BC NPHA

Operator Training Manual

Split Heat Pumps

How To Use This Guide

This guide is designed to make sure that when your split 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

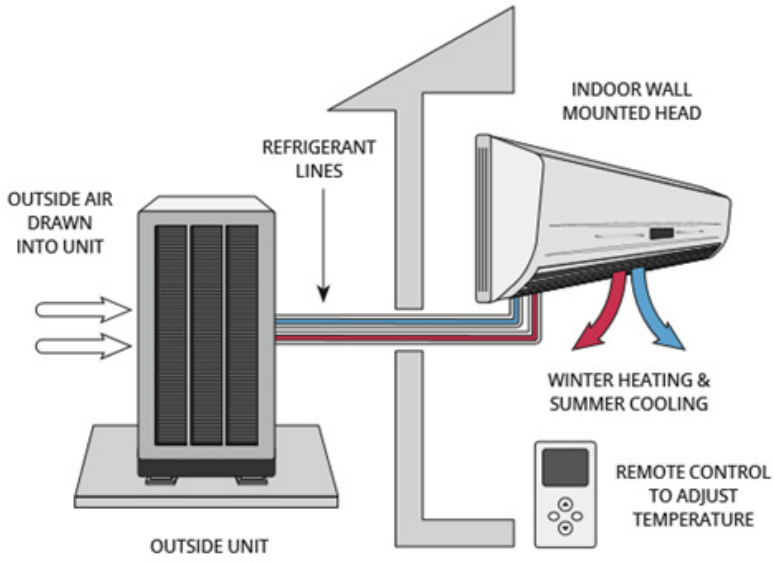
	Item	Notes/Description	Status
1. Equipment Overview			
1.1	Description	A brief explanation of how the system works	☑
1.2	Labeled Diagram	A labeled diagram of the system and its primary components *A general diagram is provided here; ask your contractor for a model-specific version.*	☐
1.3	How It Works	A high-level overview of system operation *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, back-up heating considerations *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 *A sample training agenda is provided for reference.*	☐
2.6	Simplified User Guide	Simplified version of the information found in the equipment manuals *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 *General examples for both dowcuments 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 mini split or multi split heat pump is a type of heating and cooling system that doesn't need ductwork. Instead, it uses an **outdoor unit** connected to one (mini split) or several (multi split) **indoor units** to control the temperature in specific rooms or zones.

1.2. Labeled Diagram



source: https://www.betterhomesbc.ca/products/what-are-ductlessmini-split-heat-pumps/

1.3. How It Works

The outdoor unit contains a heat pump that moves heat between the outside air and indoors through refrigerant lines. In heating mode, it pulls heat from the outdoor air and transfers it inside (to heat the space); in cooling mode, it pulls heat from inside (to cool the space) and releases it outdoors. Each indoor unit delivers the conditioned air directly into the space, and a controller (remote, wall panel, or app) adjusts temperature, fan speed, and mode.

But wait, how does it MOVE heat?

The heat pump uses a refrigerant that stays colder than the outside air, even in winter. Because heat always flows from warmer to colder, the refrigerant absorbs that heat. The system then compresses the refrigerant, making it very hot (hotter than the inside temperature), so then the heat flows naturally into the space.

It's not creating heat — it's just moving and concentrating the heat that's already in the air. Think of it like a sponge soaking up even small amounts of water and squeezing them out somewhere else. That's why a heat pump can still work in sub-zero temperatures: there's always at least a little heat in the air to capture.

Glossary of Terms

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.

Cold Climate Heat Pump (ccASHP) – A specially designed heat pump that maintains high efficiency and heating capacity in very cold outdoor temperatures (down to about –20 °C or lower).

Defrost Cycle – A short process where the heat pump melts frost from the outdoor unit in cold, damp weather. Heating pauses briefly, and overall efficiency drops slightly during this time.

Indoor Unit – The part of a split heat pump located inside the building that delivers heated or cooled air directly to the room.

Outdoor Unit – The part of the split heat pump located outside, which extracts or releases heat to the outdoor air.

Refrigerant – The fluid that moves heat between the indoor and outdoor units. It absorbs heat from cold air outside and releases it inside (or the reverse in cooling mode).

Setpoint – The temperature you choose on the thermostat or remote control for heating or cooling.

Split Heat Pump – A heating and cooling system made up of one outdoor unit and one (mini-split) or several (multi-split) indoor units, without needing ductwork.

Switchover Temperature – The outdoor temperature at which it becomes more efficient to use a backup heating system instead of the heat pump.

Zone – An area or room in the building controlled by its own indoor unit, allowing different spaces to have different temperature settings.

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) *Often used for split heat pumps in heating*
Efficiency (%)	Heating	COP shown as a percentage (COP 3 = 300%).
Heating Seasonal Performance Factor (HSPF)	Heating	Average heating efficiency over an entire heating season. *Main rating for split heat pumps in heating*
Energy Efficiency Ratio (EER)	Cooling	Cooling efficiency at one fixed condition (like a snapshot test). It measures the full load under high temperature conditions.
Seasonal Energy Efficiency Ratio (SEER)	Cooling	Measures the average cooling efficiency over an entire season. SEER tends to be higher than EER because it includes part load operation (which is more efficient). *The main efficiency rating for split heat pumps and multi-zone systems, since it reflects performance over a wide range of seasonal conditions and provides a more accurate picture of whole-building energy use*

1.4. Key Benefits and Limitations

1.4.1. Benefits

- **Energy Efficient:** Moves heat rather than generating it (ex. by burning gas), it has much higher efficient (up to 600% compared to a gas boiler that is 95% at best). This reduces energy use and costs.
- **Zoned Comfort:** Independently heat or cool specific rooms or zones.
- **Quiet Indoor Operation:** Louder components stay outside; indoor units run quietly for noise-sensitive areas.
- **Year-Round Use:** One system provides both heating and cooling.
- **Flexible Installation:** Compact indoor units can be mounted on walls, ceilings, or floors.

1.4.2. Limitations

- **Space Requirements:** Outdoor units require sufficient exterior space (balcony, roof, or ground pad), which may not be available at all sites.
- **Exterior Noise:** Outdoor units generate noise during operation and must be placed carefully to meet code requirements and avoid disturbing neighbors.

1.5. System Operation

1.5.1. Operating Range and Back-Up Heating

Most standard split heat pumps work efficiently down to about –15 °C (5 °F). Newer cold-climate models are designed for harsher winters and can maintain effective operation down to around –21 °C (–5 °F). To qualify as a cold-climate heat pump, the Northeast Energy Efficiency Partnerships (NEEP) requires the system to maintain at least 175% efficiency (COP ≥ 1.75) at –15 °C (5 °F).

In Vancouver's mild coastal climate, outdoor temperatures rarely drop below these limits, so split heat pumps can typically heat efficiently year-round without needing backup heat.

However, as outdoor temperatures fall, the heating capacity of the system decreases. In more extreme climates, if the heat pump cannot maintain comfortable indoor temperatures, it may be necessary to enable supplemental heating (such as electric baseboards or a gas furnace) if it is available.

In most modern split heat pumps, if outdoor temperatures drop below the heat pump compressor's operating limit, the system will automatically disable the compressor and switch to electric resistance heating only. This allows the unit to continue providing heat, although it will operate at lower efficiency and with higher electricity use.

1.5.2. Defrost Cycle

In damp, cold conditions, frost can build up on the outdoor coil of a heat pump. When that happens, the unit can't breathe properly, and efficiency drops. To solve this, the heat pump occasionally goes into a **defrost cycle,** where it briefly runs in reverse to warm the outdoor coil and melt the frost.

- While defrosting, the indoor unit may pause heating for a few minutes, and the backup electric resistance heater may switch on to maintain indoor comfort.
- Defrosting is normal, but because it uses power without heating your space, it slightly lowers the overall efficiency of the system in colder weather.
- Published efficiency metrics on specification sheets typically **do not account for defrost operation**, so actual seasonal performance may be lower than rated values.

1.5.3. Recommended Indoor Temperature Setpoints

To balance comfort and efficiency, we recommend the following indoor thermostat settings for buildings in the Vancouver area:

- **Heating:** 19–21 °C (66–70 °F)
- **Cooling:** 22–24 °C (72–75 °F)

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
Heat Pump Manufacturer	For warranty questions or if you need information about the equipment. **Warranty end date: mmddyyyy** **Unit warranty must be registered with the manufacturer*		
Controller or Thermostat Manufacturer	For warranty questions or if you need information about the equipment.		
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 mini-split heat pump 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 indoor and outdoor units are installed where planned, with space around them. • Check units are securely mounted and level. • Make sure pipes and cables between units look neat and protected.	Ensures good airflow and easy access for service; prevents noise, vibration, and damage; helps avoid future leaks or wear.
Refrigeration Lines Insulation	• All copper refrigerant lines should be insulated with closed foam insulation and covered with aluminum, PVC or other durable cladding to resist UV damage and bird/rodent interference.	Copper piping is a common theft target, and exposed insulation can attract birds that peck or pull it apart for nesting material. Protective jacketing prevents physical damage, insulation degradation, and potential exposure of copper piping.
Condensate	• Inspect indoor unit condensate drain: ensure drain pan is clean, drain line has proper slope, and water flows freely to a safe discharge point without leaks. • Confirm drain lines are inside, insulated, or heat traced to prevent freezing and blockages (if applicable). • Inspect outdoor unit drain path: check that the base pan drain holes are clear, that the unit is installed on a surface where water can drain safely, and that any drain pan heaters (if installed) are connected and functional.	Condensate forms on the indoor unit during cooling and drains through a pan and line, and on the outdoor unit during defrost where it drains through the base pan or to the ground. Both must be checked to avoid leaks, pooling, or icing.
When The System Is Turned On		
Controller	• Ensure system powers up and responds to the remote or wall control, and that the remote, wall panel, or app works as expected. • Ensure temperature can be adjusted in each room/zone and that both heating and cooling modes work. • Review safety indicators and error messages.	Confirms unit is working, and that controller setup works and occupants will be able to manage their space temperature.
Noise Levels	• Confirm airflow from indoor units is steady and quiet. • Check outdoor unit noise level – does it meet requirements (typically 55 dB daytime, 45 dB nighttime).	Confirms proper operation without excessive noise.

2.4.3. Commissioning Report Example

2.4.3.1. System Information

- **Manufacturer / Model:** Mitsubishi Electric MSZ-GL15NA (indoor) / MUZ-GL15NA (outdoor)
- **Serial Numbers:** Indoor: 123456789 / Outdoor: 987654321
- **Capacity:** 15,000 BTU
- **Refrigerant:** R410A

2.4.3.2. Key Checks

Item	Status
Indoor and outdoor units level, secured, and clear of obstructions	☐
Piping insulated and sealed	☐
Electrical connections correct and tight	☐
Drain line clear and tested	☐
Remote control/thermostat working	☐

2.4.3.3. Functional Tests

Test	Status
Power ON – no errors	☐
Heating and cooling modes working	☐
Airflow and louvers operating correctly	☐
Noise levels acceptable	☐
Condensate draining properly, no leaks	☐
Backup electric resistance heat engages as required	☐

2.5. Training Session

As part of hand-off, ask your contractor(s) to conduct a formal training session for facilities, maintenance staff and tenants (if possible). 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

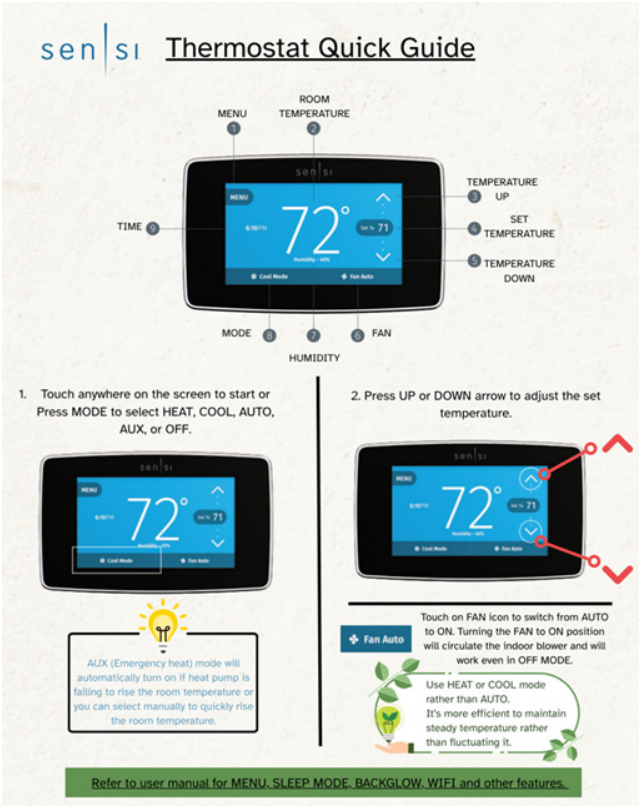
2.6. Simplified User Guides

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

Simplified guides are handy as quick references – they can be posted on the wall or shared with occupants once the project is complete.

Some example guides developed for previous Non-Profit Resilient Retrofit Grant (NRRG) program participants are presented below.

2.6.1. Remote and Thermostat User Guide (Examples)



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. This usually includes:

- **Filter cleaning/replacement** – how often this should be done (e.g., monthly or quarterly).
- **System inspections** – such as checking refrigerant levels, electrical connections, and controls.
- **Part replacements** – when to replace key components like belts, sensors, or batteries.
- **Seasonal checks** – ensuring the system is ready before peak heating or cooling seasons.

A general example as well as an example of what was provided for a specific project can be found below.

2.7.1.1. General Maintenance Schedule

Frequency	Task	Responsible
Monthly	• Ensure nothing is in front of the indoor unit (plants, furniture etc.). • Check for unusual noise or vibration from indoor or outdoor units. • Verify occupants can operate the system (remote batteries OK, thermostat working).	On Site staff
Quarterly / Seasonally	• Remove filter and rinse with lukewarm water, let dry completely then put back. • Check outdoor unit clearances (no snow, plants blocking airflow). • Pour a cup of warm water with a dash of mild soap down the condensate drain to keep it clear. • Inspect insulation on refrigerant lines for damage or wear.	On Site staff
Annually	• Full system tune-up: deep-clean indoor and outdoor coils, check refrigerant charge, tighten electrical connections, test heating/cooling change-over. • Check thermostats or remotes. • Inspect and secure mounting brackets or wall penetrations to prevent vibration damage. • Verify drain pans and traps are clean and free of algae buildup.	Licensed HVAC contractor
As Needed	• Replace damaged remote controls or batteries. • Reset system after power outages if required. • Record and respond to any error codes on indoor units. • Respond to occupant comfort complaints quickly to catch small issues before they grow.	On Site staff (basic resets) / Licensed HVAC contractor (repairs)

GREE Maintenance

WARNING

- The filter should be cleaned every three months. If there is much dust in the operation environment, clean frequency can be increased.
- After removing the filter, do not touch fins to avoid injury.
- Do not use fire or hair dryer to dry the filter to avoid deformation or fire hazard.

Clean filter

1. Remove filter

Press the spring fasteners at both sides in the direction indicated by the arrows.
Meanwhile, lift up the filter so that it is separated from the fasteners.
Pull the filter forward and remove it.

2. Clean filter

Use clear water to wash it or dust catcher to clean it. If the filter is very dirty (such as grease), use warm water (45℃) dissolved with neutral detergent to clean it, and then put it at the shady place to dry it.

3. Install filter

After cleaning, reinstall the filter in reverse order. Push it along the guide rails at both sides and then press the left and right edges of the filter. Refit the filter in the direction indicated by the arrows.

Using your unit correctly will mean that it minimizes energy use and maximizes comfort for you. It's also important to ensure your system is maintained well so that it performs efficiently and its lifespan is optimized.

QUICK TIPS

1. Avoid setting your unit to "Auto" mode and instead use "Heat" in the winter and "Cool" in the summer.
2. Clean filters regularly.
3. Schedule maintenance for your unit every 1-2 years.
4. Check your outdoor unit at the start of every season to ensure airflow is not restricted.

Error Codes ERROR!

E7	Mode conflict, please make sure all the indoor units running either on "Cool" or "Heat" mode in a multi-zone application.
E2, E9	Not Error Codes, Operational Codes.
U8, H6, H3 E1, E5, E6, E8	It can be eliminated after restarting the unit. If not, please contact qualified professionals for service.
C5, F0, F1, F2	Please contact qualified professionals for service.

2.7.2. Troubleshooting Guide

The troubleshooting guide should list common problems you may encounter and simple steps to resolve them. A general example is provided below.

Warning Sign / Issue	Initial On Site Checks	Where to Find More Info	Escalate To ...
Unit won't turn on	• Check remote batteries. • Make sure power is on at breaker or wall switch. • Look for error code or message on unit.	Operation manual – operation section	Installer (within 1 year) or Service Contractor
Airflow feels weak	• Check and clean indoor filter. • Confirm fan speed not set to low. • Make sure louvers are open.	Operation manual – operation section	Installer (within 1 year) or Service Contractor
Not enough heating or cooling	• Check mode is set correctly (heat/cool). • Adjust temperature setpoints. • Ensure windows/doors are closed. • Make sure nothing is blocking unit (clothes, furniture etc).	Operation manual – operation section	Installer (within 1 year) or Service Contractor
Water dripping inside	• Check condensate drain is clear. • Ensure indoor unit is level.	Operation manual – drainage section	Installer (within 1 year) or Service Contractor
Outside unit not working	• Clear snow, leaves, or debris around coil. • In heating mode, short "pause" may be normal defrost cycle.	Operation manual – defrost section	Installer (within 1 year) or Service Contractor
Unusual noise / vibration	• Look for loose panels. • Make sure nothing is touching the unit.	Operation manual – maintenance section	Installer (within 1 year) or Service Contractor
Error code showing	• Note the exact code – check manual for next steps. • Power cycle once.	Operation manual – troubleshooting section	Installer (within 1 year) or Service Contractor
Bad smells	• Change air filter. • If smell persists, may need professional cleaning.		Installer (within 1 year) or Service Contractor

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