HOME PERFORMANCE
STAKEHOLDER COUNCIL

HEAT PUMP BEST PRACTICES INSTALLATION GUIDE FOR EXISTING HOMES:

SUPPLEMENTAL RESOURCES

PREPARED BY

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In partnership with:
FRESCo

Foreword

This Guide provides heat pump installation contractors with general information on best practices for the installation of a heat pump system and useful information to help educate and communicate with homeowners. It provides an overview of the key steps involved in heat pump system design and installation, including job-site survey and pre-changeout, system design (sizing and selection), installation, commissioning, and homeowner education and maintenance. In addition, this guide discusses common challenges encountered by heat pump contractors during the installation of heat pump systems and suggested solutions. This guide is not intended to replace residential heat pump installation training materials developed for HVAC contractors.

Acknowledgements

This Guide was prepared by ICF in collaboration with FRESCo. It was developed in consultation with an Advisory Group consisting of individuals and organizations involved in the residential HVAC industry. Existing relevant best practices documents were leveraged in the production of this guide. We'd like to recognize and thank Northeast Energy Efficiency Partnership (NEEP), Northwest Energy Efficiency Alliance (NEEA), and the Energy Efficiency and Conservation Authority (EECA) of New Zealand for giving permission to use contents from their heat pump guides.

We also gratefully acknowledge the financial support of BC Hydro, FortisBC, the Province of British Columbia, and the City of Vancouver.

Disclaimer

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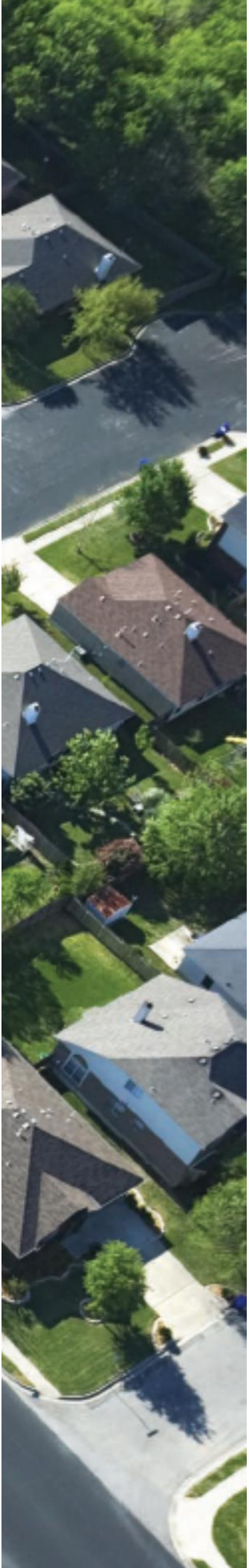

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HEAT PUMP REFERENCE GUIDE FOR HOMEOWNERS

WHY CHOOSE A HEAT PUMP?

Heat pumps are an increasingly popular option for reliably heating and cooling homes. Heat pump systems that have been designed and installed properly lasts longer, have fewer maintenance issues, and result in improved utility bill savings. They also help contribute to comfortable indoor environments, with fewer cold spots and more consistent temperature distribution. In addition, by making more efficient use of BC's green electricity grid, heat pumps can reduce the environmental impact of heating and cooling homes. In fact, a recent analysis by the Pembina Institute suggests that the costs of heating a home with a natural gas furnace are comparable to heating it with a heat pump, while heat pump option represents a 97.5% reduction in carbon pollution.[1]

STEPS TO A HIGH-QUALITY INSTALLATION

The following hints and tips for homeowners, including any items that should be considered ahead of an installation, help ensure that they are choosing the right heat pump system for their home and that the equipment is being installed properly.

☑ Building Efficiency

Building enclosure issues should be addressed before installing any new HVAC equipment. This includes but is not limited to issues with poor or inadequate insulation, leakiness of the building envelope, and duct leaks. Addressing these issues before installing new heat pump equipment reduces a home's heating and cooling costs, improves comfort and heat pump performance, and reduces the required size of any new equipment.

Homeowners should discuss any previous or planned changes to their homes with their heat pump contractors. For example, homeowners should mention improved attic insulation, new windows, changes to their homes' ventilation system, and control system improvements.

☑ Correct Equipment Sizing

It is important to ensure that ASHP are properly sized for each application. Oversizing can lead to excessive cycling, lower efficiency, and inadequate dehumidification during summer months. Room-by-room load calculations are preferable to other simplified approaches (e.g. block load calculations). However, room-by-room load calculations may not be necessary for many retrofit applications where existing heating systems will remain in place.

☑ Getting the Right Heat Pump System (Including Supplementary Heating)

There are many different types of heat pump systems. The suitability of each system to different scenarios depends on a variety of factors, including the existing condition of the building, the configuration of the existing HVAC system, any other planned upgrades, occupancy requirements, and local weather conditions.

Some heat pump installations require a supplementary heating system; however, for most of BC, this need can be eliminated by selecting a heat pump that is sized for the home's design heating load. When supplementary heating systems are employed, ASHPs are often set to shut off at a particular temperature and supplementary heating system starts working beyond that point.

[1] Pembina Institute, Gas vs. electricity? Comparing home heating costs in BC, May 2017, Available online at: https://www.pembina.org/blog/gas-vs-electricity

Conversely, ASHPs are sometimes designed to operate in conjunction with supplementary heating even at very cold temperatures since the ASHP may still be providing some useful heat. Supplementary heat can be supplied by any type of heating system. It may be incorporated into the heat pump or may be a separate system. Conventional ASHPs also require supplementary heating to prevent cold air from blowing in during defrost cycles.

Key ASHP Installation Criteria

Heat pump contractors should include the following items in their quotations:

- Heat load calculation to size the system
- Thermal balance point temperature calculation, to optimize the design and control of supplementary heating system
- Outdoor unit installed above anticipated snow level with due regard to defrost water drainage, which may otherwise result in slip hazards and damage to walkways
- Line sets have all refrigeration lines insulated, and fully protected from UV
- All penetrations (i.e. floor, wall, ceiling) sealed
- A condensate pipe connected to a drain or pump (for central systems)

Many of the above items can be reviewed visually by homeowners, allowing them to verify the quality of a heat pump installation.

Benefits of Advanced Integrated Controls

Advanced integrated controls help maximize savings from ASHP systems by managing the interaction with a home's existing heating system.[2] Control algorithms of advanced control systems minimize energy consumption and heating costs by prioritizing heat pump operation at appropriate times and ensuring that the supplementary heating system is operating during peak heating loads to ensure comfort.

Operation and Maintenance of Your New Heat Pump

Operation: The energy savings from a heat pump are highly dependent on the operational behavior of a home's occupants. Below are some operational tips to maximize energy savings and ensure comfort:

- Try to keep indoor temperature settings steady and avoid frequently adjusting the thermostat.
- Avoid large temperature setbacks during colder periods since ASHPs can take a long time to recover without supplementary heat.
- Avoid turning heat pumps "on" and "off" to control the temperature, allow the thermostat to control the temperature instead.

Maintenance: Regular maintenance schedules are critical for reliable heat pump operation. Periodic maintenance can increase the service life of your equipment and will save you money on your utility bills. Below are some common maintenance tips:

- Clean filters as recommended by manufacturer and replace as necessary.
- Be sure to keep debris and snow away from outdoor units and ensure that there is sufficient airflow around them.
- Check on your system at least once every season to make sure there's no obvious damage to the outdoor pipe covering, dirt clogging the outdoor coil, or oil drips at or below the piping connections at the unit.
- There may be indicator lights or display icons on the controller or on the indoor unit itself, that can indicate fault conditions. Review your owner's manual to interpret any displays.
- Schedule professional service at the manufacturer's recommended interval (generally annually) or if you see any problems.
- Consider using ultraviolet (UV) light to prevent growth of mold and bacteria on the coil.

[2] Where they are compatible. Older existing heating systems are more likely to have compatibility issues.eating system is referred to as the economic balance point

SYSTEM SELECTION REFERENCE GUIDE

Existing Heating System	Region/Local Weather Conditions	Other Considerations	Recommended ASHP Type	Recommended Supplementary Heating System[3]
Electric Baseboards	Lower Mainland and Vancouver Island *(Moderate Winter, Design Temp >-8°C)*	N/A	Ductless or Mini-Ducted	Not required but can use existing heating system
	Southern and Northern Interior *(Cold Winter, Design Temp <-8°C)*	N/A	Cold Climate Ductless or Mini-Ducted	Existing heating system, where necessary
Forced Air Central Heating (Gas/Oil/Electric Furnace)	Lower Mainland and Vancouver Island *(Moderate Winter, Design Temp >-8°C)*	Consider upgrading insulation and/or air sealing, modifications to the ductwork may be necessary	Centrally Ducted	Not required but can use existing heating system or electric resistance coil in air handler
		Existing ductwork does not allow for ideal airflow, and upgrading ducting is cost-prohibitive	Centrally Ducted (combined with Ductless), Ductless (Multi-Head or Multiple Units), or Mini-Ducted	Not required but can use existing heating system or electric resistance (baseboards or coil in air handler)
	Southern and Northern Interior *(Cold Winter, Design Temp <-8°C)*	Consider upgrading insulation and/or air sealing, modifications to the ductwork may be necessary	Cold Climate Centrally Ducted	Existing heating system or electric resistance coil in air handler, where necessary
		Existing ductwork does not allow for ideal airflow, and upgrading ducting is cost-prohibitive	Cold Climate Centrally Ducted (combined with Ductless), Ductless (Multi-Head or Multiple Units), or Mini-Ducted	Existing heating system or electric resistance (baseboards or coil in air handler), where necessary
Central Hydronic System (Gas/Oil Fired Boiler)	Lower Mainland and Vancouver Island *(Moderate Winter, Design Temp >-8°C)*	If replacing functioning boiler is not economically feasible, use it for the supplementary system	Ductless (Multi-Head or Multiple Units) or Mini-Ducted[4]	Not required but can use existing heating system or electric resistance coil in air handler
	Southern and Northern Interior *(Cold Winter, Design Temp <-8°C)*	If replacing functioning boiler is not economically feasible, use it for the supplementary system.	Cold Climate (Multi-Head or Multiple Units) Ductless or Mini-Ducted[4]	Existing heating system or electric resistance (baseboards or coil in air handler), where necessary

[3] Recommendations pertain to portion of home heated by heat pump(s). Supplementary heating is only required if heat pumps cannot meet design heating loads but they are recommended to improve comfort in cases where defrost cycles would blow cold air into the conditioned space. If supplementary systems are appropriately sized, they can also be used as emergency heating; this is recommended where the incremental costs are small.

[4] Air-to-water heat pumps are a direct replacement for boiler systems; however, these systems are not very common in residential applications and are not covered by this guide.

IDENTIFYING QUALITY INSTALLATIONS

Several important ASHP installation best practices can be observed visually. Exhibit 1 below provides a comparison between installation best practices and poor installation practices for reference purposes.

Exhibit 1: Comparison of Poor Installation Practices and Best Practice Installations

POOR INSTALLATION | **BEST PRACTICE INSTALLATION**

Outdoor Units

Ground not properly compacted

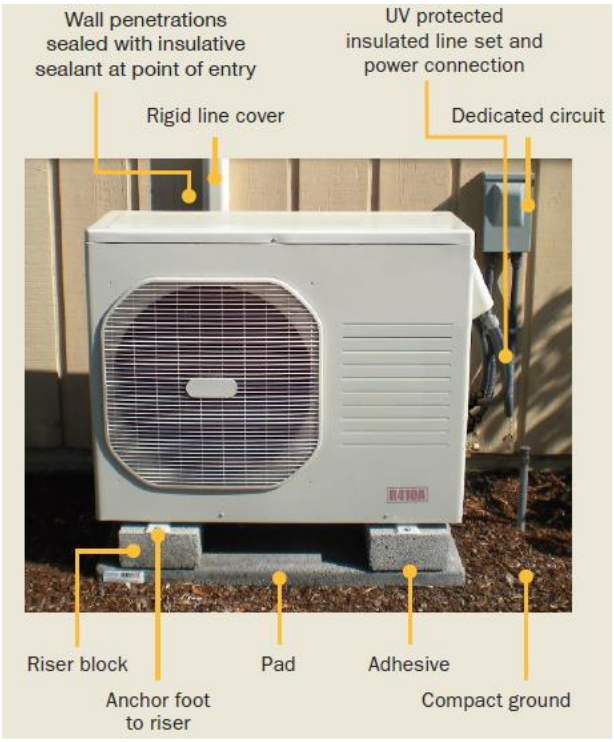
Source: Best Practices Installation Webinar, NEEA

No clearance between ground and base of outdoor unit

Source: Marc R., Minisplit Heat Pump Lessons, South Mountain Company, Martha's Vineyard, MA

Frozen discharge water poses serious safety hazards

Source: Best Practices Installation Webinar, NEEA



Best practices installation of outdoor unit

Source: Best Practices for Installing Ductless Heat and Cooling System, www.GoingDuctless.com

Unit on brackets attached to foundation wall

Source: Marc R., Minisplit Heat Pump Lessons, South Mountain Company, Martha's Vineyard, MA

POOR INSTALLATION | **BEST PRACTICE INSTALLATION**

Line Set and Penetrations

Line set not properly insulated

Source: Best Practices Installation Webinar, NEEA

Line set properly insulated

Source: Best Practices Installation Webinar, NEEA

Envelope penetration not sealed properly

Source: Marc R., Minisplit Heat Pump Lessons, South Mountain Company, Martha's Vineyard, MA

Envelope penetration properly sealed

Source: Marc R., Minisplit Heat Pump Lessons, South Mountain Company, Martha's Vineyard, MA

Indoor Units

Indoor units located below window and too close to celling

Source: Best Practices Installation Webinar, NEEA

Indoor units located more than 30 cm below the celling (best practice 30-45 cm from celling)

Source: www.pinterest.es

CONTRACTOR RESOURCES

SAMPLE QUOTATION

Date:
Quotation Number:

BUYER INFORMATION					
First Name:			Last Name:		
Address:					
City:		Province:		Postal Code:	
Phone Number:			Email:		

CONTRACTOR INFORMATION			
Company Name:			
Representative:		Phone Number:	

PROJECT DETAILS					
Basic Install	**Description**				**Installed Cost**
Heat Pump	**Type:** Ductless mini-split/Compact-ducted/Centrally ducted				
	Brand:				
	Model - Indoor Unit:				
	Model - Outdoor Unit:				
	# of Outdoor Unit(s):				
	# of Indoor Unit(s):				
Controls	Type: Integrated/Stand alone				
	Brand:		Model:		
Platform for Outdoor Unit	Base Pad	L:	W:	H:	
	Riser Blocks	L:	W:	H:	
Line Set	Total Length:				
	Insulation Type:				
Sealing	Sealing of all penetration				
Load Calculation	Heat load calculation following CSA F280-12 standard				
Other					
				SUBTOTAL:	
				PST:	
				GST:	
				TOTAL:	

STEPS TO A HIGH-QUALITY INSTALLATION

Step 1: Job-Site Survey and Pre-Changeout

In existing buildings, an initial assessment of the existing heating and cooling system, ducting system, overall home condition (i.e. existing insulation, air leaks, etc.), and occupancy should be completed pre-quote. Identified issues should be addressed before installing any new equipment to ensure proper sizing and efficient operation of the ASHP system. Any required ducting modifications for centrally ducted ASHPs should also be made prior to installing any new equipment.

Step 2: Design (Sizing and Selection)

Correct sizing is important for the proper operation and economic viability of ASHP systems. Oversizing equipment can lead to excessive cycling, reduced equipment life, lower efficiency, and ineffective summer dehumidification. CSA standard CAN/CSA-F280 combined with HRAI's Residential Heat Loss and Heat Gain Manual or TECA's Quality First® Heat Loss & Heat Gain software or equivalent are recommended for calculating heating and cooling loads. For sizing of equipment, CSA standard CAN/CSA-C273.5-11 should be followed.

Step 3: Installation

ASHP installations should be completed by properly trained and qualified contractors. Manufacturer training on specific system is recommended. Installations should also meet CSA standard CAN/CSA-C273.5-11 and all other required codes and standards and should be installed in a manner that optimizes the systems' performance and durability and occupant comfort. TECA and/or HRAI membership is recommended, as this will reinforce continuing education requirements and lead to other benefits.

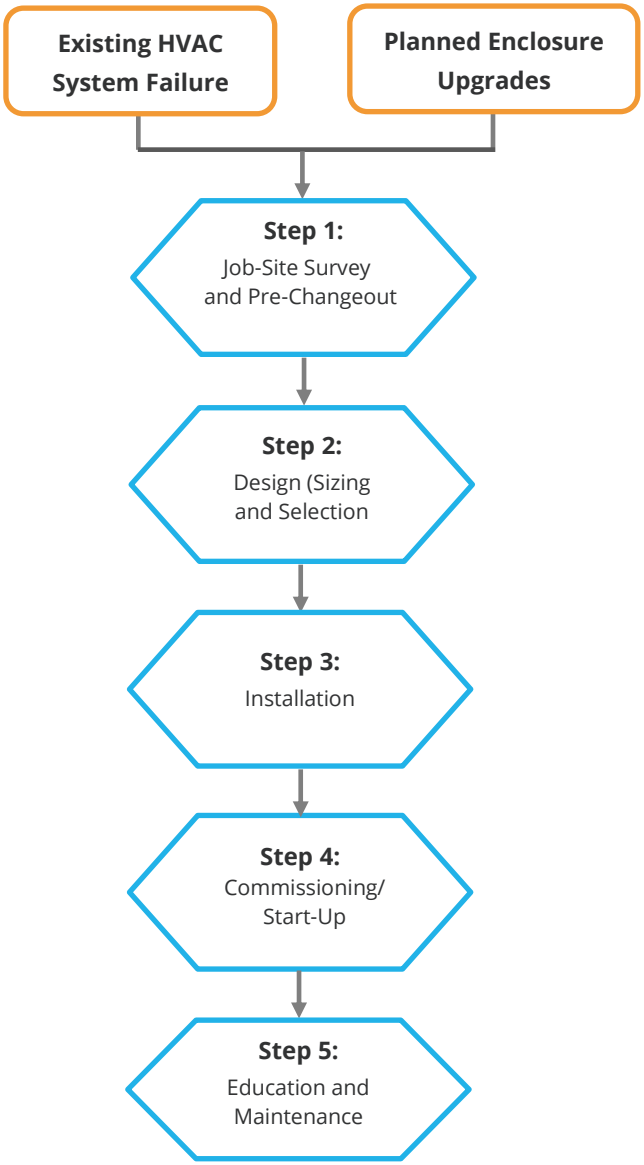
Step 4: Commissioning/Start-Up

Commissioning and system start-up must be performed by appropriately trained and qualified contractors. At ASHP start-up, the necessary commissioning tests should be completed and logged to ensure equipment is operating according to manufacturer specifications.

Step 5: Education and Maintenance

Contractors should provide the commissioning checklist and manufacturer's information to the homeowner. Contractors should also review warranty information and operation and maintenance procedures for the new ASHP with the homeowner before leaving the site.

Exhibit 2: Steps for Installation Best Practices



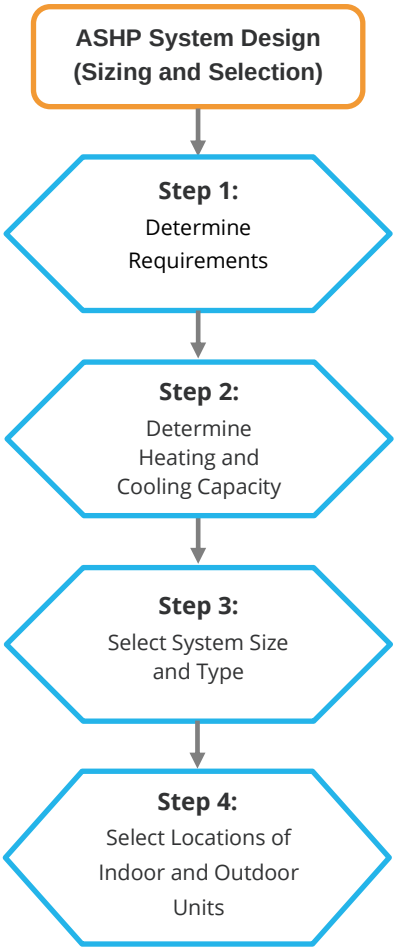
STEPS TO A HIGH-QUALITY SYSTEM DESIGN

Step 1: Determine Requirements
Gather the information that is needed to determine what the most appropriate heat pump option is for a particular home. All the required information will be available from the Job-Site Survey.

Step 2: Determine Heating and Cooling Capacity
The required heating capacity for the heat pump can be calculated following CSA standard CAN/CSA F280-12 combined with HRAI's "Residential Heat Loss and Heat Gain Manual" or TECA's Quality First® Heat Loss & Heat Gain software or equivalent.

Step 3: Select System Size and Type
With the load calculations completed, all required information needed to select the right size of heat pump system is now available. Select the appropriate size of system following Section 5 of CAN/CSA standard C273.5-11.

Step 4: Select locations of Indoor and Outdoor Units
To enable optimum performance of an ASHP system, it is important to select appropriate locations for both outdoor and indoor units. Units installed at improper locations can cause poor performance of heat pump system, leading to comfort issues and customer complaints.



JOB-SITE SURVEY CHECKLIST

JOB-SITE SURVEY CHECKLIST					
Item	**Description**	**Orientation**			
		North	**South**	**East**	**West**
Homeowner's Requirements					
Homeowner's requirements and reason for replacement	Mainly for heating or cooling				
Indoor unit preference*	Homeowner preference for floor-mounted, high wall-mounted, or ceiling-mounted unit				
Control type preference	Wi-Fi enabled remote control or other				
Location and Home Type					
Outdoor design conditions					
Indoor design conditions					
Home Type	Vintage, single detached, middle-unit townhome, etc.				
Zoning requirements					
Room types	Typical single room or a large or open plan room/hallway, where more than one unit may be required				
Plans, Sketches, Notes					
Measurement, Areas, and Volumes					
Windows					
Doors					
Exposed walls					
Above grade walls					
Partitions					
Daylight-basement floors (wedgies)					
Closets (size matters)					
Halls (size matters)					
Above grade volume (for infiltration)					

JOB-SITE SURVEY CHECKLIST					
Item	**Description**	**Orientation**			
		North	**South**	**East**	**West**
Construction Details					
Walls					
Windows (detail and direction)					
Doors (detail and direction)					
Ceiling					
Roof					
Skylights					
Floors					
Slab on grade (edge insulation?)					
Envelope leakage evaluation					
Internal load survey – Occupants					
Internal load survey – Appliances					
Duct system survey – Location					
Duct system survey – Insulation					
Duct system survey – Sealing					
Air quality survey (ventilation?)					
Garages					
Fireplaces					
Others					
Retrofit Checklist					
Load estimate required					
Comfort, Air-quality and Efficiency – Compliance with BC Building Code					

[*] *A floor-mounted unit may be better for an older user to give more direct heat flow and allow easier access for maintenance. A high wall-mounted or ceiling-mounted unit can provide more effective cooling and allows occupants more flexibility with arranging furniture in the room.*

COMMON CHALLENGES AND SOLUTIONS

There are a variety of challenges that can lead to poor performance of ASHP installations. If not addressed, these challenges can result in higher energy consumption, decreased equipment longevity, and sub-optimal occupant comfort. Some common challenges encountered by ASHP installation contractors and the suggested solutions for overcoming these barriers are summarized below. At a high level, it is recommended that contractors attend factory-sponsored training and keep current with evolving technology on an ongoing basis (i.e. continuing education).

Issue/Challenge	Solution
System requires more control wires	Implement one of the following solutions: • Rough in 18-8 or 18-10 thermostat wire • Employ wireless thermostats or thermostats that use only two wires • Use existing thermostat location and wiring for a temperature sensor and install a new thermostat in an alternate location
ASHP controls (i.e. thermostats and control panels) have more connections	Read and follow field wiring diagrams
Higher level of snow accumulations	Use risers or "pump-ups" to get outdoor units high enough off the ground
Water runs out of the outdoor unit during defrost and can re-freeze on the ground	Provide a safe, suitable drainage plane for the water and ice
Heating capacity drops with the outdoor temperature	Ensure adequate supplementary heat or use cold climate heat pumps
Defrost controls and reversing valves have unique service and repair considerations	Attend factory-sponsored training and keep current with evolving technology (i.e. continuing education)
Installations or repairs may have to be done outdoors in the winter	Maintain a portable heat source (radiant propane or kerosene "torpedo" heater) for field use in the winter. A more comfortable technician is more likely to do high quality work.
Excessive number of call-backs related to installs	Properly educate homeowners (refer to Homeowner Education and Maintenance section)
Excessive use of supplementary heating system	Ensure that lockout temperature is appropriate and that the control system is programmed properly to operate in conjunction with the supplementary heating system. Homeowner education is also very important to ensure optimal performance of the ASHP.
Capacity of existing duct system insufficient for centrally ducted ASHP system	Complete duct system improvements (e.g. adding turning vanes, replacing square elbows, etc.) to improve the capacity of the duct system. Building envelope upgrades that reduce the heat load can also help to solve this issue.
Misconceptions about heat pump sizing limitations (e.g. heat pump can't be primary heater as it can't be sized for >125% of cooling load)	Multi-stage or variable capacity ASHP and cold climate system (ccASHP) can be designed/sized for >125% of cooling load.

HEAT PUMP BEST PRACTICE INSTALLATION CHECKLIST: DUCTLESS MINI-SPLITS [5]

Customer's Name:		**Address:**	
Manufacturer:		**Model#**	

SECTION 1. Registered Vendor Checklist. Please complete and sign the following section.

Heat Load Served by ASHP (Check only one):

- ☐ ASHP project serves entire home
- ☐ ASHP project is full replacement of existing heating system
- ☐ ASHP project is partial replacement of existing heating system
- ☐ ASHP project serves isolated zone only

Installer to Complete - Check Done or N/A in the columns, fill in blanks. Installer to Sign.

SYSTEM DESIGN	
Calculated heating/cooling load (kWh): _____, Design temperature (°C): _____	
Capacity of system selected (kWh) at design temperature: _____	
Heating/cooling load calculated using CA/CSA F280-12	YES / NO / NA
Heat Pump system sized following CA/CSA C273.5	YES / NO / NA
OUTDOOR UNIT	
Height from ground (cm): _____ Best Practice: Above snow level (> 60 cm)	
Has unobstructed airflow as required by manufacturer?	YES / NO / NA
Is under roof drip line and is protected by ice/snow shield?	YES / NO / NA
Is fastened to structure or mechanical pad?	YES / NO / NA
Was measured to be level?	YES / NO / NA
Does not interfere with walkway, porch, window, or door?	YES / NO / NA
Is installed at serviceable height?	YES / NO / NA
Is protected by rain cap?	YES / NO / NA
INDOOR UNIT	
Is properly located, properly fastened to structure, and level?	YES / NO / NA
Has clearance for service and operation as required by manufacturer?	YES / NO / NA

[5] Air-Source Heat Pump Commissioning Checklist, New York State Energy Research and Development Authority (NYSERDA), 2019 and Ductless Heat Pump Installation requirements, Efficiency Maine, 2018

LINE SET	
Diameter of line set (mm): _____	
Manufacturer-specified lengths (cm): Minimum: _____ Maximum: _____	
Maximum with factory charge: _____ Manufacturer-specified vertical difference: _____	
Installed line set length: _____ Installed vertical difference:_____	
Does line set length exceed manufacturer's requirements for factory charge?	YES / NO / NA
Refrigerant added: Pounds _____ Ounces _____ N/A	
Line set purged with N_2; Pressure tested with N_2; Evacuated to 250 µm or per manufacturer.	
N_2 test pressure (PSIG): _____ Test duration (minutes): _____	
# evacuations performed: _____, Vacuum Level (µm): _____, Vacuum duration (minutes): _____	
Were brazing joints required?	YES / NO / NA
Was N_2 purge used during brazing operations?	YES / NO / NA
Was flare connection tightened per mfg.'s recommended torque? Torque setting: _____	YES / NO / NA
Visible line sets run through line set covers with transition and termination fittings.	YES / NO / NA
Insulation completely covers line sets (no exposed copper).	YES / NO / NA
Insulation UV protection provided on exterior of building.	YES / NO / NA
Floor/wall/ceiling pipe penetrations are sealed.	YES / NO / NA
Line sets and units were sensed with refrigerant detector and no leaks were found.	YES / NO / NA
ELECTRICAL WORK	
All electrical work performed by licensed electrician or an authorized person in the territory under B.C. Reg. 183/2019, July 22, 2019.	YES / NO / NA
Disconnect box wiring shock risk reduced by lock, strap tie, and/or box that provides other means of protection.	YES / NO / NA
OPERATION/CONTROL	
Unit(s) were operated in both heating and cooling mode to verify proper operation.	YES / NO / NA
Continuous fan function disabled (unless it is a part of ventilation system).	YES / NO / NA
Dual fuel outdoor cutoff control installed and functioning as designed to optimize use of ASHP for heating.	YES / NO / NA
INTEGRATED CONTROL	
Have integrated controls been installed to provide automatic changeover from the ASHP to the existing central heating system per the manufacturer's instructions?	YES / NO / NA

HOMEOWNER'S EDUCATION	
Owner's Manual for the ASHP has been provided to the homeowner.	YES / NO / NA
Homeowner has been taught how to control the ASHP system, including turning it on and off, adjusting the temperature, setting baseboard thermostat appropriately (if applicable), and switching between heating and cooling modes.	YES / NO / NA
Preventative maintenance requirements, including how to clean and/or change the filter, have been explained.	YES / NO / NA
Homeowner has been shown what alarms look like when the ASHP is not functioning properly.	YES / NO / NA
Warranty documents have been provided to the homeowner and have explained who to contact for service.	YES / NO / NA
Installer's Signature:	**Date:**
Installer's Full Name:	**Company Name:**

SECTION 2. Homeowner Checklist. Please complete and sign the following section.

I have received Owner's Manual for the heat pump.	YES / NO
Installer has taught me how to control the heat pump, including turning on and off, adjusting the temperature, setting baseboard thermostat (if applicable), and switching between heating and cooling modes.	YES / NO
Installer has explained preventative maintenance requirements, including how to clean and/or change the filter.	YES / NO
Installer has showed me what alarms look like when the heat pump is not functioning properly.	YES / NO
Installer has provided warranty documents and explained who to contact for service.	YES / NO
Noise and vibration levels of the system are acceptable.	YES / NO
Line set covers are aesthetically acceptable.	YES / NO
Homeowner's Signature:	**Date:**

HEAT PUMP BEST PRACTICE INSTALLATION CHECKLIST: CENTRALLY-DUCTED SYSTEMS[6]

Customer's Name:		**Address:**	
Manufacturer:		**Model#**	

SECTION 1. Registered Vendor Checklist. Please complete and sign the following section.

Heat Load Served by ASHP (Check only one):

- ☐ ASHP project serves entire home
- ☐ ASHP project is full replacement of existing heating system
- ☐ ASHP project is partial replacement of existing heating system
- ☐ ASHP project serves isolated zone only

Installer to Complete - Check Done or N/A in the columns, fill in blanks. Installer to Sign.

SYSTEM DESIGN	
Calculated heating/cooling load (kWh): _____, Design temperature (°C): _____	
Capacity of system selected (kWh) at design temperature: _____	
Heating/cooling load calculated using CA/CSA F280-12	YES / NO / NA
Heat Pump system sized following CA/CSA C273.5	YES / NO / NA
OUTDOOR UNIT	
Height from ground (cm): _____	Best Practice: Above snow level (≥ 60 cm)
Has unobstructed airflow as required by manufacturer?	YES / NO / NA
Is under roof drip line and is protected by ice/snow shield?	YES / NO / NA
Is fastened to structure or mechanical pad?	YES / NO / NA
Was measured to be level?	YES / NO / NA
Does not interfere with walkway, porch, window, or door?	YES / NO / NA
Is installed at serviceable height?	YES / NO / NA
Is protected by rain cap?	YES / NO / NA
INDOOR UNIT	
Is properly located, properly fastened to structure, and level?	YES / NO / NA
Has clearance for service and operation as required by manufacturer?	YES / NO / NA

[6] Air-Source Heat Pump Commissioning Checklist, New York State Energy Research and Development Authority (NYSERDA), 2019 and Ductless Heat Pump Installation requirements, Efficiency Maine, 2018

LINE SET	
Diameter of line set (mm): _____	
Manufacturer-specified lengths (cm): Minimum: _____ Maximum: _____	
Maximum with factory charge: _____ Manufacturer-specified vertical difference: _____	
Installed line set length: _____ Installed vertical difference:_____	
Does line set length exceed manufacturer's requirements for factory charge?	YES / NO / NA
Refrigerant added: Pounds _____ Ounces _____ N/A	
Line set purged with N_2; Pressure tested with N_2; Evacuated to 250 µm or per manufacturer.	
N_2 test pressure (PSIG): _____ Test duration (minutes): _____	
# evacuations performed: _____, Vacuum Level (µm): _____, Vacuum duration (minutes): _____	
Were brazing joints required?	YES / NO / NA
Was N_2 purge used during brazing operations?	YES / NO / NA
Was flare connection tightened per mfg.'s recommended torque? Torque setting: _____	YES / NO / NA
Visible line sets run through line set covers with transition and termination fittings.	YES / NO / NA
Insulation completely covers line sets (no exposed copper).	YES / NO / NA
Insulation UV protection provided on exterior of building.	YES / NO / NA
Floor/wall/ceiling pipe penetrations are sealed.	YES / NO / NA
Line sets and units were sensed with refrigerant detector and no leaks were found.	YES / NO / NA
ELECTRICAL WORK	
All electrical work performed by licensed electrician or an authorized person in the territory under B.C. Reg. 183/2019, July 22, 2019.	YES / NO / NA
Disconnect box wiring shock risk reduced by lock, strap tie, and/or box that provides other means of protection.	YES / NO / NA
DUCT SYSTEM	
Design airflow: _____ Design discharge static pressure: _____	
Measured airflow: _____ Measured static pressure: _____	
Is the existing ducting being used for ASHP system?	YES / NO / NA
If YES, was the duct system adequately sized for required heat pump airflow?	YES / NO / NA
If NO, were required upgrades/modifications to the duct system completed?	YES / NO / NA
Were ducts sized using NBC (Section 9.33.6) and ACCA Manual D or equivalent?	YES / NO / NA
Ducts are sealed, and no leaks are evident.	YES / NO / NA
Any ducts outside conditioned space are insulated to Code.	YES / NO / NA

OPERATION/CONTROL	
Unit(s) were operated in both heating and cooling modes to verify proper operation.	YES / NO / NA
Continuous fan function disabled (unless it is a part of ventilation system).	YES / NO / NA
Dual fuel outdoor cutoff control installed and functioning as designed to optimize use of ASHP for heating.	YES / NO / NA
INTEGRATED CONTROL	
Have integrated controls been installed to provide automatic changeover from the ASHP to the existing central heating system per the manufacturer's instructions?	YES / NO / NA
HOMEOWNER'S EDUCATION	
Owner's Manual for the Heat Pump has been provided to the homeowner.	YES / NO / NA
Homeowner has been taught how to control the ASHP system, including turning it on and off, adjusting the temperature, setting baseboard thermostat appropriately (if applicable), and switching between heating and cooling modes.	YES / NO / NA
Preventative maintenance requirements, including how to clean and/or change the filter, have been explained.	YES / NO / NA
Homeowner has been shown what alarms look like when the ASHP is not functioning properly.	YES / NO / NA
Warranty documents have been provided to the homeowner and have explained who to contact for service.	YES / NO / NA
Installer's Signature:	**Date:**
Installer's Full Name:	**Company Name:**

SECTION 2. Homeowner Checklist. Please complete and sign the following section.

I have received Owner's Manual for the heat pump.	YES / NO
Installer has taught me how to control the heat pump, including turning it on and off, adjusting the temperature, setting baseboard thermostat appropriately (if applicable), and switching between heating and cooling modes.	YES / NO
Installer has explained preventative maintenance requirements, including how to clean and/or change the filter.	YES / NO
Installer has showed me what alarms look like when the heat pump is not functioning properly.	YES / NO
Installer has provided warranty documents and explained who to contact for service.	YES / NO
Noise and vibration levels of the system are acceptable.	YES / NO
Line set covers are aesthetically acceptable.	YES / NO
Homeowner's Signature:	**Date:**

HEAT PUMP COMMISSIONING REPORT[7]

Customer's Name:		**Address**:	
Heat Pump Equipment Information			
Manufacturer:		Model#	Outdoor Unit# Indoor Unit#
Heating capacity (BTU/h)		HSPF	
Cooling capacity (BTU/h)		EER (35°C)	
Design air flow (CFM)		SEER	
Variable speed HP compressor	YES / NO	Thermal balance point (°C)	
Duct design static pressure (IWC)			
Existing Heating System Being Replaced		Electric forced air w/out AC Electric forced air w/ AC Electric zonal Air-source heat pump Natural gas furnace Other non-electric heating: _____	
Supplemenary/Backup Heating System		Electric forced air w/out AC Electric forced air w/ AC Electric zonal Natural gas furnace Other non-electric heating: _____	
All tests performed in Test Only/Check Charge mode			YES / NO / NA
External Static Pressure Test and Airflow			
Outdoor Air Temperature (°C)			
Test performed in heating or cooling mode?		Heating (if ≤18°C) / Cooling (if >18°C)	
Unit of Pressure Used		Supply Static Pressure	
Return Static Pressure		External Static Pressure	
Compressor suction pressor		Compressor head pressure	
Airflow at Evaporator (CFM)		Measurement method used	Trueflow/ Fan Curve / Temperature split / Other_____

[7] Installation of air-source heat pumps and air conditioners, CSA Standard C273.5-11 and Performance Tested Comfort Systems (PTCS) Air-Source Heat Pump Form

Refrigerant Charge Test			
Heating Mode		**Cooling Mode**	
Supply Air Temperature (SAT)		Discharge Pressure	
Return Air Temperature (RAT)		Discharge Temperature (DT)	
Temperature Split (SAT – RAT)		Liquid Line Temperature (LLT)	
Expected Temp Split from Performance table		Sub Cooling (DT – LLT)	

Controls	
Is the control system an Integrated Control?	Yes / No
Control system make and model	Manufacturer: Model:
Compressor Low Ambient Lockout Control Setting at 3°C or less?	Yes No installed/Disabled Non-electric backup No
Supplementary/auxiliary heat lockout has been set to:	2°C <2°C

Power Draw			
Outdoor temperature into Outdoor unit		Outdoor unit power (A)	
Indoor dry bulb temp. into indoor coil		Fan motor power (W)	
Indoor wet bulb temp. into indoor coil		Total unit power (W)	
Temperature of suction line		Temperature of liquid line	

Duct Leakage (applicable for Ducted Systems only)			
Test method used	Duct Blaster / Blow Dorr Subtraction / Other: _____		
Exiting system duct leakage (CFM)		Leakage % reduction [(Existing – Post)/Existing]	
Post installation duct leakage (CFM)		Total % leakage (Post/Design)	
Notes:			
The ASHP is designed and installed accordance with CAN/CSA C273.5 and other applicable codes and standards.			
Installer's Signature:		**Date:**	
Installer's Full Name:		**Company Name:**	