BC NPHA

## Operator Training Manual

# Heat Pump Water Heater

*source: https://www.rheem.ca/heatpumpwaterheaters/*

## How To Use This Guide

This guide is designed to make sure that when your domestic hot water (DHW) heat pump installation is complete, you have all the information you need to operate and maintain it effectively and confidently.

It includes references and checklists you can use directly, as well as items you should request from your contractor before the project is finished. The checklist below shows everything covered in this guide:

- ☑ Items already included here
- ☐ Items you'll need to ask your contractor for

## Contents

| | Item | Notes/Description | Status |
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| **1. Equipment Overview** | | | |
| 1.1 | Description | A brief explanation of how the system works | ☑ |
| 1.2 | Labeled Diagram | A labeled diagram of the system and its primary components<br>*A general diagram is provided here; ask your contractor for a model-specific version.* | ☐ |
| 1.3 | How It Works | A high level overview of system operation<br>*General overview has been provided, but model specific details should be provided by the contractor during your training session or handoff process.* | ☐ |
| 1.4 | Key Benefits and Limitations | Key benefits and limitations of the system | ☑ |
| 1.5 | System Operation | A summary of operating limits, recommended setpoints<br>*These should be provided to occupants to improve efficiency and ensure comfort.* | ☑ |
| **2. Commissioning and Project Handoff** | | | |
| 2.1 | Equipment Spec Sheets | Equipment specification sheets (spec sheets) or manuals for each piece of equipment – Including make, model and serial number | ☐ |
| 2.1 | Equipment O&M Manuals | These provide details on how to operate and maintain the equipment | ☐ |
| 2.2 | Key Contacts List | A list of all key people to contact for questions, issues, warranty etc. | ☐ |
| 2.3 | Warranty Details | Warranty terms and expiry date | ☐ |
| 2.4 | Commissioning Report | The completed record showing the results of commissioning tests - it provides proof that the systems work | ☐ |
| 2.5 | Training Session | This is not always done as part of a project handoff and likely needs to be requested<br>*A sample training agenda is provided for reference.* | ☐ |
| 2.6 | Simplified User Guide | Simplified version of the information found in the equipment manuals<br>*This is not standard and will need to be specifically requested. It can be an output of the training session.* | ☐ |
| 2.7 | Maintenance Requirements | This consists of a maintenance schedule and a troubleshooting guide<br>*General examples for both documents have been provided, but the contractor should provide model specific details in the handoff documentation.* | ☐ |
| - | Digital Copies | Digital copies (USB / shared folder) of all above | ☐ |

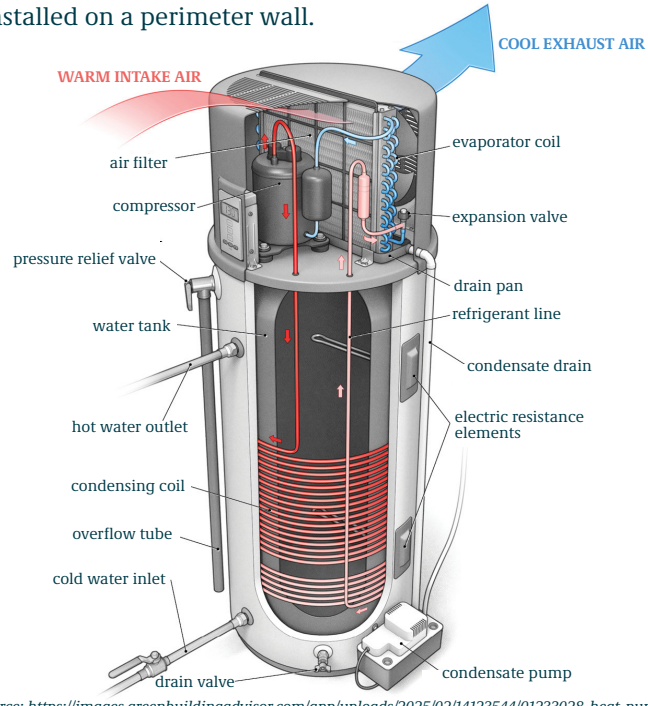
# 1. Equipment Overview

## 1.1. Description

A heat pump water heater (HPWH) uses a refrigeration cycle to pull heat from surrounding air and transfer it to water, rather than generating heat. In contrast, gas water heaters burn fuel, and electric resistance heaters create heat through heating elements. HPWHs are typically 2–3 times more efficient than electric resistance and emit fewer greenhouse gases (GHGs) than gas models.

## 1.2. Labeled Diagram

The first picture shows a heat pump water heater (HPWH) unit installed on a perimeter wall.




*source: https://images.greenbuildingadvisor.com/app/uploads/2025/02/14123544/01233028-heat-pump-water-heater-faq-6.jpg*

## 1.3. How It Works

A HPWH warms water by taking heat from the air around it (ambient air) and transferring that heat into the water tank. Because it's using the warmth already in the room - rather than creating heat from scratch - it uses less electricity, typically 2 to 4 times more efficient than a standard electric water heater.

Most models also include an electric resistance backup heater, which automatically turns on during high hot water demand or when room temperatures are too low for the heat pump to operate efficiently.

As the heat pump gathers heat from the air, it releases cooler, drier air back into the room. This can make the space where it is installed a bit colder, but the built-in dehumidifying effect is often useful in damp areas like basements or laundry rooms.

## Glossary of Terms

**Ambient Air –** The air in the room around the water heater, which the heat pump uses as its heat source.

**Coefficient of Performance (COP)** – A measure of efficiency for heat pumps. A COP of 2.0 means the system produces two units of heat for every one unit of electricity used.

**Domestic Hot Water (DHW)** – Hot water used in a building for everyday purposes such as hand washing, showering, dish washing, and laundry. This is different from the hot water used to heat the building through systems like baseboard heaters or in-floor heating.

**Energy Factor (EF) / Uniform Energy Factor (EUF)** – Ratings that show how efficiently a water heater uses energy. Higher numbers mean better efficiency.

**Hybrid Water Heater** – A DHW heat pump with integrated electric resistance backup when extra hot water is needed.

**Recovery Rate** – How fast a water heater can heat up a full tank of water again after it's been used.

**Refrigerant** – The fluid that moves heat between the ambient air and water tank. It absorbs heat from the air in the surrounding room and releases it into the hot water.

**Setpoint (SP)** – The temperature you choose for how hot you want the water in the tank to be.

**Standby Losses** – Heat lost through radiation from the DHW tank and piping over time, even when your aren't using any hot water.

**But wait, how does it MOVE heat?**

Inside the unit is a special cold fluid called a refrigerant. Because it is colder than the air in the room (even in winter), heat naturally flows into it. The system then compresses this warmed refrigerant, which makes it much hotter - hotter than the water in the tank. That heat is then transferred into the water.

It's not making heat from electricity - it's gathering small amounts of heat from the air and concentrating them, like squeezing drops of water from a sponge into a bucket.

### 1.3.1. Performance Rating Metrics

| Unit | Use | What It Means |
|---|---|---|
| Coefficient of Performance (COP) | Heating | Instant measure of heat output per unit of electricity. *COP 3 = 3 units of heat out for every 1 unit of electricity in.* |
| ⚡ Uniform Energy Factor (UEF) | Heating (seasonal) | Measures the water heater's efficiency over a full day of typical hot water use. Higher UEF means lower operating cost. *This is the main rating used for HPWHs.* |
| First-Hour Rating (FHR) | DHW delivery | The amount of hot water (in liters or gallons) the unit can supply in the first hour starting from a full tank. Reflects realworld performance during high demand times. |
| Recovery Rate | Heating speed | How quickly the unit can reheat the water after the tank has been drained. HPWHs recover more slowly in heat-pump-only mode but much faster in hybrid of full electric-resistance mode. |
| Standby Loss | Efficiency | How much heat escapes from the tank over time when no water is being used. Lower standby loss means better insulation and lower energy waste. |

## 1.4. Key Benefits and Limitations

### 1.4.1. Benefits

- **Energy Efficient:** Moves heat rather than generating it and uses less electricity than electric resistance water heaters. This reduces energy use and costs.
- **Dehumidification:** As it runs, it naturally removes moisture from the air, which is especially helpful in damp basements or utility rooms.
- **Cooling Effect:** It releases slightly cooler air back into the room, which can be an advantage in warm or humid spaces.

### 1.4.2. Limitations

- **Requires Sufficient Air Volume:** The unit requires a sufficient volume of air (typically 450–1,000 $ft^3$ depending on make and model) to operate efficiently. It is possible to provide a louvered door on the room where the water heater is located to accommodate this requirement.
- **Produces Cooler Exhaust Air:** Cools the Room: In smaller rooms, the cooling effect may be more noticeable and may not be desirable.
- **Noise:** The built-in fan and compressor make a low, steady sound during operation, like a window air conditioner or dehumidifier.
- **Electric Capacity:** In some cases, electric back up heat may be larger than the existing circuit. Be careful with unit selection as they come with a variety of different electric back up heat options.

## 1.5. System Operation

### 1.5.1. Operating Range

Most HPWHs work effectively when ambient air is above 2-3°C so in Vancouver it is recommended to place these units inside.

### 1.5.2. Legionella Risk

Legionella is a type of bacteria that can grow in water systems and cause illness, including Legionnaires' disease and Pontiac fever. These bacteria thrive under certain conditions that can occur in buildings and homes, especially when:

- Water sits still for long periods (stagnant water).
- Water is kept at warm temperatures, particularly 20°C to 50°C.
- There is buildup inside the plumbing system, such as biofilm, scale, or sediment.

Maintaining proper water temperatures and avoiding long periods of stagnation are important steps in reducing this risk.

More information: National Research Council of Canada – Legionella Risk Overview

### 1.5.3. Hot Water Setpoints

The National Plumbing Code of Canada (NPC) 2015 states that electric storage-type water heaters should be set to 60°C to help reduce the growth of Legionella bacteria.

Keeping the tank at this higher temperature helps reduce the risk of Legionella bacteria, which can grow in warm, stagnant water. Storing water at 60°C is especially important in systems where water may sit in pipes or tanks for longer periods.

To keep occupants safe from scalding, the water delivered to taps and showers should be kept below 52°C and below 49°C in homes with children, seniors, or people with disabilities. This lower outlet temperature is typically achieved in one of two ways:

- A mixing valve in the plumbing system, which automatically blends hot and cold water before it reaches fixtures.
- Thermostatic mixing valves built into individual fixtures, which are common in modern showers and faucets.

Many older buildings may not have a central mixing valve, so it's important to confirm whether temperature-limiting devices are present before setting the water heater temperature.

## 2. Commissioning and Project Handoff

### 2.1. Spec Sheets and Manuals

Your contractor should provide a spec sheet and manual for each piece of equipment that's installed. Because manuals often cover several different models, make sure you know the exact make and model of your unit. You can usually find this in the commissioning reports.

While these manuals are helpful, they're often long and hard to follow. That's why it's a good idea to also ask your contractor for a training session and a simplified user guide. These guides are shorter and can be helpful to understand how to operate and take care of your system day-to-day, see section 2.6- Simplified User Guides for examples.

### 2.2. Key Contact List

| Contact Type | Contact When? | Company / Name | Phone / Email |
|---|---|---|---|
| Manufacturer | For warranty questions or if you need information about the equipment.<br>**Warranty end date: mmddyyyy**<br>**Unit warranty must be registered with the manufacturer* | | |
| General Contractor (Installer) | For any questions about the system or if something isn't working within the warranty period; typically one year after install. | | |
| Service Contractor (If different) | For repairs or issues that come up more after the warranty period. | | |

### 2.3. Warranty Details

Make sure you know when warranty expires as well as how to reach the manufacturer if you need to submit a warranty claim.

## 2.4. Commissioning Report

### 2.4.1. Overview

When a new HPWH is installed, the contractor follows a process to make sure everything is set up and working the way it should. This process involves two key parts:

- **Commissioning Checklist:** A step-by-step list the contractor uses to confirm the system is installed correctly and operating as intended.
- **Commissioning Report:** The completed record showing the results of those checks and tests. It confirms the system works properly, provides key details like model and serial numbers, and documents that the owner/operator has been shown how to use and maintain the system.

While only the **commissioning report** will be provided to you at the end of the project, we've included examples of both the checklist and the report so you can understand the process. If the contractor does not have a clear commissioning checklist, or if the report is unclear, this reference can help you know what types of checks they should be performing and documenting.

### 2.4.2. Commissioning Checklist Example

| Section | What To Check | Why It Matters |
|---|---|---|
| **Before Start-Up** | | |
| Install Details | • Ensure unit is installed in an unoccupied space.<br>• Check unit is securely mounted and level.<br>• Confirm room volume meets manufacturer requirements and that louvers or ducting are added if air volume is not sufficient.<br>• Verify air intake and discharge are unobstructed.<br>• If ducting is used, ensure connections are sealed and airflow is not restricted. | Operating the heat pump in rooms below recommended size will result in reduced efficiency and performance. |
| Refrigeration System | • Inspect factory refrigerant lines for damage, kinks, or rubbing points.<br>• Confirm insulation is intact and protected from moisture or mechanical wear. | Any restriction or insulation damage can reduce performance or shorten equipment life. |
| Condensate | • Ensure the condensate drain line is sloped downward and discharging to an approved drain.<br>• If a condensate pump is used ensure capacity matches requirements.<br>• Ensure P-trap is included if drain lines connect to sewer pipe.<br>• Ensure condensate drain and water heater drain pan are separate.<br>• Ensure drain line is insulated to prevent sweating. | Improper condensate drainage can cause leaks and water damage. |
| **When The System Is Turned On** | | |
| Controller | • Confirm unit powers on with no error codes.<br>• Verify control panel responds to inputs and displays correct tank temperature.<br>• Adjust temperature setpoint to confirm system accepts the change. | Confirms unit is working, and that controller setup works. |
| Heat Pump Mode | • Confirm compressor engages and unit enters heat pump heating mode.<br>• Check for cool air leaving the evaporator (heat being removed from room air). | Confirms the heat pump is transferring heat correctly. |
| Backup Heating Element | • If applicable, test that resistance heating engages when commanded (hybrid/electric modes).<br>• Verify system switches correctly between heat pump, hybrid, and electric modes. | Ensures hot water recovery capability during high demand or cold ambient conditions. |
| Noise Levels | • Confirm fan and compressor noise is normal (no rattling, buzzing, or vibration).<br>• Ensure no adjacent surfaces or piping are transmitting vibration. | Abnormal noise often signals installation issues, airflow problems, or loose fasteners. |

### 2.4.3. Commissioning Report Example

*2.4.3.1. System Information*

- **Manufacturer / Model:** Rheem / PROPH80 T2 RH400-SO
- **Serial Numbers:** 123456789
- **Capacity:** 80 gallons
- **Refrigerant:** R-134a

*2.4.3.2. Installation Checks*

This installation checklist comes directly from the Rheem Electric Residential Hybrid Water Heater Use and Care manual.

### A. Water Heater Location

- ☐ Close to area of heated water demand.
- ☐ Indoors and protected from moisture, wet conditions, freezing temperatures (below 32°F (0°C)) and high temperatures (above 140°F (60°C)).
- ☐ Area free of flammable vapors.
- ☐ Provisions for air circulation (louvered doors on ducting).
- ☐ Provisions made to protect area from water damage.
- ☐ Sufficient room to service heater.
- ☐ Six inches (6”) of clearance from ceiling to top of hybrid water heater to allow for filter maintenance.
- ☐ Access to condensate disposal.
- ☐ Vibration isolation kit (non-concrete floors).
- ☐ Hybrid seismic kit (if required).

### B. Water Supply

- ☐ Water heater completely filled with water.
- ☐ Air purged from water heater and piping.
- ☐ Water connections tight and free of leaks.
- ☐ Flexible water connections.

### C. Relief Valve

- ☐ Temperature and pressure relief valve properly installed and discharge line run to open drain.
- ☐ Discharge line protected from freezing.

### D. Wiring

- ☐ Power supply voltage agrees with water heater rating plate.
- ☐ Branch circuit wire and fusing or circuit breaker of proper size. Recommended 15 amp and 30 amp breaker for select models.
- ☐ Electrical connections tight and unit properly grounded.
- ☐ 10 gauge wire.

### E. Condensate Lines

- ☐ Condensate lines from heat pump installed correctly.
- ☐ Condensate lines from heat pump run to a suitable drain location.

### F. Ducting

- ☐ HVAC approved ducting.
- ☐ Calculated length of duct no greater than maximum allowed.
- ☐ UL certified terminations (for ducting to the outside).
- ☐ Insulated duct.
- ☐ Ducting adequately supported.
- ☐ Ducting adequately isolated from structure.

### G. Shutoff Valve

- ☐ Make sure valve is open condition.

### H. Leak Sensor

- ☐ Make sure sensor is dry and doesn’t touch the water during installation.

*2.4.3.3. Functional Tests*

| Test | Status |
|---|---|
| Power ON – no errors | ☐ |
| Cool exhaust air felt at discharge (heat removed from room air) | ☐ |
| Tank temperature achieves setpoint | ☐ |
| Noise levels acceptable | ☐ |
| Condensate draining properly, no leaks | ☐ |
| Mode switching between heat pump, hybrid, and electric works correctly | ☐ |
| Control panel responds to inputs (setpoint changes, mode changes) | ☐ |

## 2.5. Training Session

As part of hand-off, ask your contractor(s) to conduct a formal training session for facilities and maintenance staff. This has proven to be the best way to make sure everyone understands the system.

A sample agenda for a training session is laid out below. Consider recording the training for future reference or for new staff.

- System overview and walkthrough
  - Labeled diagrams should be presented here
- Controls and operation
  - Explain how the unit works, how to control it – live demo
- Maintenance schedule and requirements
  - Provide details on maintenance requirements
- Documentation review, including manuals and warranty information
  - Make it clear where to find all the information
- Operational quirks and seasonal tips
- Training session deliverables
  - Simplified user guides (see section 2.6 Simplified User Guides)
  - Simplified maintenance guides

## 2.6. Simplified User Guides

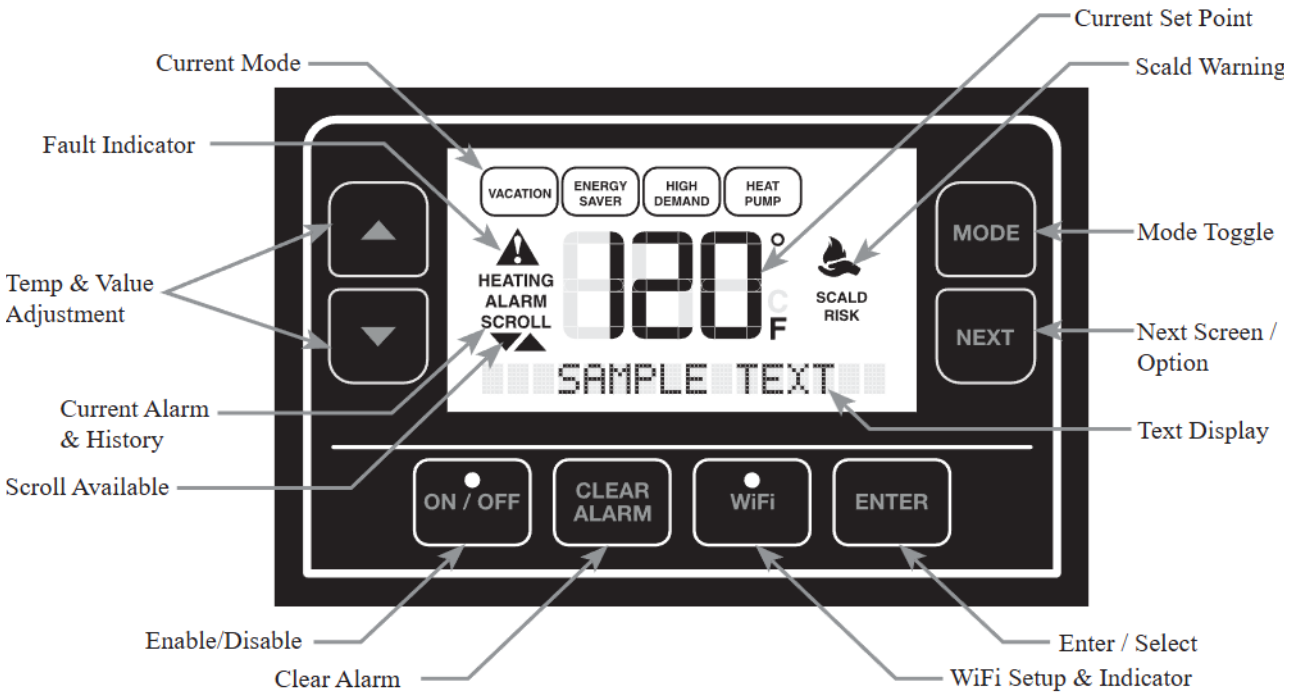
Most equipment comes with an installation or user manual, but these can be long or difficult for building occupants to follow. A good practice is to ask your contractor for a simplified operator or user guide during the training session or handoff.

These simplified guides serve as quick, easy-to-use references that can be posted on a wall near the equipment or shared with building occupants once the project is complete. They may be brief excerpts from the manufacturer's manual or separate, customized documents created during the training session.

*2.6.1.1. HPWH User Guide*

This user reference was pulled directly from the Rheem Residential Hybrid Water Heater User and Care Manual. It has been shortened to serve as a simple, printable quick-reference guide for residents.

# User Interface




ICONS show the current state of the entire systems.

1. **Current Mode** - Illuminated when the system is working on the corresponding mode.
2. **Wi-Fi Indicator** - Illuminated when the display detects valid connection to a Wi-Fi network. Blinking when in provisioning mode.
3. **Fault Indicator** - Illuminated when the display detects OBJECT codes ALMCODE 1, 2, 3 or 4 is greater than "0". This indicates the Control Board has detected either an Alarm or an Alert.
4. **Scroll Available Indicator** - Illuminated when the display detects the Up/Down arrows are enabled to scroll.
5. **Scald Warning** - Illuminated when the display detects potential scalding water temperatures. Use water at own risk.
6. **Enable/Disable Indicator** - Illuminated when the display is Enabled (ON).

### Operating Mode

MODE

Press the "Mode" button to utilize the five major modes of operation: The active mode is displayed on the top of the screen.

### Heat Pump Only

HEAT PUMP

This mode will heat with compressor operation only and will not use any electric heat during typical heating and demand cycles, This mode will minimize power consumption.

### Energy Saver - Factory set mode for shipping

ENERGY SAVER

This mode optimizes compressor and electric heat that results in water heater performance that meets Energy Star requirements.

As result, compressor operation will be maximized and use of electric heat will be minimized.

### High Demand

HIGH DEMAND

This mode will maximize the performance of the water heater while still providing good energy savings. Water heater operates with simultaneous compressor and electric heat.

### Electric Only

ELECTRIC

This Mode will heat with the electric resistance elements. This mode should only be used during compressor maintenance periods. This mode will result in maximum power consumption.

### Vacation

VACATION

This mode will allow during setting between 2 and 28 days or set indefinitely with the "Hold" setting. Tank temperature will be maintained at about 82°F. Only compressor operation will be allowed as needed.

## 2.7. Maintenance Requirements

The operation and maintenance information for your system is usually included in the equipment manual and should also be covered during your training session and project handoff. Be sure to review this information carefully and confirm that clear instructions are provided – either in the documents you receive, during training, or ideally in both places. This will help you feel confident in operating and maintaining your equipment. You'll want to make sure that both a maintenance schedule and a troubleshooting guide are provided.

### 2.7.1. Maintenance Schedule

The maintenance schedule should outline the types of checks and service tasks needed to keep your equipment running efficiently.

A general example as well as well as two model specific examples are presented below.

*2.7.1.1. General Maintenance Schedule*

| Frequency | Task | Responsible |
|---|---|---|
| Monthly | • Check that the area around the unit is clear of storage items or new obstructions, and that air-intake/exhaust paths are unblocked.<br>• Ensure the condensate drain line is free and draining properly (check for any signs of blockage or overflow).<br>• For units with built-in WiFi (app control), check the app for any alerts (leak detection, system fault codes) and verify remote connectivity.<br>• Drain a few quarts of water from the tank (via the brass drain valve) to remove any sediment buildup – this helps maintain efficiency and prolong tank life. | User and Operator |
| Quarterly / Seasonally | • Remove filter and wash with mild detergent and water, let dry completely then put back. | User |
| Annually | • Inspect the anode rod (if applicable) after first six months, then at least annually.<br>• Lift and release temperature pressure relief valve to ensure it operates freely.<br>• Pour cup of bleach in condensate drain to kill algae, mold, or mildew. Ensure condensate can flow freely, unclog if needed.<br>• Confirm unit mounting is secure and level.<br>• Check all electrical connections for tightness, any signs of corrosion, especially at the control board / junction box. | User / Licensed HVAC Contractor |

*2.7.1.2. Maintenance Guide Example*

Two examples of maintenance guides can be found here:

- AO Smith Hybrid Electric Heat Pump Water Heater Maintenance Guide pages 26 – 30
- Rheem Residential Hybrid Water Heater User and Care Manual pages 29 – 30

### 2.7.2. Troubleshooting Guide

The troubleshooting guide should list common problems you may encounter and simple steps to resolve them. An example from the Rheem Residential Hybrid Water Heater User and Care Manual is provided below.

| Problem | Possible Causes | What to Do |
|---|---|---|
| Rumbling noise | Water conditions in your home caused a build up of scale or mineral deposits in the water heater. | • Allow a few quarts of water to run from drain valve to remove sediment settlings. |
| Relief valve producing popping noise or draining | Pressure build up caused by thermal expansion in a closed system. | • This is an unacceptable condition and must be corrected. Contact the water supplier or plumbing contractor on how to correct this. DO NOT plug the relief valve outlet. |
| Not enough or no hot water | Water usage may have exceeded the capacity of the water heater. | • Wait for the water heater to recover after an abnormal demand |
| | A fuse is blown or a circuit breaker tripped. | • Replace fuse or reset circuit breaker. |
| | Electric supply may be off. | • Confirm electric supply to water heater and see installation section of this manual. |
| | The thermostat may be set too low. | • See the temperature regulation of the water heater section of this manual. |
| | Leaking or open hot water faucets. | • Make sure all faucets are closed. |
| | Electric service to your home may be interrupted. | • Contact the local electric utility. |
| | Improper wiring. | • See the installing the water heater section of this manual. |
| | Manual reset limit (ECO). | • See the temperature regulation of the water heater; refer to page 3 of the Rheem manual for more information. |
| | Cold water inlet temperature may be colder during the winter months. | • This is normal. The colder inlet water takes longer to heat. |
| | Not enough air exchange for efficient heat pump operation. | • If air temperature drops more than 15°F (8°C) during heat pump operation, more air circulation around heater is needed. |
| Water is too hot | The thermostat is set too high. | • See the temperature regulation of the water heater section of this manual. |

**CAUTION:** For your safety DO NOT attempt repair of electrical wiring, thermostats, heating elements or other safety devices. Refer repairs to qualified service personnel.