



AIR SOURCE HEAT PUMPS

QUALITY INSTALLATION AND COMMISSIONING

Quality installation and commissioning help ensure the long-term performance of new heat pump systems.

Even a perfectly designed HVAC, if not installed correctly, can lead to equipment degradation and performance and comfort issues for homeowners. This guide provides contractors with information and best practices for installing and commissioning heat pumps in homes. [Additional published resources](#) are available, including best practices for sizing and selection, customer leave-behinds and maintenance checklists.



Installation Contracts

Before a heat pump is installed, a detailed installation contract should be prepared, reviewed and accepted by the homeowner. The contract should include details of equipment performance, layout, floor plans, wiring diagrams, installer licence and experience, testing, commissioning, inspections, manuals and warranties, along with pricing and information and requirements to obtain incentives. Document the installation and commissioning process, and update the contract with photos, test results, and notes when work is complete.



Compliance with Codes and Standards

Adhere to all local, provincial and national codes and standards for HVAC installations. Ensure homeowners obtain permits and inspections in accordance with Canadian Standards Association (CSA) and the Electrical Safety Authority (ESA) when necessary. For some homes, such as condominiums, approval of installation by the board of directors and/or the property manager may be required.



Equipment Design and Sizing

An external static pressure test must be conducted for any new blower installation or change to the filter system and the new equipment sized for the pressure drop of the existing ductwork. For more information, see [Air Source Heat Pumps: Sizing and Selection](#).

Best Practices for Installation

HEAT PUMP LOCATION

Install the heat pump in a location with adequate airflow and ensure there is sufficient space for access and proper maintenance. Avoid areas prone to vandalism and extreme weather.

Avoid placing units where any of these conditions exist:

- exposure to high wind
- under the drip line of the roof or under other sources of water
- heavy snowmelt or rain runoff that may undermine the compressor pad
- defrost cycle melt water that may refreeze and become a slip hazard
- drifting snow that may accumulate (generally on the leeward side of the house)
- noise-sensitive areas, such as near bedroom windows

REFRIGERANT SYSTEMS AND COMPLIANCE WITH CSA STANDARDS

Refrigerant Line Set and Tubing

- Follow section 5.12, 6.2 and other relevant sections of CSA C273.5-11 for refrigerant line set and tubing.
- Protect the outdoor line. Insulate where possible with rigid line covers and protect any remaining sections with UV protected insulated line.
- Protect line penetrations through the building enclosure with a gasket, insulative sealant and rodent-proof insulation.

Condensate Drain

- Ensure appropriate drainage room and location to avoid pooling or ice build up.
- Do not exceed manufacturer's specifications for the vertical lift allowed before a continuous downward slope, or a condensate pump may be required.
- Do not allow the condensate outlet pipe to be immersed in water. Doing so can cause an air lock and prevent water drainage.

Refrigerant Charge and Adjustment

- Refrigerant charging must be carried out in accordance with CSA B52 section 8: Maintenance of System.
- Keep the charge lines as short as possible. Measure the additional pipe run length and accurately calculate the amount of refrigerant required according to the manufacturer's instructions.
- Any system that is charged with refrigerant or lubricant must be labelled appropriately. Labelling must be done in accordance with section CSA B52 clause 5.11 including the type, date of service and refrigerant charge.
- Ensure the heat pump is charged with the correct amount of refrigerant as specified by the manufacturer. **Improper refrigerant levels can result in poor performance and compressor damage.**

DUCTWORK

- Ensure ductwork is adequately sized for the heat pump air flow requirements and available static pressure. Duct system design must follow section CSA F280-12.
- Appropriately seal ductwork to prevent air leakage and improve energy efficiency and thermal comfort.
- Conduct your external static pressure test and compare the before-and-after installation results.

ELECTRICAL CONNECTIONS

- Ensure proper electrical connections and wiring are in place to prevent electrical issues and ensure system safety.
- Any electrical work beyond the wiring connections required for example, service or panel upgrades, should be handled by a licensed electrician prior to heat pump installation.

COMMISSIONING AND SYSTEM TESTING

If commissioning instructions are provided by the manufacturer, they must be followed; otherwise, testing and commissioning must comply with section 6.3 of CSA Standard C273.5-11.

- Conduct thorough system testing to verify the heat pump is functioning correctly. Check for refrigerant charge and leaks, airflow, power inputs and thermostat operation. All metrics should meet the manufacturer's specifications. In instances where line set length has changed, record any adjustments.
- For centrally ducted systems, the airflow to individual rooms should be balanced with the designed duct system flow.
- Additional testing should also include before-and-after measurements of sound levels in all rooms and outdoors, and temperature readings in all rooms.
- Any uneven temperatures should be discussed with homeowners and resolved where possible.
- All testing should be documented with pictures, videos and written notes to create a record of the work that was done.

SYSTEM CONTROLS

Control System Installation

- Place thermostats on interior walls, away from direct sunlight, appliances and drafts.
- Locate any outdoor thermostats in shady, protected areas.
- Wall-mounted controls should be positioned to facilitate seamless functionality and operational control within the space they serve.
- Use an integrated multi-stage control for systems that include a central HVAC system as the supplementary heat source. If integrated multi-stage control is not available, use two thermostats.
- Some compact-ducted air handlers require adjustment for static pressure on duct systems.

Control of Supplementary Heating

- Supplementary heat must be controlled so that it does not engage when the outdoor air temperature is above the balance point temperature of the heat pump, except when supplementary heating is required during a defrost cycle, or when emergency heating is required during a refrigeration cycle failure.
- If thermal balance point is used for sizing the heat pump system, the supplementary system must not cut out the compressor at temperatures above the thermal balance point temperature.
- Any independent thermostats for supplementary heating systems (e.g., baseboards) should be set 3–5°C lower than the typical setpoint to ensure that the heat pump is the primary heating source.

HOMEOWNER TRAINING

- Provide homeowner with information on how to operate and maintain the heat pump to get the most out of their new system.
- Thoroughly describe the control system installed, including why the control method was selected, any automation and the importance of avoiding overrides and what to do in case of system failure.
- Inform the homeowner about heat pump heating characteristics such as:
 - longer runtimes
 - lower supply air temperature
 - implications of using temperature setback
 - avoiding “Auto” mode
- Provide the homeowner with a complete system manual post-installation including:
 - system description and operation
 - installation contract
 - thermostat setup
 - testing results
 - ESA inspection
 - warranties
 - operation
 - troubleshooting
 - maintenance

In addition to providing a complete system manual, consider providing the Customer Leave Behind – Post Installation document specifically tailored for customers. They can refer to it after the installation for basic maintenance and troubleshooting purposes.

Sources:

Home Performance Stakeholder Council. (2019, Fall). *Heat Pump Best Practices Installation Guide For Existing Home*.
http://www.homeperformance.ca/wp-content/uploads/2019/12/ASHP_QI_Best_Practice_Guide_Supplements_20191209.pdf

CSA Group. (n.d.). <https://www.csagroup.org/>

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