HVAC Systems

Maintain HVAC Systems in Attics

Touchstone Energy® Cooperatives

SKILL SET

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

SAFETY

This job requires working in unconditioned attic spaces, tight clearances and under task lighting. Use a dust mask/respirator, gloves, safety glasses and kneepads.

TOOLS

Utility knife, caulk gun, gloves and lights

MATERIALS

Duct mastic and foil tape

Foam/caulk/construction adhesive

Duct insulation – duct wrap

Fasteners – sheet metal screws, duct attachment straps and duct support strapping

COST BENEFIT

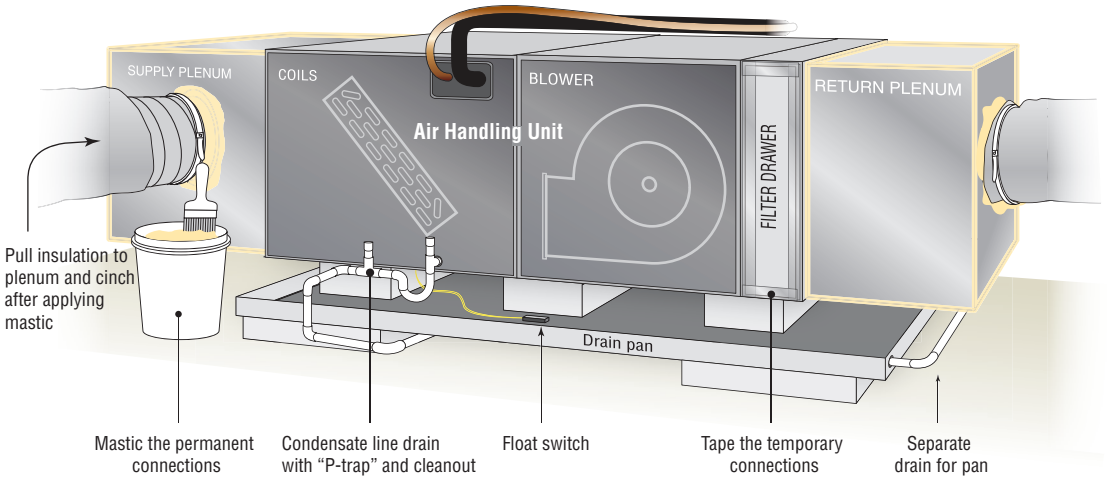
Air sealing the air handler unit and duct connections can save up to 30% on heating and cooling costs compared to unsealed units. Another benefit is that less unwanted attic air infiltrates a well-sealed unit – improving indoor air quality.

PRIORITY LEVEL

LOW MED **HIGH**

SKILL LEVEL

DIY PRO



Horizontal Heat Pump Installation

Whether a heat pump or a fuel-fired furnace, HVAC systems in the attic 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. Many of these items can be easily addressed by a do-it-yourselfer and can save money for the homeowner by ensuring that conditioned air is efficiently delivered to the living space.

Attic HVAC Systems

Although not ideal from an energy standpoint, attics are often used as a location for the **Heating Ventilation and Air Conditioning** (HVAC) system and associated ductwork. A standard vented attic is cold in the winter and extraordinarily hot in the summer; this puts the mechanical system in an extreme environment for much of the heating and cooling season. Before taking on other attic upgrade projects (such as air sealing and insulation), make sure that any attic-located HVAC systems comply with the following considerations.

The two most common types of HVAC equipment found in attics are typically:

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

Both assemblies contain a blower motor and fan in what is referred to as the **air handling unit** (AHU).

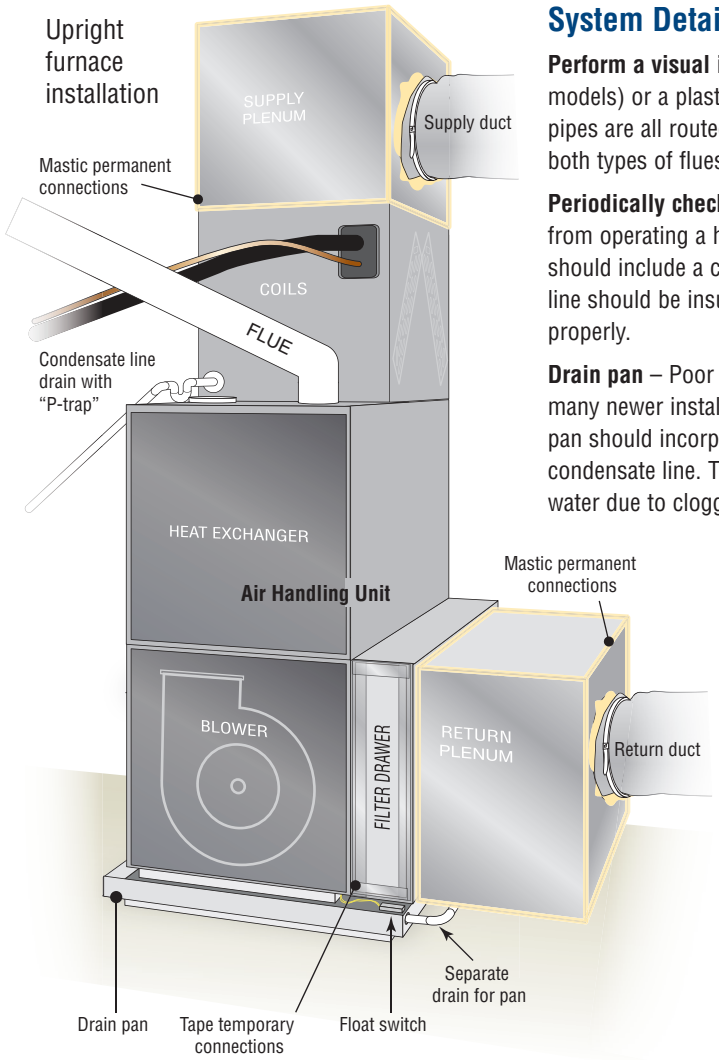
Basic Features

Furnaces will have a gas line run to them, a vent or flue and feature an integral blower as well as being connected 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 features the blower and indoor refrigerant coil; refrigerant lines also connect to the outdoor condensing unit. Heat pumps are typically all electric and usually have a large electrical wire leading to the supplemental resistance heat, unless they are dual-fuel and then may also incorporate a gas line and vent or flue

Supply & Return – *the pathway for air*

- **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 in 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.

Evaluate hazards and repair existing maintenance issues before proceeding including knob and tube wiring, exposed electrical junctions, vermiculite insulation containing asbestos, lead paint, pest infestation and roof leaks. Always follow common-sense safety measures when working in the attic.



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 – visually inspect for signs of rust. For both types of flues, ensure they are properly vented outside.

Periodically check all lines for proper drainage. Liquid water known as condensate will be formed from operating a high efficiency furnace and also from any air conditioner. The main condensate line should include a cleanout access as well as a P-trap design. The high efficiency furnace condensate line should be insulated to prevent it from freezing in the winter. Ensure the unit is level and drains properly.

Drain pan – Poor water drainage details can lead to damaging moisture problems and for this reason many newer installs include a large secondary drain pan located under the entire HVAC unit. The drain pan should incorporate a separate drainage line that is independent from the main air conditioner condensate line. The pan should also include a float switch that will disable the unit if the pan fills with water due to clogged drain lines.

Fix the leaks – Inspect the air handler unit (AHU) by looking for unsealed leaks, especially between the blower compartment and the surroundings since these leaks will draw unconditioned air from the attic. Examples of common leaks at the blower portion of the air handler are: filter slot connections, thermostat wires run through large knockouts in the 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 since these are temporary seals.

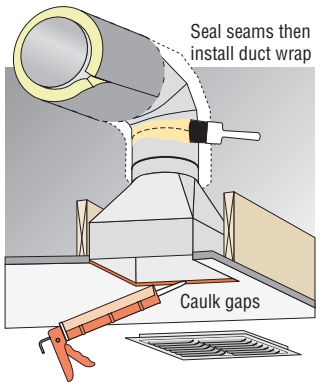
Other leaks associated with the AHU are the connections between the unit and the evaporator coil and the connections to and from the supply and return plenums. Check the evaporator coil for air leakage pathways at the condensate and refrigerant line penetrations – these and other leaks should be sealed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

Filters. Thicker, pleated filters will likely require a professional to modify the ductwork but generally perform better at capturing particles without creating unacceptable pressure drop. Attach a filter log-sheet to the AHU so that periodic filter changes are recorded.

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 penalty in many homes. Focus on these issues:

- Starting at the AHU, feel around it for obvious leakage while it is operating. Next, count supply and return duct runs and try to trace them out to where they penetrate the ceiling into the home. Occasionally, a duct is attached to a boot that was never cut through the ceiling.
- 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 attic side or the inside (living space) with mastic. There is often a gap between the boot and the ceiling which can be caulked or foamed either from the attic or interior side.
- 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 connections, especially at collars. Flex ducts leak mainly at the connections (located at the ends of the duct run). Visual access to 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 to 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-8 for supplies and R-6 for returns. New duct wrap should be added only after all mastic has been applied.
- If the ducts are made from rigid fiberglass (duct board), carefully inspect for damaged or leaky material and then apply mastic to the outside foil surface of the duct board.
- Mastic paste should be applied at least 2 mm thick, approximately the thickness of a nickel.

042314