

# Heat Pump Space Heating Permitting & Inspection Checklist

For Permitting and Inspecting of Air Source Heat Pump Systems For Space Heating in Single-Family and Duplex Homes

2020 National Electrical Code

2021 I-Codes



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Use of Heat Pump Space Heating Permitting & Inspection guidelines is permitted on a royalty-free basis. The authors claim no rights in and make no representations as to the contents or use of the 2020 National Electrical Code (NEC), the 2021 International Residential Code (IRC), and the 2021 International Fuel Gas Code (IFGC). The authors further make no representations towards the suitability of this guide for any purpose, and all content is provided as-is. Projects are expected to meet locally adopted codes and should refer to the 2020 NEC, 2021 IRC, and local amendments to ensure full compliance.

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## Introduction

Heat pumps are a key technology in the effective electrification of space heating systems. Heat pumps stand out for several reasons when it comes to electrifying space heating: they are a mature technology, a high market awareness of them exists and continues to grow, and available equipment efficiency is already 3-to-5 times more efficient than standard electric or gas heating systems. Within the residential sector, the most mature and readily available technology is a split system air source heat pump (ASHP), which can easily be implemented in both new and retrofit applications.

Heat pump systems offer households a super-efficient, clean energy solution to dramatically reduce the use of less efficient, carbon-intensive space heating systems while also offering effective air conditioning. In many parts of the country, the economics of heat pumps are favorable, even against natural gas, in new construction. Even in existing buildings, the gains in efficiency make these systems economical, particularly in buildings heated with delivered fuels such as oil and propane. The replacement of a furnace with a heat pump in many older residential buildings may also come with the added benefit of introducing cooling or replacing inefficient window air conditioners. Additionally, the Inflation Reduction Act provides a tax credit of 30% of the cost of a heat pump, capped at \$2,000 per year. For low-income households (under 80 percent of Area Median Income), a rebate may be available soon to cover 100 percent of heat pump costs up to \$8,000. For moderate-income households (between 80 percent and 150 percent of Area Median Income), the rebate may cover 50 percent of the cost of the heat pump costs up to \$8,000.

This permitting and inspection checklist references the most applicable requirements of the 2020 National Electrical Code (NEC), the 2021 International Residential Code (IRC) and the 2021 International Fuel Gas Code (IFGC) as they apply to air source heat pump installations in single-family homes and duplexes. Although not all requirements are covered by these checklists, they do include the most important life and safety requirements of the installation and can be used to highlight “common mistakes” made by installers. While these guidelines are geared primarily toward implementing the 2020 NEC and 2021 I-Codes jurisdictions, contractors using earlier editions of these codes can make use of these guidelines. Note that the International Building Code (IBC) is an alternative compliance option for IRC buildings in accordance with Section 101.2 of the IBC and the International Mechanical Code (IMC) may also be used for compliance.

## How to Use This Guide

This guide is intended for both code enforcement agencies and code users. The building department may conduct a plan review and inspection for air source heat pump installations using this guide as a starting point. Designers, contractors, and building owners can use this guide to know what to expect during the permitting and inspection processes.

This guide was designed with limitations on its scope and applicability in mind, including:

- X** This permitting guide does not include any service upgrades or ancillary electrical work. If the load calculations demonstrate a service upgrade is needed, this permitting and inspection guide cannot be used to determine compliance with code requirements for a service upgrade.
- X** This permitting guide was developed with a focus on the installation of air source split-system heat pumps in single-family and duplex buildings. While its contents may be adapted for use with other heat pump systems or other building types (such as small commercial buildings), it has not been designed for that use.
- ✓** The least expensive permitting process may use the 2-in-1 model (mechanical and electrical) that charges a flat rate for up to three items. This is to make the process more uniform and create a universal and simpler format for permitting projects.

## Location Considerations

### Space Requirements:

Per 2021 IRC Section M1401.1, outdoor units must be installed according to the manufacturer's instructions. Typical requirements ensure adequate airflow around the outdoor unit. In locations susceptible to snow, outdoor units must be installed on stands above the snow line. A best practice is sheltering the outdoor unit from potential snow or ice that could fall on it.

### Sound Considerations:

Some jurisdictions have ordinances that dictate where outdoor equipment can be installed. Not all jurisdictions have these ordinances, and those that do can have very different requirements. However, air source heat pump outdoor units are typically much quieter than familiar air conditioning condensing units and may offer greater flexibility in equipment location.

# Permit Submission Requirements

## To apply for a permit, submit the following:

1. Combination permit application (electrical, mechanical, and plumbing)
2. Floor plan drawn to scale showing:
  - a. Labeled location and type of existing heating appliance, if applicable
  - b. Labeled proposed location(s) of new ASHP, including exterior location for unit and interior locations for air handler or ductless mini-split head(s)
  - c. Labeled location of electric panel(s)
3. Mechanical design including:
  - a. ASHP specifications (manufacturer, type, size, and efficiency)
  - b. Installation specifications, including exterior mounting details
  - c. Location and length of refrigerant lines
  - d. Locations, sizes, and installation specifications for ductwork, including insulation and sealing,
  - e. Condensate drain line installation specifications (depending on location, some systems require a condensate pump)
  - f. Equipment and system controls
4. Electrical line diagram including:
  - a. Conductors, cables, and conduit types, sizes, and markings,
  - b. Conduit routes and requirements for their installation (e.g., within framing, mounted to structures, underground,
  - c. Voltage drop and derating information where multiple conductors are fed in a circuit,
  - d. Type and size rating of overcurrent protection and disconnects,
  - e. Type and location any GFCI protection devices
5. Load calculation for heat pump and outlet installations
6. Equipment manufacturer specifications and installation manual(s)

# Permitting and Inspection Checklist

**Plan**      **Inspection**

## Minimum Installation and Labeling Requirements

1. ASHP is installed according to manufacturer's installation instructions. (IRC M1401.1)		<input type="checkbox"/>
2. ASHP is listed and labeled for space heating and cooling. (IRC M1302.1)	<input type="checkbox"/>	<input type="checkbox"/>
3. ASHP is listed and labeled according to UL 1995 or UL/CSA/ANCE 60335-2-40. (IRC M1403)	<input type="checkbox"/>	<input type="checkbox"/>
4. ASHP has a nameplate with identifying name and rating in volts and amperes or in volts and watts. (NEC 424.28)		<input type="checkbox"/>
5. ASHP meets federal minimum efficiency requirements (7.5 HSPF2/14.3 SEER2). (IECC R403.7)	<input type="checkbox"/>	
6. All heating elements that are replaceable in the field and are part of an electric heater (such as electric resistance heating elements in heat pumps or heat strips) are marked with the ratings in volts and watts or in volts and amperes. (NEC 424.29)		<input type="checkbox"/>
7. If the ASHP is replacing a furnace, the gas outlets are capped gastight. (IRC G2415.15)		<input type="checkbox"/>

## Location Requirements

8. ASHP outdoor unit is listed, labeled and installed in an outdoor location. (IRC M1401.4, NEC 424.12B)		
9. Supports and foundations built to prevent excessive vibration, settlement or movement of the equipment. (IRC M1305.1.3.1)		<input type="checkbox"/>
10. Fixed electric space-heating equipment located with the required spacing between the equipment and adjacent combustible material, unless it is listed to be installed in direct contact with combustible material. (NEC 424.13)	<input type="checkbox"/>	<input type="checkbox"/>
11. The service side of the ASHP has an area that is 30" wide and 30" deep for access and serves as a level working space. (IRC M1305.1)		<input type="checkbox"/>
12. ASHP is protected from damage when installed in a garage or carport. (NEC 424.12A)		<input type="checkbox"/>
13. ASHP installed in flood hazard areas is either:		
a. Located at or above a required elevation (IRC R322.1.6) and not mounted on walls intended to break away under flood loads, or		
b. Designed and installed to prevent water from entering the appliance and have electrical components that conform with requirements for wet locations. (IRC M1401.5, Table R301.2, R322.1.6)	<input type="checkbox"/>	<input type="checkbox"/>
14. ASHP installation location matches approved floor plan.		<input type="checkbox"/>

## Electrical Requirements

15. For ASHP installations, the electrical service rating is greater than or equal to the electrical service load as demonstrated by electrical service load calculations. (NEC 220)	<input type="checkbox"/>	<input type="checkbox"/>
16. Circuit conductors for ASHP are sized at 125% or more of electrical load. (NEC 210.19(A)(1), NEC 215.2(A), NEC Table 310.16, NEC 424.4(B))	<input type="checkbox"/>	<input type="checkbox"/>
17. ASHP is properly identified on electrical panelboard. (NEC 408.4(B))		<input type="checkbox"/>
18. An individual branch circuit may supply any volt-ampere or wattage rating of fixed electric space heating equipment for which the branch circuit is rated. (NEC 424.4)	<input type="checkbox"/>	<input type="checkbox"/>
19. All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground have ground-fault circuit interrupter (GFCI) protection if installed outdoors, in crawlspaces or basements, or in indoor damp and wet locations such as laundry rooms or bathrooms. (NEC 210.8)	<input type="checkbox"/>	<input type="checkbox"/>
20. All receptacles for ASHP installed in a wet location have a weatherproof enclosure with the attachment plug cap inserted or removed. (NEC 407.9 (B))	<input type="checkbox"/>	<input type="checkbox"/>
21. Appropriately sized overcurrent protection (e.g., circuit breaker) is provided for the branch circuit serving the ASHP. (NEC 240.4)	<input type="checkbox"/>	<input type="checkbox"/>
22. Fixed electric space-heating equipment requiring supply conductors with an insulation rating greater than 60°C are clearly and permanently marked. (NEC 424.11)		<input type="checkbox"/>
23. Where equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type is installed in outdoor portions of metallic raceway systems that use compression-type fittings. (NEC 440.9)		<input type="checkbox"/>
24. A controller is marked with the manufacturer's name, trademark, or symbol; identifying designation; voltage; phase; full-load and locked-rotor current (or horsepower) rating; and other data as may be needed to properly indicate the motor-compressor for which it is suitable. (NEC 440.5)		<input type="checkbox"/>
25. A disconnecting means capable of disconnecting an ASHP from the circuit conductors, including motor-compressors and controllers, is installed within sight of the ASHP and is readily accessible. (NEC 440.11, NEC 440.14)	<input type="checkbox"/>	<input type="checkbox"/>

## Mechanical Requirements

### Sizing, Controls and Duct Requirements

26. ASHP is sized using ACCA Manual S based on loads determined using ACCA Manual J. (IECC C403.3.1, IECC R403.7)	<input type="checkbox"/>	<input type="checkbox"/>
27. If energy recovery systems (ERVs) are installed, heating loads are adjusted to account for reductions in the load associated with the ERV using the ASHRAE HVAC Systems and Equipment Handbook. (IECC C403.1.1)	<input type="checkbox"/>	<input type="checkbox"/>
28. ASHP with supplementary electric-resistance heat has controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. (IECC R403.1.2)	<input type="checkbox"/>	<input type="checkbox"/>
29. Duct systems serving the ASHP meet design, sizing, material, installation, location, sealing, testing insulation and other applicable requirements. (IECC R403.3, IRC M1601)	<input type="checkbox"/>	<input type="checkbox"/>

### Condensate Drain and Refrigerant Requirements

30. Condensate from cooling coils and evaporators is drained from the drain pan outlet to an appropriate place of disposal (e.g., not a street, walkway, crawl space, above outdoor equipment, or other area where it would cause a nuisance). The condensate drain piping slopes downhill with a minimum 1-percent slope (1/8 unit vertical in 12 units horizontal). (IRC M1411.3)	<input type="checkbox"/>	<input type="checkbox"/>
31. A secondary drain or auxiliary drain pan is installed for each cooling or evaporator coil where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping. (IRC M1411.3.1)	<input type="checkbox"/>	<input type="checkbox"/>
a. The secondary condensate drain piping is not less than 3/4-inch pipe sizing and maintains a minimum horizontal slope in the direction of discharge with a minimum 1-percent slope (1/8 unit vertical in 12 units horizontal).	<input type="checkbox"/>	<input type="checkbox"/>
b. The secondary drain or auxiliary drain pan uses one of the following methods:	<input type="checkbox"/>	<input type="checkbox"/>
i. An auxiliary drain pan with a separate drain installed under the coils on which condensation will occur. The auxiliary pan drain discharges to a conspicuous point of disposal so that occupants are aware of a stoppage of the primary drain. The pan is at least 1.5 inches deep, is at least 3 inches larger than the unit or the coil dimensions in width and length, and is constructed of corrosion-resistant material.		
ii. A separate overflow drain line connected to the drain pan installed with the equipment. This overflow drain discharges to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line connects to the drain pan at a higher level than the primary drain connection.		

<ul style="list-style-type: none"> <li>iii. An auxiliary drain pan without a separate drain line installed under the coils on which condensation will occur. This pan is equipped with a water level detection device conforming to UL 508 that will shut off the equipment served prior to overflow of the pan. The pan is equipped with a fitting to allow for drainage. The auxiliary drain pan is constructed according to Item i of this section.</li> <li>iv. A water-level detection device conforming to UL 508 is installed that will shut off the equipment served in the event that the primary drain is blocked. The device is installed in the primary drain line, the overflow drain line or the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.</li> </ul>			
<ul style="list-style-type: none"> <li>c. On down-flow units and other coils that do not have secondary drains or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device is installed inside the primary drain pan. This device will shut off the equipment served in the event that the primary drain becomes restricted. Devices are not installed in the drain line. (IRC M1411.3.1.1)</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>	
<ul style="list-style-type: none"> <li>d. If the ASHP is subject to water damage when auxiliary drain pans fill, that portion of the appliance is installed above the rim of the pan. Supports located inside of the pan to support the ASHP are water resistant and approved. (IRC M1411.3.1.2)</li> </ul>			<input type="checkbox"/>

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<p>32. Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, are connected to the ASHP, such that when the pump fails, the ASHP will be prevented from operating. Condensate pumps are installed according to the manufacturer’s instructions. (IRC M1411.4)</p>			
<p>33. Refrigerants used in direct refrigerating systems conform to the applicable provisions of ANSI/ASHRAE 34. (IRC M1411.1)</p>	<input type="checkbox"/>	<input type="checkbox"/>	

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<p>34. Refrigerant piping meets the following requirements:</p> <ul style="list-style-type: none"> <li>a. Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) are insulated to a minimum of R-3. (IECC R403.4 and IRC M1411.6)</li> <li>b. Refrigerant piping and tubing is securely fastened to a permanent support within 6 feet of the condensing unit. (IRC M1411.8)</li> <li>c. Refrigerant piping exposed to weather is protected from damage. The protection provides shielding from solar radiation. Adhesive tape is prohibited. (IECC R403.4.1)</li> </ul>			
<ul style="list-style-type: none"> <li>a.</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>	
<ul style="list-style-type: none"> <li>b.</li> </ul>			<input type="checkbox"/>
<ul style="list-style-type: none"> <li>c.</li> </ul>			<input type="checkbox"/>

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## **Resources**

[2021 International Residential Code \(IRC\)](#)

[NFPA 70: National Electrical Code 2020](#)

[2021 International Fuel Gas Code \(IFGC\)](#)

[2021 International Energy Conservation Code \(IECC\)](#)

# Appendix: Example Permit Application

New Application       Revised Application

## SECTION 1: General Info

Project Address

(   ) -

Property Owner's Name

Phone Number

E-mail

Property Owner's Mailing Address (if different from Project Address)

## SECTION 2: Project Details

Single-Family       Multi-family       Other \_\_\_\_\_

Project Scope:

Make & Model #:

SEER2:

Volts and Ampacity:

HSPF2:

Capacity (Tons):

Location of Air Handler:

In conditioned space

Garage or basement

Attic

## SECTION 3: Contractor Information

Business Address

(   ) -

Contractor Contact Name

Phone Number

E-mail

Contractor Business Name

Contractor License Number

Electrician/Subcontractor Business Name

Electrician/Subcontractor License Number

Business Address

(   ) -

Electrician/Subcontractor Contact Name

Phone Number

E-mail

**SECTION 4: Permit Fee**

[Include fee schedule/options and/or instructions for calculating fee, directions on how and when to submit the permit fee.]

**SECTION 5: Important Notice**

A permit must be obtained for all installations or alterations of electrical equipment BEFORE WORK STARTS. Refer to the Permitting Checklist for additional documents required. Failure to provide all required documents will delay permit approval. All permits expire six (6) months after date of issuance. Failure to start the work authorized by a permit within this six-month period renders the permit invalid, and a new permit must be obtained. Once work begins, noticeable progress must continue until completion. All work must be completed within eighteen (18) months of a permit issue date.

**Please submit the following additional documents with the ASHP Permit Application**

- Site Plan or Floor Plan
- Electrical Load Calculations and Electrical Line Diagram
- Mechanical Design
- Equipment Manufacturer Specifications
- [Additional Document – edit or delete as necessary]

**Submit Permit Application**

[Describe the submission process, how should the permits be submitted? In-person, on-line, e-mail, fax, etc.]

**SECTION 6: Applicant Signature**

I, the undersigned, certify that I have proper authority to apply for this permit, that the Contractor has obtained a signed contract from the Property Owner for the specified work, that all contractors have consented to being listed, and that all the information contained on this application is true and accurate to the best of my knowledge.

Name	Title
Signature	Date

**For Office Use Only**

Application Number:	Date Applied:
Permit Number:	Date Issued:
Issued By:	

## Bibliography

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