HVAC Systems

Maintain HVAC Systems in Basements and Crawlspaces

Touchstone Energy® Cooperatives

SKILL SET

Be sure you have the experience needed for this job. If you are in doubt, hire a contractor.

SAFETY

These tasks require working in tight clearances and under task lighting. Use a dust mask, gloves, safety glasses and kneepads.

TOOLS

Utility knife, caulk gun, stapler, measuring tape, lights and markers

MATERIALS

Foam/caulk/duct mastic, UL-rated tape for temporary connections

Insulation – duct wrap, duct board insulation

Fasteners – sheet metal screws, staples, webbing for hanging ducts

COST BENEFIT

An unsealed air handler and duct system can be 33% less efficient than a well-sealed system. Sealing and maintaining an HVAC system can reduce heating and cooling costs and improve comfort and indoor air quality.

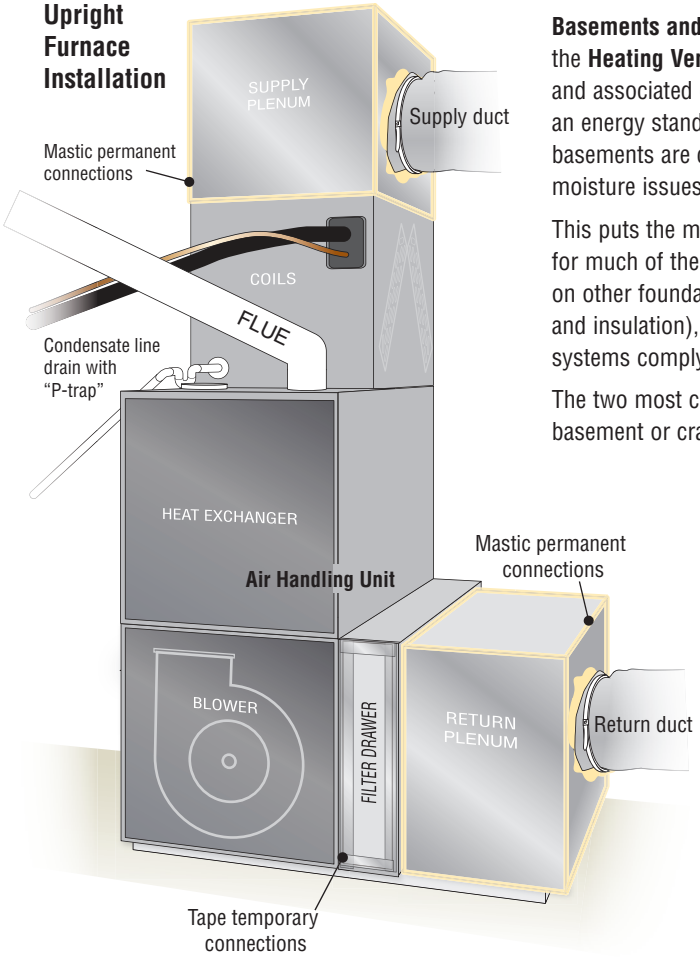
PRIORITY LEVEL

LOW MED **HIGH**

SKILL LEVEL

DIY PRO

Upright Furnace Installation



Basements and crawlspaces are often used as a location for the **Heating Ventilation and Air Conditioning** (HVAC) system and associated ductwork, although not always ideal from an energy standpoint. Vented crawlspaces or unconditioned basements are cold in the winter and often experience moisture issues in the summer.

This puts the mechanical system in an extreme environment for much of the heating and cooling season. Before taking on other foundation upgrade projects (such as air sealing and insulation), make sure that any foundation-located HVAC systems comply with the following considerations.

The two most common types of HVAC equipment found in basement or crawlspace foundations are:

- **Fuel-fired** - (e.g., natural gas or propane) furnace with electric split-system air conditioner attached or;
- **Split-system electric heat pump** - identical to an air conditioner in the cooling season but also has the ability to reverse itself and provide space heating in the wintertime.

Each assembly contains a blower motor and fan in what is referred to as the **air handling unit** (AHU).

Return ducts *pull air from the living space of the house via the blower in the AHU. A filter should be located somewhere along the return pathway, either at the AHU or at the return grill located in the living space.* **Supply ducts** *deliver conditioned air from the unit to the supply registers; typically every room has at least one supply duct.*

Basic Features

Furnaces will have a gas line and feature an integral blower as well as connection to the air conditioner's indoor evaporator coil. A refrigerant line set connects the evaporator coil to the outdoor condensing unit.

Electric heat pumps are typically a single box that includes the blower and indoor refrigerant coil; refrigerant lines also connect to the outdoor unit. Heat pumps typically are all electric and usually have a large electrical wire leading to the supplemental resistance heat unless they are dual-fuel which incorporates a gas line to a backup furnace.

Combustion Safety

Gas furnaces and all combustion appliances should always follow two simple rules for safe combustion:

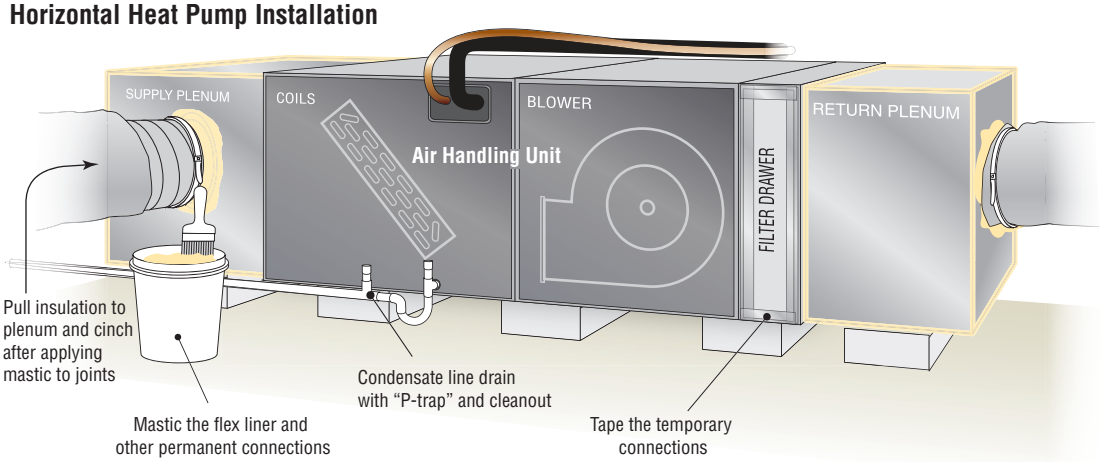
1. Each appliance should have its own source of combustion air that is separate from the breathing air of the occupants.
2. Each appliance should have its own flue pipe to expel combustion by-products to the outside.*

Comply with the manufacturers recommendations for combustion make-up air and flue venting.

**Natural draft combustion appliances may have a combined flue that is shared with another combustion appliance that exhausts to the outside, check for local code compliance.*

Evaluate hazards and repair existing maintenance issues before proceeding including knob and tube wiring, exposed electrical junctions, asbestos, lead paint, radon, dust, mold, pest infestation and water infiltration. Always follow common-sense safety measures when working in tight crawlspaces.

Horizontal Heat Pump Installation

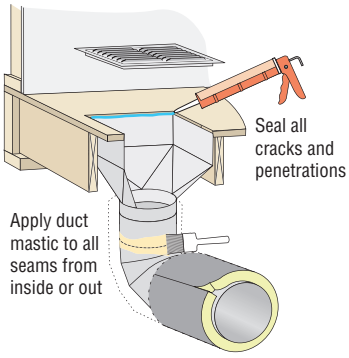


Whether a heat pump or a fuel-fired furnace, foundation-located HVAC systems need proper attention to details such as: adequate drainage for water condensation from the evaporator coils, mastic sealant on permanent joints of the air handler unit and ductwork, taped seams of temporary enclosures such as the filter drawer and attention to regular maintenance needs.

Ductwork – *the lungs of the building*

Many HVAC technicians concentrate their efforts on the unit and do not spend adequate time on the duct system - poor ductwork represents a huge energy loss in many homes. Focus on these issues:

- Starting at the AHU, feel around while it is operating for obvious leakage. Next, count supply and return duct runs and try to trace them out to where they penetrate the subfloor into the home. Occasionally a duct is attached to a boot that was never cut through the subfloor or a duct run has become disconnected.
- A duct boot is usually installed where a duct penetrates through the ceiling, floor or wall. This boot has seams and connections and these should be sealed either from the foundation side or the inside (living space) with mastic. There is often a gap between the boot and the subfloor which can be caulked, foamed or sealed with mastic from the foundation or interior side.



Install insulation for complete coverage

- Inspect duct runs for pinches, sagging or disconnects especially for flexible ducts. Metal ducts are generally tight at seams that run lengthwise but very leaky at any other seams and joints, especially at collar connections. Unless they are punctured, flex ducts leak mainly at the connections (located at the ends of the flexible duct run). Visual inspection of the metal duct or the flex duct liner (the portions that need to be sealed with mastic) is usually blocked by insulation that is commonly covered by a foil vapor retarder. This insulating duct wrap may have to be cut in order to expose the joints and connections that should be sealed with mastic.
- After all sealing has been performed, the duct wrap will need to be foil taped back into place. The latest energy codes call for a minimum R-6 insulation for supplies and returns located inside an unconditioned foundation space. Any new duct insulation wrap should be added only after all mastic has been applied.
- Ducts made from rigid fiberglass (duct board) need to be carefully inspected for damage and leaks and then apply mastic to the joints on the outside foil surface of the duct board.
- Mastic paste should be applied at least 2 mm thick, approximately the thickness of a nickel.

System Details – *get to know your system*

Perform a visual inspection. Combustion furnaces will incorporate a metal flue pipe (60-80% efficient models) or a plastic (usually PVC) flue pipe for high efficiency models (90%+). Confirm that metal flue pipes are all routed upwards at a minimum ¼" per foot slope and visually inspect for signs of rust.

Periodically check all lines for proper drainage. Water known as condensate will be formed from operating a high efficiency furnace and also from any air conditioner in the cooling mode. The main condensate line should include a cleanout access as well as a P-trap design. Depending on whether or not the basement/crawlspace is conditioned, the high efficiency furnace condensate line may need to be insulated to prevent it from freezing in case the foundation gets very cold in the winter, especially for vented crawlspaces with underfloor insulation.

Fix the leaks – Particularly for foundations that are vented or unconditioned, inspect the AHU by looking for leaks, especially between the blower compartment and the surroundings. Sealing these leaks prevents contaminating the conditioned air. Examples of common leaks at the blower portion of the air handler are: filter slot connections, thermostat wires running through large knockouts in the AHU cabinet and unsealed channels of the cabinet itself. Mastic is acceptable for permanently sealing these leaks but foil tape is recommended for sealing the blower access panel and the filter cover. Thicker, 6-inch or more pleated filters will likely require a professional to modify the ductwork but create less resistance to airflow and generally perform better at capturing particles – periodically inspect the filter and change as needed.

Other leaks associated with the AHU are connections between the unit and the evaporator coil and connections to and from the supply and return plenums. Check the evaporator coil for air leakage pathways at the condensate and refrigerant line penetrations – leaks should be sealed with mastic.