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INSTALLATION OF TRAPS AND VENTS IN CONDENSATION DRAIN LINES FOR HVAC EQUIPMENT

Home inspectors find that one of the most misunderstood applications in homes in the Dallas/Fort Worth area is the primary drain line for the air conditioning system. P-traps are required for all fixtures and appliances that discharge waste water. Often, they are either missing or are improperly installed on the primary condensation drain lines. A P-trap is an important part of the drainage system, and the method of installation of the P-trap will determine how effectively the condensate drain line will work. Misapplication of these P-traps can result in poor performance of the condensate drain line and loss of valuable, conditioned air into the attic.

The lack of a P-trap on an HVAC system with a negative pressure across the evaporator coils can result in poor drainage of the evaporator cabinet. The negative pressure can draw air into the air distribution system through the condensate drain line. This inflow of air can restrict the outflow of condensation, which can cause the evaporator cabinet to overflow into the furnace closet or the attic. When a P-trap is installed in the condensate drain line, the water in the P-trap prevents an inward rush of air from the drain pipe into the cabinet so that the water can adequately drain from the evaporator cabinet. Systems with negative pressure across the evaporator coils are usually all-electric heating and cooling systems. In these systems, the P-traps generally tend to be installed correctly.

The lack of a P-trap on an HVAC system with a positive pressure across the evaporator coils can result in air loss into the attic from the open vent pipe (if there is one) in the condensate drain pipe. Air can also be forced through the condensate drain pipe where it will discharge through the sink or other drain where the condensate drain pipe terminates inside of the house (usually in the bathroom). That air can carry with it all of the odors and/or allergens that can develop within that waste water pipe, if not already present, and can discharge into the bathroom through the sink basin or other waste receptor. A properly-installed P-trap can prevent any air loss through the vent pipe or condensate drain pipe, while allowing the condensation to freely drain without the passage of air through this drain pipe.

Another common misapplication is to install the vent pipe upstream from the P-trap. When the vent pipe is installed upstream from the P-trap, then the P-trap continues to seal the one end of the pipe and restricts proper drainage of the condensation. That seal creates a vacuum in the drain pipe that restricts the free flow of condensation, (much like placing a finger over the top of a drinking straw would prevent the liquid from draining from that straw). Therefore, the drain downstream from the P-trap should be vented in order to allow the waste water (condensation) to freely drain. The vent pipe should be no closer to the weir (the spillover side of the trap on the downstream side) of the P-trap than two (2) pipe diameters.



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Additionally, if the vent pipe is installed upstream from the P-trap, conditioned air would discharge into the attic through the vent pipe. This conditioned air loss lessens the efficiency of the HVAC equipment and is a needless waste of costly conditioned air. This condition also contributes to negative pressures generated within the house. Negative pressures can hinder the proper venting of a fireplace, and can draw unfiltered and unconditioned air into the house through receptacle boxes, switch boxes, lighting junction boxes, and other uncontrolled openings throughout the house. Flue gases from fireplaces can contain carbon monoxide. Air that is drawn from the outlet boxes and junction boxes can contain insulation fibers that typically contain fiberglass. Both are potential health and safety concerns. The proper installation of a P-trap with a vent downstream from the P-trap can prevent the loss of conditioned air into the attic through the vent pipe in the condensate drain line and can lessen the potential for negative pressures to develop, while allowing the condensate drain pipe to vent and drain properly. (It is important to note that other mechanical equipment within the house such as clothes dryers, outside-venting kitchen exhaust fans, and bathroom exhaust fans also contribute to the development of negative pressures).

The P-trap should be of a sufficient depth to withstand the head pressure caused by the positive pressure in the evaporator cabinet. A two-inch (2") deep trap is usually sufficient, although sometimes a "deep seal" trap is needed. The P-trap should be as close to the discharge opening of the appliance, but no further than thirty inches (30") away from the discharge opening at the evaporator cabinet, and no further than twenty-four inches (24") below the discharge opening of the evaporator cabinet. The P-trap should be level with respect to the water seals. NOTE: If the positive pressure in the evaporator cabinet pushes the water out of a two-inch (2") deep trap, then the supply ducts should be evaluated for restrictions and to determine if the size and number of ducts are sufficient for the amount of cubic feet per minute of air flow the particular air handler unit generates.

Home inspectors find little consistency in condensate drain line applications throughout the DFW area on HVAC systems with a positive pressure across the evaporator coils. Some drain lines are not equipped with any P-trap at all. Some drain lines are installed with the vent downstream of the P-trap. Some vents are installed upstream from the P-trap. Some P-traps are installed out of level and consequently do not function. Some P-traps are too shallow and do not maintain an adequate seal.

The **International Residential Code for One and Two-family Dwellings (2006 edition)** was used as the primary reference for this informational document in order to determine what the correct installation specifications are for P-trap applications in condensate drain line systems. This document was written to explain and clarify the standard installation practice for primary condensate drain lines in HVAC systems. This information was also found in the 2000 and 2003 editions of the IRC.



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Five Basic Rules

(Based on the International Residential Code for One and Two-family Dwellings)

1. (P2601.2): Plumbing fixtures, drains and *appliances* that discharge waste water or sewage SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CODE*.

The cooling system is an appliance that discharges waste water, and so this code would apply to the draining system of the HVAC equipment. Basically, the CONDENSATE DRAIN PIPING for the HVAC needs to be installed to PLUMBING CODE.

2. (P3201.6): Each fixture shall be separately trapped, and the vertical distance from the fixture outlet to the trap weir should not be greater than 24 inches, and the horizontal distance from the fixture outlet to the trap should not be greater than 30 inches.

These statements mean that each cooling system should have its own trap, and that the trap should be within 30" of the evaporator cabinet outlet, and no lower than 24" below the evaporator coil outlet.

3. (P3201.3): Traps should be level with respect to their water seals.

This means that the trap will not work if it is not level because the waste water will spill out of the trap and compromise the seal.

4. (P3105.1): Each fixture trap shall have a protective vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 3105.1.

The trap weir is the downstream side of the trap, which means that the vent is to be DOWNSTREAM of the trap. Basically, the fixture drain line should extend outward from the evaporator cabinet outlet no further than 30 inches into a trap no lower than 24 inches below the evaporator cabinet outlet.

5. (P3105.3): A vent shall not be installed within two (2) pipe diameters of the trap weir.



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These five sections of the IRC building code make it clearly evident that all fixtures, drains, and *appliances* that discharge waste water or sewage must be installed according to the requirements of the plumbing code (P2601.2). The trap should be of a sufficient depth to withstand the head pressure caused by the positive pressure in the evaporator cabinet. A two-inch deep trap is usually sufficient. The trap should be as close to the discharge opening of the appliance, but no further than thirty inches (30") away from the discharge opening at the evaporator cabinet, and no further than twenty-four inches (24") below the discharge opening of the evaporator cabinet (P3201.6). The trap should be level with respect to its water seals (P3201.3). The drain downstream from the trap should be vented to allow the water to freely drain (P3105.1). The vent pipe should be no closer to the weir (the downstream side) of the trap than two pipe diameters (P3105.3).

This information should serve to clarify the proper installation and plumbing of a P-trap for an HVAC condensation drain system.

*All referenced codes from the IRC were paraphrased for simplification purposes in this document. Please note that building codes are subject to interpretation and enforcement by the local building official whose interpretation supersedes that of the Author. All questions relating to building code interpretation and enforcement should be addressed by the local building official.

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