Owner’s manual
Sanden Heat Pump Water Heater with Natural Refrigerant (CO2)
Covering model numbers for residence

Heat Pump Unit GS3-45HPA-US

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.
Contents

Page title ................................................................. 1
Contents ........................................................................... 2
Introduction ....................................................................... 3
How it works ..................................................................... 3
Installation details .......................................................... 7
Trouble shooting guide ...................................................... 8
Error Codes ...................................................................... 9
Filling the System & Purging Air ........................................... 10
Mains Power/Electrical Installation ........................................ 11
Electrical connections ....................................................... 11
How to connect Main Power ............................................... 11
System operation using continuous power ............................... 12
System operation if connected to Demand Response power .......... 13
Water Supply Quality (Supplemental) ......................................... 14
Change of water supply ..................................................... 14
Technical data .................................................................... 15
Warranty Policy .................................................................. 18
Registration for warranty .................................................. 20

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. Sanden is in a process of continuous improvement with, therefore specifications may be different to those referenced in this manual – Please contact Sanden International or it’s distributors for the latest specifications at the time of install.
Introduction

The Sanden 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 used is CO₂ which does not contribute to global warming so it allows us to help keep a clean healthy earth for future generations.

We have also considered the power requirement. 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 throughout the night.

How it works

The Sanden 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

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.
Safety precautions

Please ensure you fully observe the precautions.

The following instructions need to be fully followed to prevent any harm to users and others or damage to your property.

The extent of the possible harm or damage caused by misuse of the product falls into the following classifications.

⚠️ **Warning**  The column with this classification indicates “the extent of harm that includes the possibility of death or serious injury”.

⚠️ **Caution**  The column with this classification indicates “the extent of harm/damage that includes the possibility of injury or damage to property”.

The type of content to be observed can be explained with the following pictorial classifications.

- Indicates content requiring “attention”.
- Indicates content that is prohibited.
- Indicates content with “instructions” that need to be fully followed.

⚠️ **Warning**

1. **Do not touch the faucet while hot water is being supplied**
   - Do not touch
   - Could result in being burnt by hot water.

2. **Check the water temperature before supplying any hot water or taking a shower.**
   - Could result in being burnt.

3. **Do not touch the relief valve, drainage pipe, drain outlet or drain elbow when inspecting the relief valve or while draining hot water.**
   - Do not touch
   - Could result in being burnt.

4. **Do not touch the heat pump unit pipes or hot-water supply pipes.**
   - Could result in being burnt.
**Warning**

Do not use any damaged, altered, or bundled power cords.

- Verify that the piping has all been insulated.
  - Any of the pipes freezing up and getting damaged could result in scalding or water leaking.
  - Please contact the dealer on insulating the pipes.

Ensure the product is removed from any gas containers, sources of fire and flammable substances.

- Sparks from the electrical parts of the product could result in fire.

Do not disassemble, repair or alter the product in any way.

- Could result in electric shock or fire.
  - Contact the dealer for repair.

Do not open the front board of the hot water storage unit or the heat pump unit cover.

- Could result in electric shock.

Do not poke your fingers or a stick into the air inlet (fins)/air outlet of the heat pump unit.

- Could result in injury.
Caution

Do not climb or put anything on top of the unit. Do not apply any force to the piping.

Could result in injuries from a fall or being scalded.

Do not use the heat pump unit if the installation blocks have been damaged.

Damaged installation blocks could result in the heat pump unit falling over and causing injury.

Do not put anything susceptible to humidity under the heat pump unit.

Water could drain out. In addition, condensation could drip from the pipe connections.

Could result in harm to animal and plant life.

Ensure no animal or plant life is placed directly in front of where air is blown from the unit.

Could result in poor performance and unexpected problems.

Remove any snow from the units after snowfalls.

Snow building up around the heat pump unit and hot water storage tank unit could result in malfunction and failure.

Check the installation conditions of the unit.
Installation of the unit in the following places could result in accidents or failure and the performance of the unit not being guaranteed.

- Anywhere the lowest temperature reached is under minus 4 degree Fahrenheit
- Indoors (Applies only to the heat pump unit)
- Anywhere not completely flat, unstable or where drainage is difficult
- Ensure not to put anything around the heat pump unit. Could result in poor performance and unexpected problems.

In the winter in particular please pay attention to any snow coverage.

Select an installation place with consideration given to neighbors.

Please select a place where noise and vibration while operating will not bother your neighbors.
Installation details

This Sanden Eco Hot water Heat Pump 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 and any other usage, such as space heating requires a heat exchanger suitable for local codes to be installed on the system to separate potable and non-potable water.

- 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.

Figure 2: Typical installation layout
Trouble shooting guide
If you face a problem while using our Heat Pump water heater system, please check the following table prior to calling for support.

<table>
<thead>
<tr>
<th>Status</th>
<th>Considerable Causes</th>
<th>Action to Take</th>
</tr>
</thead>
<tbody>
<tr>
<td>No hot water comes out of water tap</td>
<td>Small or no hot water is left in the storage tank.</td>
<td>- Stop using hot water and wait for about 1 hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Consider a change of the electricity supply off-peak mode (Length of power-supply hours may be too short for the water heating cycle to cover the hot water consumption)</td>
</tr>
<tr>
<td>Temperature of hot water is too low</td>
<td>Air removing procedure from the heat pump system may be insufficient.</td>
<td>- Open the water drain plugs on the Heat Pump Unit to remove air from water circuit. (Be careful for burning)</td>
</tr>
<tr>
<td></td>
<td>Filter on cold inlet connector may be blocked.</td>
<td>- Check the filter and remove if there is any blockage</td>
</tr>
<tr>
<td></td>
<td>Water flow speed may be dropped due to the heat pump piping bend, blockage or crush.</td>
<td>- Check for any piping bend or crush and remove if any</td>
</tr>
<tr>
<td></td>
<td>Pipes may be frozen.</td>
<td>- If frozen area is found on the piping, melt the ice on the pipe and provide a heat insulation</td>
</tr>
<tr>
<td></td>
<td>Stop valve is closed.</td>
<td>- Open the valve</td>
</tr>
<tr>
<td></td>
<td>Air absorption is not sufficient due to a blockage on the evaporator.</td>
<td>- Remove the object blocking the air flow through the evaporator (e.g. fallen leaves, grass, snow, etc.)</td>
</tr>
</tbody>
</table>

For those problems not listed above, an inspection provided by a skilled engineer is required. Please contact the distributor.

Caution:
Do not shut the electricity supplied to the Heat Pump system off even if you go away from home and do not use hot water for a long while.
If the system is equipped with freeze protect heaters, also do not shut the power supply to the heaters.
Failure to do so may cause a crack on the pipes due to the pipes getting frozen.
**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 3 Error Code example*

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.

<table>
<thead>
<tr>
<th>Error code</th>
<th>Error contents</th>
<th>Error code</th>
<th>Error contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>E001</td>
<td>HP water outlet over temperature 1</td>
<td>E015</td>
<td>HP ambient temperature thermistor wire break</td>
</tr>
<tr>
<td>E002</td>
<td>HP water outlet over temperature 2</td>
<td>E016</td>
<td>Tank thermistor wire break</td>
</tr>
<tr>
<td>E003</td>
<td>HP outlet temperature thermistor detection error</td>
<td>E021</td>
<td>HP inlet temperature thermistor wire short circuit</td>
</tr>
<tr>
<td>E004</td>
<td>HP discharge over temperature 1</td>
<td>E022</td>
<td>HP outlet temperature thermistor wire short circuit</td>
</tr>
<tr>
<td>E005</td>
<td>HP discharge over temperature 2</td>
<td>E023</td>
<td>HP discharge temperature thermistor wire short circuit</td>
</tr>
<tr>
<td>E006</td>
<td>HP discharge temperature Thermistor detection error</td>
<td>E024</td>
<td>HP defrost temperature thermistor wire short circuit</td>
</tr>
<tr>
<td>E007</td>
<td>High pressure side error</td>
<td>E025</td>
<td>HP ambient temperature thermistor wire short circuit</td>
</tr>
<tr>
<td>E008</td>
<td>High ambient temperature defrost drive error</td>
<td>E026</td>
<td>Tank thermistor short circuit</td>
</tr>
<tr>
<td>E009</td>
<td>HP defrost thermistor detection error</td>
<td>E031</td>
<td>Fan motor locked</td>
</tr>
<tr>
<td>E011</td>
<td>HP inlet temperature thermistor wire break</td>
<td>E032</td>
<td>Fan motor revolution error</td>
</tr>
<tr>
<td>E012</td>
<td>HP outlet temperature thermistor wire break</td>
<td>E034</td>
<td>Water circulation pump locked</td>
</tr>
<tr>
<td>E013</td>
<td>HP discharge temperature thermistor wire break</td>
<td>E040, E082</td>
<td>System control error</td>
</tr>
<tr>
<td>E014</td>
<td>HP defrost temperature thermistor wire break</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

- 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.

- Supply power to the heat pump unit and leave the hot water faucets open for 3 minutes. Close the faucet after no air can be seen in the water.

Figure 4: Air removal process
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 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 power supply wiring below the terminal block with the screw clamp fitting.

- Attach the terminal block cover and piping cover back on the heat pump unit.
System operation using continuous power

- The system runs its water heating cycle once a day to fill up the storage tank unit with heated water.

- If the block out time function is selected 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 (i.e. if it is connected to demand response power). However, the system will automatically start operation, once the electric power 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 off peak tariff 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.

Select the electrical supply mode that best suits the customer's hot water consumption. The type of off-peak connection may need to be changed if hot water supply is not maintained as required.

Figure 6: Outline of electrical system connections

The basic system installation is now complete; the unit is now ready for initial 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.
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 7 Chlorides and PH

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 unit cylinder, 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

Hot water storage tank unit

Material information

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage tank material</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Outside casing</td>
<td>Colour coated zinc steel</td>
</tr>
</tbody>
</table>
Stainless Steel Storage Tank Dimensions

<table>
<thead>
<tr>
<th>Tank Model No:</th>
<th>GAUS-169QTA</th>
<th>GAUS-315EQTD</th>
<th>SAN-43SSAQA</th>
<th>SAN-83SSAQA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Height</td>
<td>47-3/4&quot;</td>
<td>58-3/8&quot;</td>
<td>38-3/16&quot;</td>
<td>68-3/8&quot;</td>
</tr>
<tr>
<td>B Hot Water Outlet &amp; PR Valve</td>
<td>37-3/8&quot;</td>
<td>49-3/16&quot;</td>
<td>29-7/16&quot;</td>
<td>60-3/16&quot;</td>
</tr>
<tr>
<td>C Heat Pump Return</td>
<td>37-3/8&quot;</td>
<td>49-3/16&quot;</td>
<td>29-7/16&quot;</td>
<td>60-3/16&quot;</td>
</tr>
<tr>
<td>D Sensor Port</td>
<td>17-3/4&quot;</td>
<td>37&quot;</td>
<td>9-3/16&quot;</td>
<td>40 3/8&quot;</td>
</tr>
<tr>
<td>E Cold Water Inlet / Cold Water to HP</td>
<td>8-3/4&quot;</td>
<td>7-7/8&quot;</td>
<td>8-3/16&quot;</td>
<td>8-7/16&quot;</td>
</tr>
<tr>
<td>F Diameter</td>
<td>22-3/8&quot;</td>
<td>26-3/16&quot;</td>
<td>24-3/16&quot;</td>
<td>24-3/16&quot;</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>88 lbs</td>
<td>154 lbs</td>
<td>88 lbs</td>
<td>115 lbs</td>
</tr>
<tr>
<td>Tank Capacity (gallons)</td>
<td>43 gallons</td>
<td>83 gallons</td>
<td>43 gallons</td>
<td>83 gallons</td>
</tr>
</tbody>
</table>
GS3-45HPA-US Dimensions

**Specification**

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerant type</td>
<td>R744 (CO2)</td>
</tr>
<tr>
<td>Mass volume</td>
<td>22 oz. (650g)</td>
</tr>
<tr>
<td>Setting Outlet water temp</td>
<td>130~175°F</td>
</tr>
<tr>
<td>Product weight</td>
<td>106lb (48 kg)</td>
</tr>
<tr>
<td>Thermal capacity</td>
<td>4.5 kw</td>
</tr>
<tr>
<td>Fan motor FLA</td>
<td>0.3A, 70W</td>
</tr>
<tr>
<td>Water pump FLA</td>
<td>0.2A, 30W</td>
</tr>
<tr>
<td>Compressor RLA / LRA</td>
<td>7.5 / 9.8A</td>
</tr>
<tr>
<td>MCA</td>
<td>13A</td>
</tr>
<tr>
<td>Circuit Breaker Size</td>
<td>15A</td>
</tr>
<tr>
<td>Design Pressure (High / Low)</td>
<td>1885 / 1059 PSI</td>
</tr>
<tr>
<td>Max inlet water temperature</td>
<td>110°F</td>
</tr>
<tr>
<td>Protection Raining Class</td>
<td>IPX4</td>
</tr>
<tr>
<td>Max, Operating water Pressure</td>
<td>100PSI</td>
</tr>
</tbody>
</table>
Warranty Policy

Warranty Conditions

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, and in accordance with all relevant statutory/local requirements of the state/province/municipality in which the water heater is installed.

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 Heat Pump Water Heater System does not carry a new warranty.

3. Where the Heat Pump Water Heater System is installed outside the boundaries of a metropolitan area as defined by Sanden or further than 15 miles from an accredited service agent, the cost of transport, insurance and travelling costs between the nearest accredited service agent's premises and the installed site shall be the owner's responsibility.

4. Where the Heat Pump Water Heater System is installed in a position that does not allow safe, ready access, the cost of accessing the site safely, including the cost of additional materials handling and/or safety equipment, shall be the owner's responsibility.

5. The warranty only applies to the Heat Pump Water Heater System 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 pressure regulating valve, isolation valves, check valves, electrical switches, pumps or fuses.

6. The Heat Pump Water Heater System must be sized to supply the hot water demand in accordance with the guidelines in the Sanden Heat Pump Water Heater System literature.

7. 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.

Warranty Exclusions

1. 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.

2. 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. 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 water pressure; 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.

4. Where the Heat Pump Water Heater System or its component has failed directly or indirectly as a result of excessive water pressure.

5. Overflow vent drain has not been installed or blocked or corroded.

6. Where the Heat Pump has rusted as a result of a corrosive atmosphere;
7. 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.

8. 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 bring the Heat Pump Water Heater System to floor or ground level or to a serviceable position.

9. 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.

10. Warranty service is provided to the original owner of the equipment only. Subject to any statutory provisions to the contrary, this warranty excludes any and all claims for damage to furniture, carpets, walls, foundations 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.

11. Internet purchase
Any Sanden parts that are purchased on the internet are not eligible for the warranty term. The parts must be purchased through Sanden certified distributors/contractors.

**Warranty period**
Subject to the Warranty Conditions and Exclusions stated above, your Sanden Heat Pump Water Heater System is warranted in a Residential application as follows:

**Heat pump unit** – Sanden 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 directly to the servicing contractor per the payment cost schedule published by Sanden and revised from time to time at Sanden’s requirement.

**Tank unit** – Sanden warrants that the tank 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 end after Fifteen years from date of installation.
Registration for warranty

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

Sanden International USA Inc.
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.