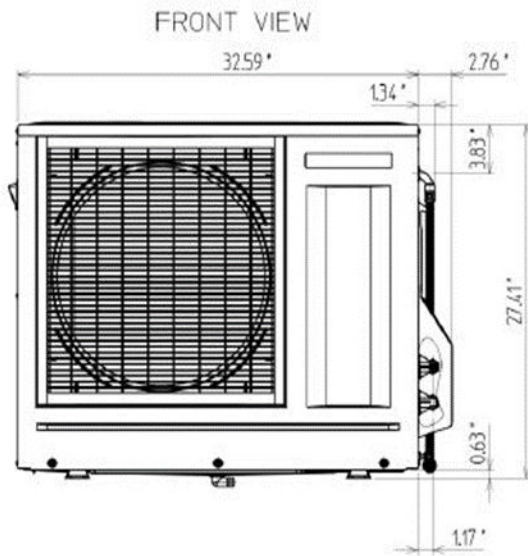
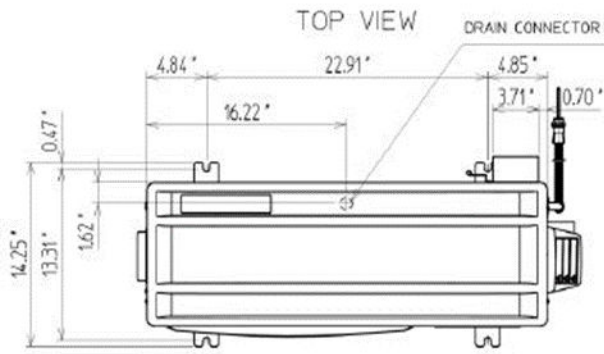
Changing, or alternating, from one water supply to another can have a detrimental effect on the operation and/or life expectation of the water tank, PR valve, water heating circulation and the heat exchanger in the system.

Where there is a changeover from one water supply to another, for example, a rainwater tank supply, desalinated water supply, public recirculated water supply or water brought in from another supply, then water chemistry information should be sought from the supplier or the water should be tested to ensure it meets the warranty requirements in this installation manual.

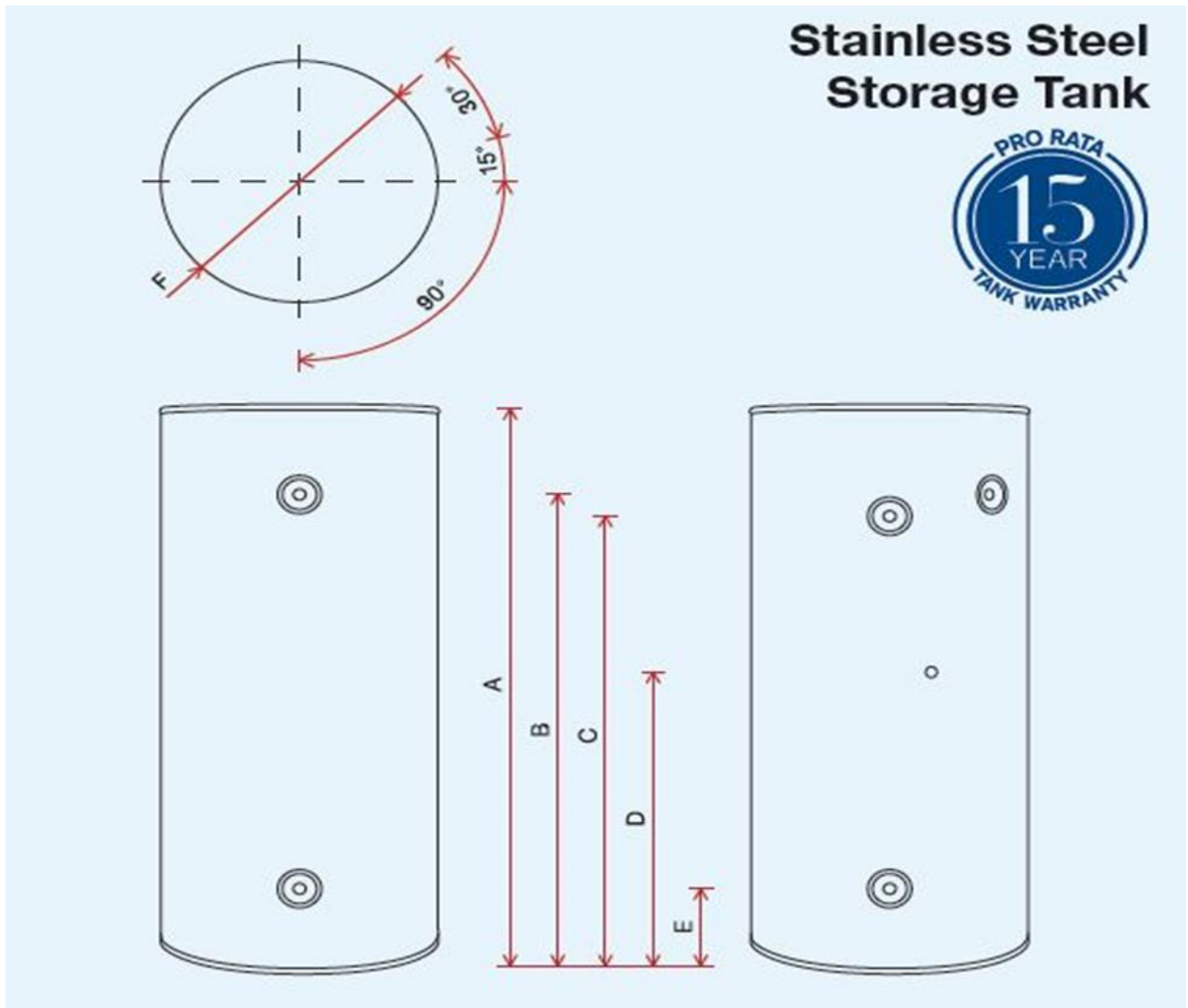
## Technical data

<b>Specifications</b>	<b>GS3-45HPA-US</b>
<b>Performance</b>	
Energy Factor - 43 Gal System	3.09
First Hour Rating - 43 Gal System	71 Gallons
Energy Factor - 83 Gal System	3.84
First Hour Rating - 83 Gal System	101 Gallons
Nom Heating Capacity (Btu/h)	15,400 Btu/h
Nom Heating Capacity (kw)	4.5kw
Heating COP	5.0
Water Temperature Setting	130 to 175 DegF
Refrigerant Type	R744 (CO <sub>2</sub> )
Refrigerant Charge (Oz)	22oz
Power Voltage	208/230v-1Ph-60Hz
Breaker Size	15A
MCA (Amps)	13.0A
Compressor RLA/LRA (Amps)	7.5/9.8A
Fan Motor RLA/Watts	0.3A / 70W
Pump RLA/Watts	0.2A / 30W
Noise Level (DbA)	37
Weight (lbs)	106lbs
<b>Storage Tank</b>	
GAUS-160QQT/SAN-43SSAQA	43 Gallons
GAUS-315EQTD/SAN-83SSAQA	83 Gallons
<b>Tank Connection Sizes</b>	
Cold Water Inlet	3/4" NPT
Hot Water Outlet	3/4" NPT
Cold Water to Heat Pump	3/4" NPT
Hot Water Return from Heat Pump	3/4" NPT
Press Relief Valve Setting	100 Psig
<b>Pipe Size - Tank to Heat Pump</b>	
Size	1/2" & 1/2"
Max Pipe Length inc	50ft
Max Vertical Separation of	16ft
<b>Certifications</b>	
Safety	ETL & ETLc
Performance	AHRI
ARI Certification reference #	TBA
<b>Warranty</b> - System	3 Years Labor
Heat Pump	10 Years Parts
Tank	15Yrs Limited Lifetime

# GS3-45HPA-US Dimensions



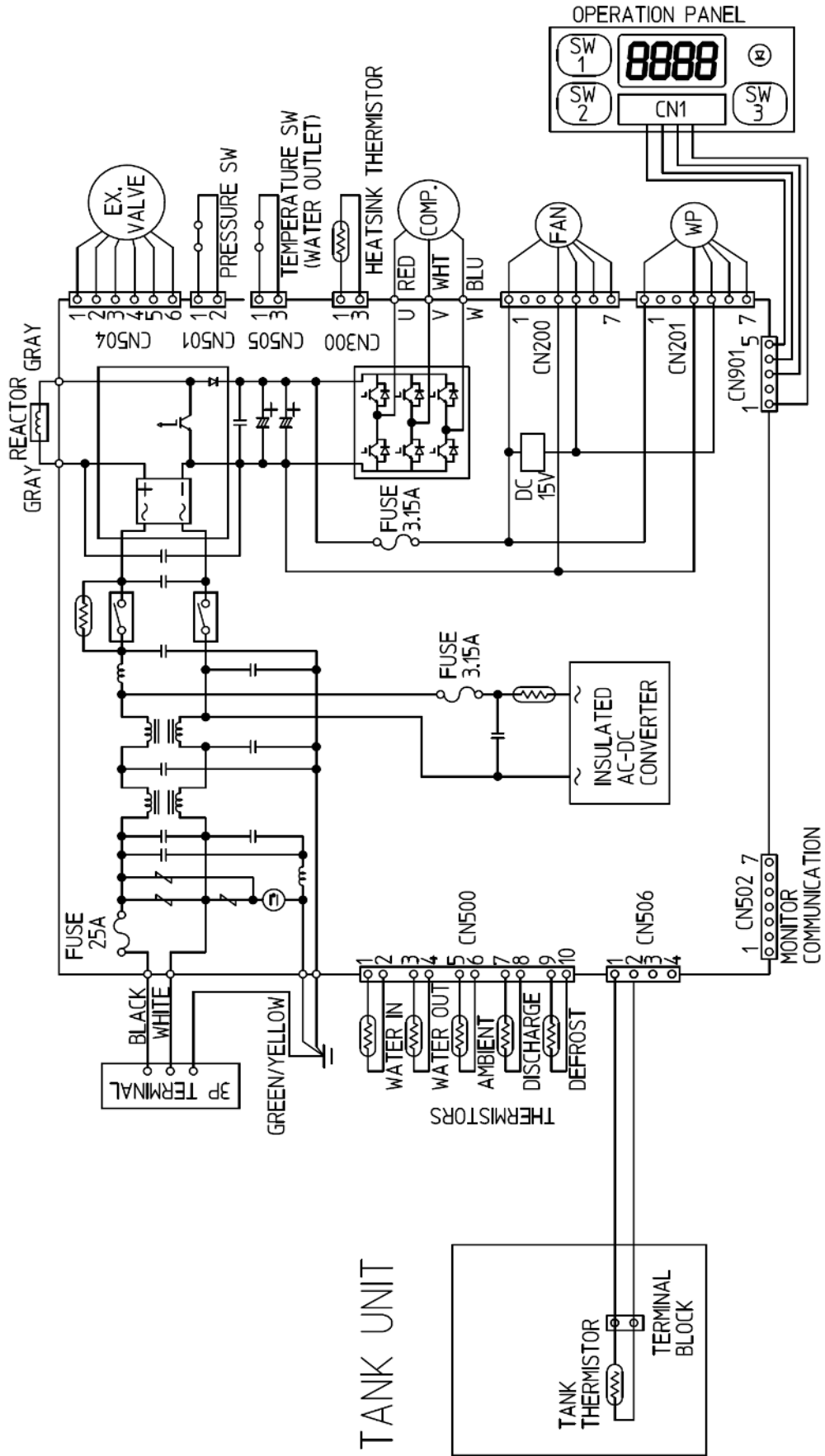
## Stainless Steel Tank Dimensions



Tank Model No:	GAUS-160QTA	GAUS-315EQTD	SAN-43SSAQA	SAN-83SSAQA
<b>A</b> Height	47-1/4"	58-5/8"	38-1/8"	68-7/8"
<b>B</b> Hot Water Outlet & PR Valve	37-3/8"	49-5/8"	29-1/2"	60-1/4"
<b>C</b> Heat Pump Return	37-3/8"	49-5/8"	29-1/2"	60-1/4"
<b>D</b> Sensor Port	17-1/8"	37"	9-3/4"	40 3/8"
<b>E</b> Cold Water Inlet / Cold Water to HP	8-1/4"	7-7/8"	8-3/4"	8-3/4"
<b>F</b> Diameter	22-1/2"	26-3/4"	24-1/2"	24-1/2"
Weight (lbs)	88 lbs	154 lbs	88 lbs	115 lbs
Tank Capacity (gallons)	43 gallons	83 gallons	43 gallons	83 gallons

# Wiring Diagram

## HEAT PUMP UNIT



## Warranty Policy

**Covering the following Model #'s :**

**Heat Pump : GS3-45HPA, GUS-A45HPA**

**Storage Tanks : SAN-43SSAQA, SAN-83SSAQA, SAN-119GLBK, GAUS-160QTA & GAUS-315EQTD**

### Warranty Conditions as of April 1 2019 to the Original Owner Only

#### 1. Warranty period

Subject to the Warranty Conditions and Exclusions stated below, the Sanden Heat Pump Water Heater System with the corresponding model numbers warranted in Residential / Combi DHW & Heating applications as follows:

##### 1-1. Residential DHW application ; Heat pump unit

Sanden warrants all parts & labor on the SANCO<sub>2</sub> 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 Sanden and revised from time to time at Sanden's requirement (Exhibit A).

Should at any time during the 10 year Parts warranty any component directly part of the CO<sub>2</sub> refrigerant circuit fail, where replacement of that component would require opening of the refrigerant circuit, Sanden 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 unit

Sanden warrants that the *SAN-43SSAQA, SAN-83SSAQA, GAUS-160QTA, GAUS-315EQTD* 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 Fifteen 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**

Sanden 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 Sanden and revised from time to time at Sanden's requirement.

#### **1-3.2. Combined DHW/Heating application ; Tank unit**

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**

- 2-1. The Sanden 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 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 Sanden 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 Sanden 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 Sanden 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 a Sanden accredited service agent or the Sanden service department.

- 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 GS3-45HPA and GUS-A45HPA heat pump(s) with other storage tanks that have not been specifically approved in writing by Sanden Eco Systems.
- 3-3. Where the Heat Pump Water Heater System or its component has failed directly or indirectly as a result of excessive water pressure above 75 Psi.
- 3-4. The factory supplied pressure regulating drain 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 Sanden Heat Pump Water Heater Systems that are purchased on the internet are not eligible for warranty. The system must be purchased from a Sanden 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. Sanden 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 4-1-2019.**

## **Exhibit A: Labor Costs**

Labor costs are paid per the payment cost schedule published by Sanden and revised from

time to time at Sanden's requirement.

Labor warranty specifically excludes (unless agreed 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 4/1/2019

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

## 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**

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

**Water Piping**

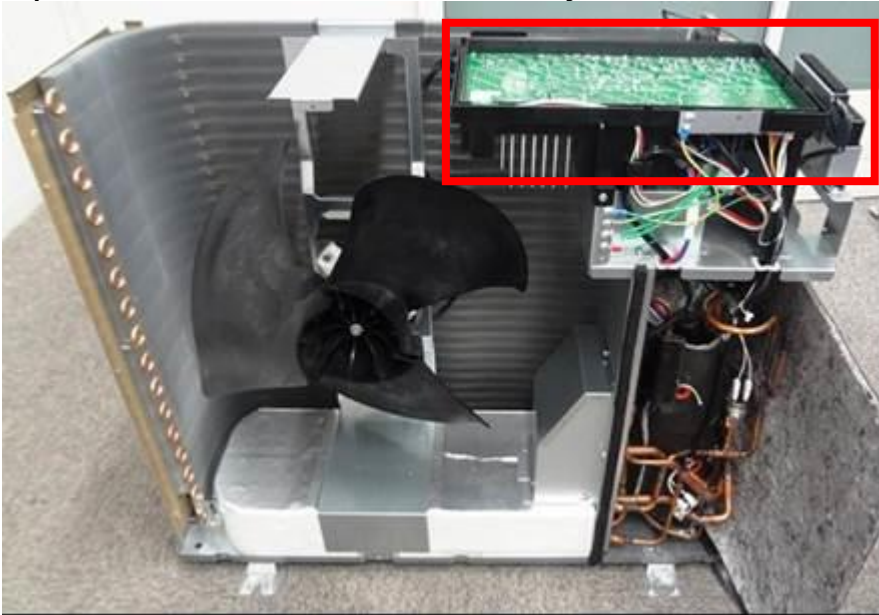
<b>Action</b>	<b>Completed</b>
A dedicated water supply shut off valve is installed	
The piping for the hot water supply has been properly insulated.	
There is no water leaking from the water supply/hot water supply and heat pump pipes.	
In areas subject to snap freezes, protection is provided.	
Union 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.....

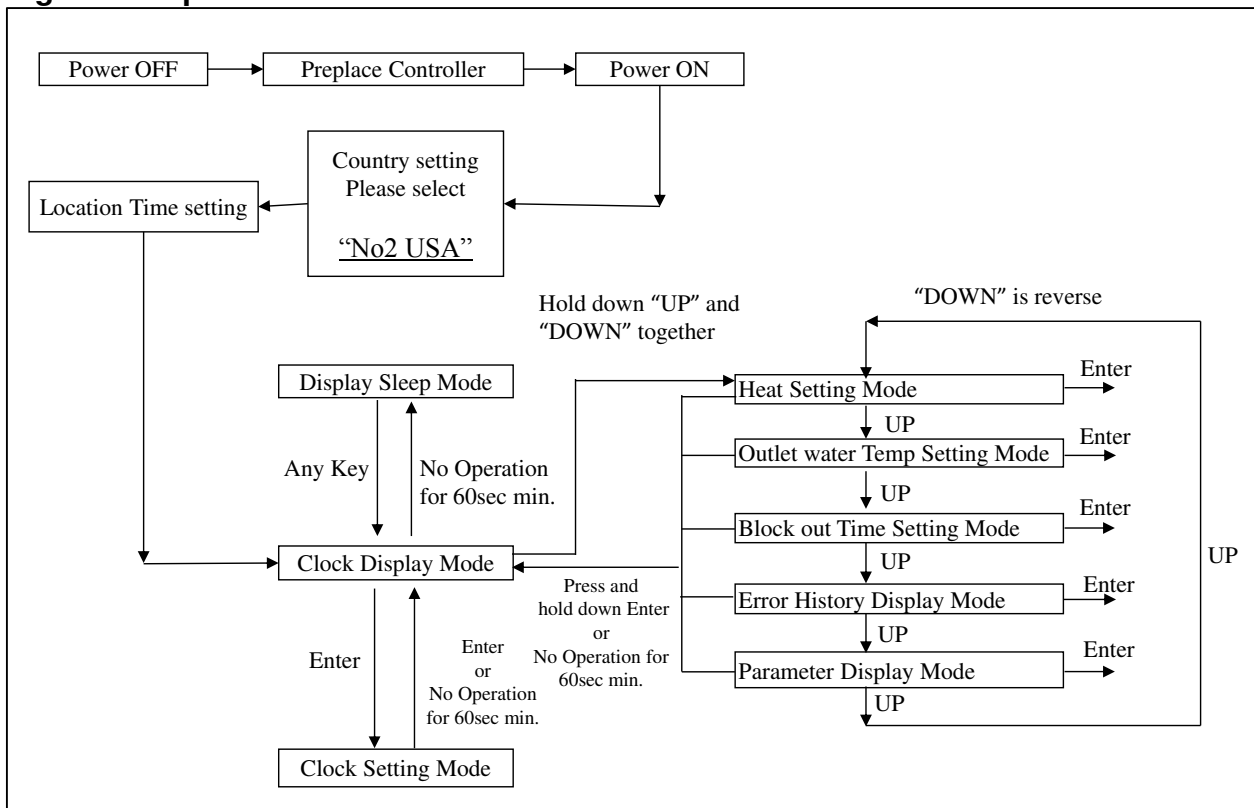
## Replace controller assembly

Please replace the controller assembly box.



After PCB replace, Panel operation flow

Figure 15 Operation flow



# Memo

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