

TECHNICAL INFORMATION COMMUNICATION



Quality and Continuous Improvement

Number: TIC2013-0014

Date: 10/30/2013

Title: New 35" Condensing Furnace Condensation

Product Category: Heating Products

Products Affected

New 35" condensing gas furnaces

Situation

The factory has been notified of instances where condensation is entering the furnace cabinet and dripping onto the gas valve and/or inducer motor resulting in no heat. In some situations, cabinet insulation is absorbing the condensation and sheet metal parts are rusting. There are two general sources of condensation: combustion air pipe and evaporator coil.

Technical Information

To prevent further condensation failures, **it is now mandatory to install a drain or External Trap Kit when the furnace is installed in an upflow configuration with the combustion air pipe attached to the top plate.** Changes to the Installation Instructions will follow.

If a drain or trap on the combustion air pipe is not desired, the combustion air pipe MUST enter the side of the cabinet.

Condensation dripping from the combustion air pipe in a direct vent (2-pipe) configuration can be an indication of one or more of the following problems. Please make a reasonable effort to correct the following conditions:

- 1) Home depressurization (improper ventilation) and unsealed furnace cabinet.
- 2) Improper vent and combustion air system design and/or termination location.
- 3) Unapproved holes in the blower shelf or furnace cabinet.
- 4) Unbalanced duct system.

Condensation dripping from the suction line is an indicator that the suction line is not sealed to the evaporator coil cabinet or insulated as required.

Drilling holes in the blower shelf is prohibited, except when using the Internal Vent Kit accessory (KGAD0101BVC). The blower compartment is under a vacuum (negative pressure). When the seal between the blower and combustion compartment is breached, the combustion compartment depressurizes and may result in outdoor air being pulled into the combustion compartment. In addition, all openings in the furnace cabinet must be sealed when a direct vent system is desired.

Only trained and qualified personnel should design, install, repair and service HVAC systems and equipment. All national standards and safety codes must be followed when designing, installing, repairing and servicing HVAC systems and equipment. It is the responsibility of the Dealer to ensure local codes, standards, and ordinances are met.

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Do not install a field fabricated shield between the combustion air pipe opening and burners. It disrupts the flow of combustion air to the burners and results in degraded furnace operation which may result in early component failures.

Condensation Caused by Depressurization

Condensation can form inside the combustion air pipe during cooling season. Advances in home construction have resulted in low leakage home envelopes. Inadequate ventilation of low leakage homes causes depressurization, where the interior pressure is lower than outside. Under this condition, the house draws hot and humid outdoor air through bathroom/kitchen/dryer vents and combustion air intakes into conditioned spaces. When outdoor air reaches the cooler, conditioned air, condensation forms. **Homes should be slightly pressurized per ASHRAE 62.1 “Ventilation for Acceptable Indoor Air Quality”.** A slight positive pressure limits entrance of outdoor moisture.

Condensation from the Evaporator Coil

Condensation from a plugged coil drain or un-level coil can enter the furnace if the combustion air and vent pipe adapters are installed without the gasket. **The furnace Installation Instructions require the gasket to be installed at the time of installation.** See Figure 1.

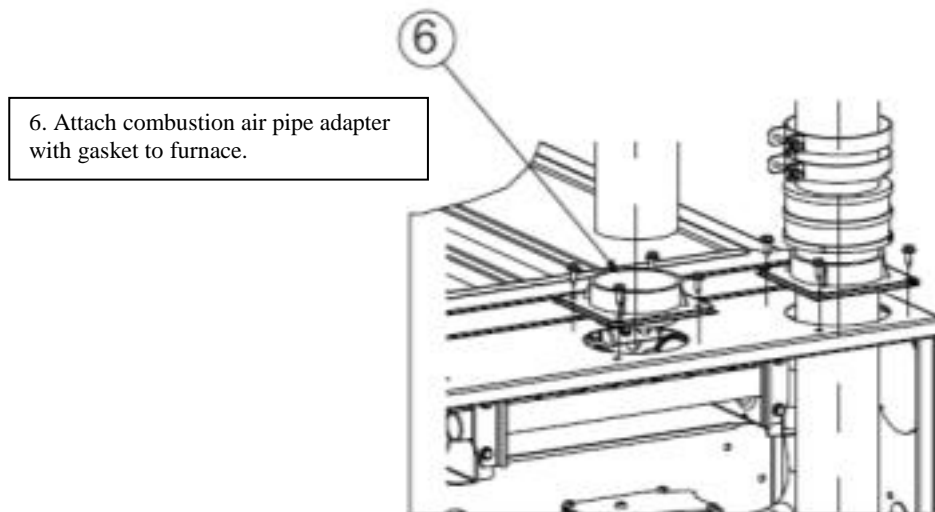


Figure 1: Gasket Instructions and Adapter Diagram

The suction line from the evaporator coil should be insulated and sealed to the coil cabinet using the grommet per the coil Installation Instructions. See Figure 2.

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Connect Refrigerant Piping

Use accessory tubing package or field-supplied tubing of refrigerant grade. **Suction tube must be insulated.** Do not use damaged, dirty, or contaminated tubing because it may plug refrigerant flow-control device. ALWAYS evacuate the coil and field-supplied tubing before opening outdoor unit service valves.

6. After brazing, allow joints to cool. Slide rubber grommets over joints. Position tubing at center of each grommet to ensure an air seal around the tube.

7. Always evacuate lines and reclaim refrigerant when making connections or flaring refrigerant lines. Leak check connections before insulating entire suction line.

Figure 2: Excerpt from Evaporator Coil Installation Instructions

Exhaust Recirculation Due to Vent and Combustion Air System Design: The distance between appliance, room and gas furnace vents and air intakes is important in preventing exhaust recirculation. Vents from water heaters, dryers, microwaves, kitchen and bathrooms can be overlooked when planning the vent and combustion air pipes for a gas furnace. The following code requirements (ANSI Z223.1/NFPA 54 National Fuel Gas Code for US and CAN/CSA B149.1 Natural Gas and Propane Installation Code for Canada) reduce the likelihood of recirculation. See Figure 3 (from Installation Instructions).

Item	Clearance Description	Canadian Installations ⁽¹⁾ (per CAN/CSA B149.1)	U.S. Installations ⁽²⁾ (per ANSI Z223.1/NFPA 54)
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	12 in. (305 mm) for appliances >10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in. (914 mm) for appliances >100,000 Btuh (30 kW)	9 in. (9 mm) for appliances >10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in. (305 mm) for appliances >50,000 Btuh (15kW)
K	Clearance to a mechanical air supply inlet	6 ft. (1.8 M)	3ft. (.9 M)
M	Clearance to each side of the centerline extended above or below vent terminal of the furnace to a dryer or water heater vent, or other appliance's vent intake or exhaust	12 in. (305 mm)	12 in. (305 mm)
N	Furnace combustion air intake clearance to a water heater vent, dryer vent or other types of appliance exhausts.	3 ft. (.9 M)	3 ft. (.9 M)

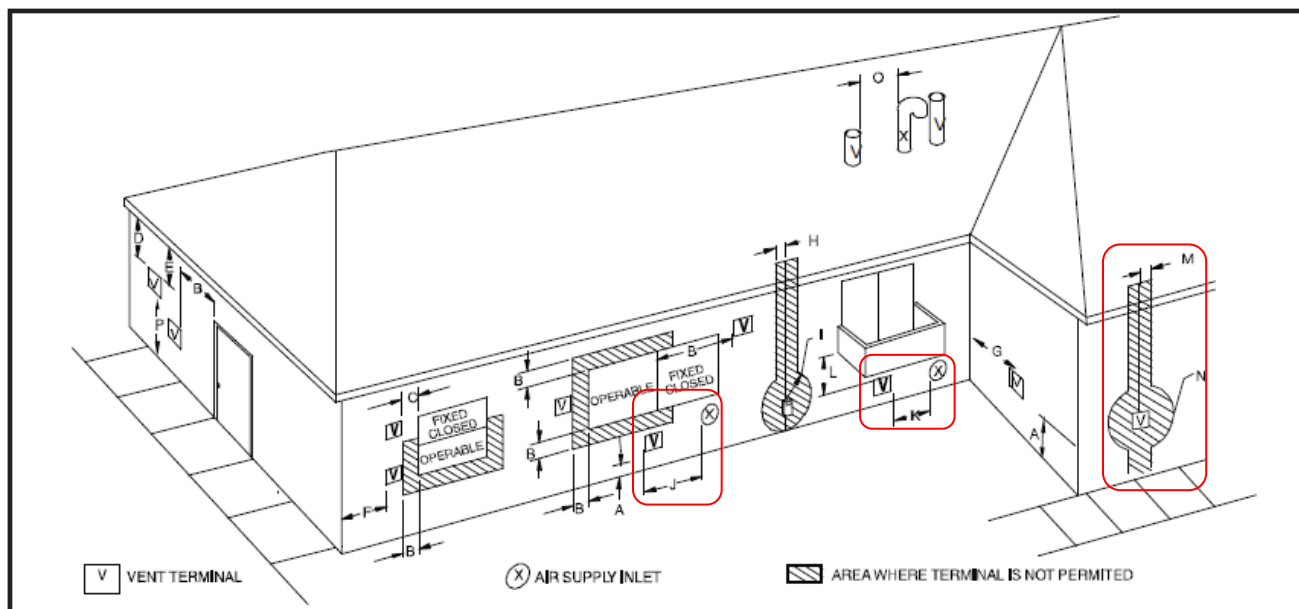


Figure 3: Combustion Air and Vent Pipe Requirements for Direct Vent (2-pipe) System

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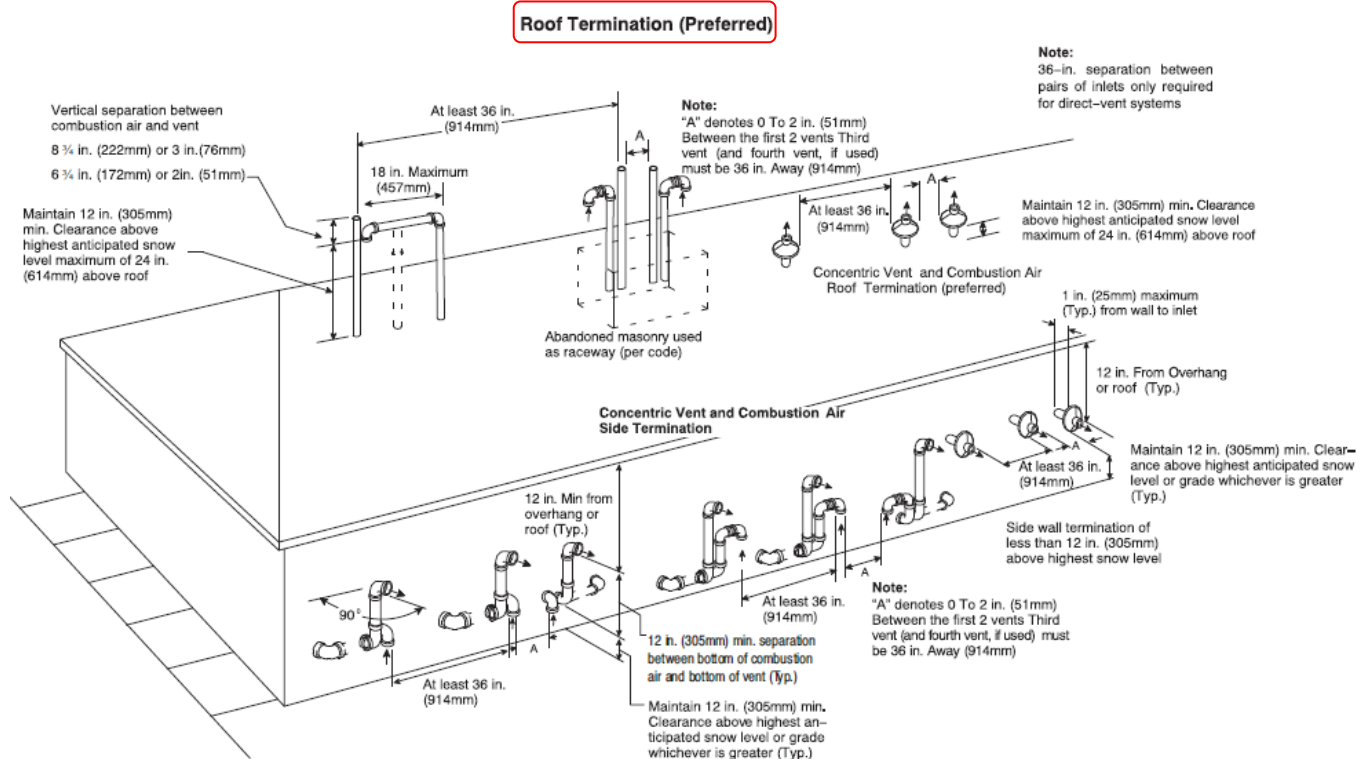


Figure 3: Combustion Air and Vent Pipe Requirements for Direct Vent (2-pipe) System Cont'd

Exhaust Recirculation Due to Improper Vent and Combustion Air Termination Location: Meeting all code requirements does not prevent all recirculation. **Local climate conditions must be taken into consideration when selecting the appropriate termination location per the Installation Instructions** (Figure 4).

- 5 When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the combustion products of adjacent vents. Recirculation can cause poor combustion, inlet condensation problems, vent termination icing, and/or accelerated corrosion of the heat exchangers.

Figure 4: Excerpt from New 35" 90% Gas Furnace Installation Instructions

Wind creates a positive pressure field on the wall perpendicular to wind direction. The three remaining walls are under a negative pressure (suction). See Figure 5. Inside corners increase the wind pressure/suction effect 2 - 4 times greater than the pressure applied to the wall perpendicular to the wind. See Figure 6. Topographical features such as hills, trees and other structures can further amplify pressure/suction fields as much as eight (8) times around the vent and combustion air terminations. These pressure/suction fields act on the vent and combustion air system. **Special consideration must be given to locate the vent and combustion air terminations in a low magnitude pressure/suction field when a side wall termination is desired.**

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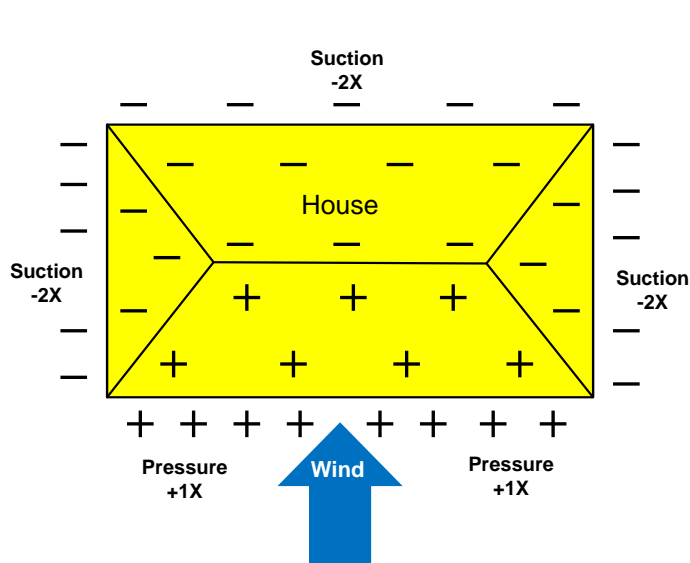


Figure 5: Pressure Fields Created by Wind

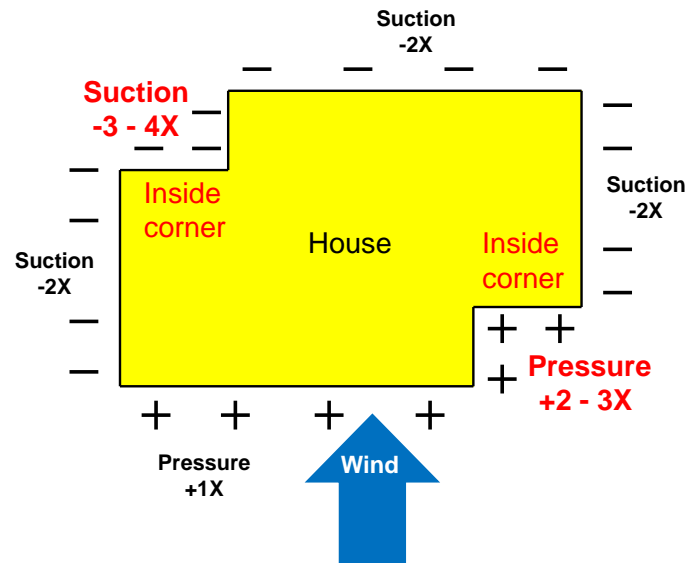


Figure 6: Pressure on Inside Corners from Wind

Wind pressure effects on a roof are generally less than walls. See Figure 7. In addition, vent and combustion air roof terminations are typically above the pressure field. **For these reasons, roof terminations are strongly preferred.** The combustion air intake should be installed upwind of the vent outlet when exposed to prevailing winds.

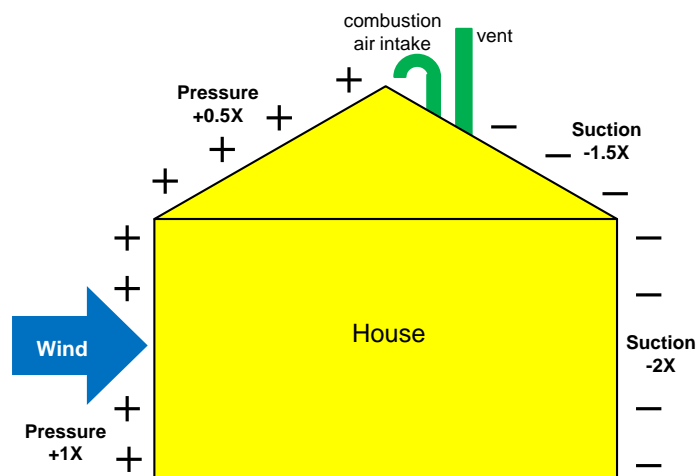


Figure 7: Pressure Effect on Roof from Wind

Improper vent and combustion air pipe sizing and termination may cause furnace performance and reliability issues that are difficult to detect without proper measurement devices.

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Failure to locate the air intake one (1) foot or greater from the maximum snow line can allow snow to enter the intake, melt, and drip water. The following code requirement reduces the likelihood of snow entering the combustion air pipe.

A minimum of 1 foot (US) or 1.5 feet (Canada) separation is required between the maximum anticipated snow level and the bottom of the combustion air intake. (ANSI Z223.1/NFPA 54 for US and CAN/CSA B149.1 for Canada) See Figure 3 (from Installation Instructions).

Many geographical regions in the United States and Canada have climates that can cause condensation in vents and combustion air pipes. **If an installation site experiences the following conditions, condensation may form in the combustion air pipe:**

- 1) Outdoor dew point (temperature) exceeds the indoor air temperature.**
- 2) Combustion air pipe runs through a conditioned space.**

Corrective Action

There are three (3) options available to capture condensate in the combustion air pipe.

Option 1: A field constructed drain can be added to existing combustion air pipe. The drain should be located as close to the air intake pipe adapter as possible. See Figures 8 and 9 for approved configurations.

The example shown below is for a 2-inch combustion air/vent system. Size the combustion air and vent pipes per the installation instructions. If a different diameter of combustion air and vent pipes are required, substitute the 2-inch fittings shown below for the required diameter pipe. The change in pipe diameter **MUST** be made in the vertical portion of the vent, as close to the furnace as practical.

Option 1: Field Constructed Combustion Air Pipe Drain



Figure 8: Field Constructed Combustion Air Pipe Drain, Two options

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Supplies list for field constructed combustion air pipe drain (option 2, Figure 11):

1. (1) 2" X 2" X 2" PVC Schedule 40 Tee
2. (1) 3" length 2" PVC Schedule 40 Pipe
3. (1) 1½" X 2" PVC Reducer
4. (1) ½" NPT X 1½" PVC Bushing
5. (1) ½" X ½" NPT PEX straight connector
6. (1) Length of ½" vinyl flexible tubing

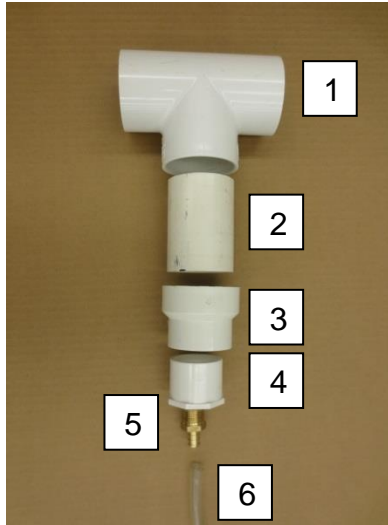


Figure 9: Field Constructed Pipe Drain

Option 2: Purchase a drain tee (328055-701), install in the combustion air pipe and add a field supplied drain tube. See Figure 10. Note: This option is only available for 1 ½ and 2 inch combustion air pipes. Connect the drain tee to the furnace as shown; then run the remaining combustion air pipe to the termination with 1 ½-in pipe.

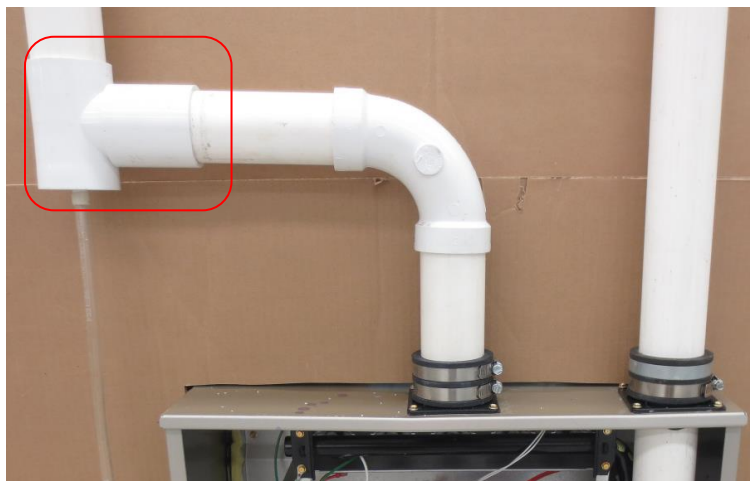


Figure 10: Option 2, Drain Tee (328055-701)

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Supplies list for drain tee (option 2, Figure 10):

1. (1) Drain tee, 328055-701
2. (1) Length of ½" vinyl flexible tubing

Drain tubing should be secured to the standpipe or site drain to prevent displacement.

Option 3: Purchase and install an External Trap Kit (KGAET0201ETK). See Figure 11. The trap is sized for 2-inch pipe and includes a 2" x 2" x 2" PVC tee. If a different diameter combustion air and vent pipe are required, discard the tee included in the kit and install the appropriately sized reducing fitting in a field supplied tee for the required combustion air pipe diameter.

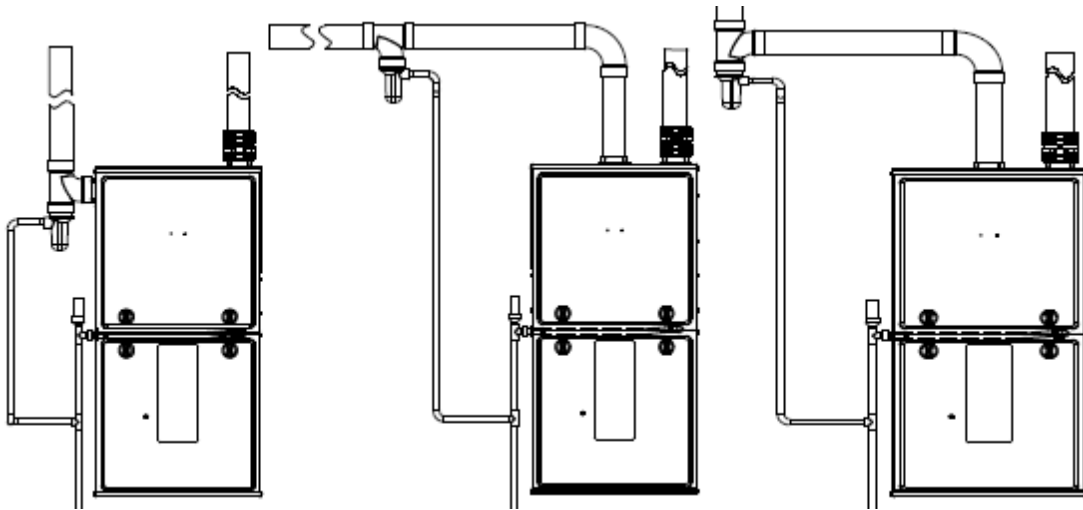


Figure 11: External Drain Trap Configurations (from Installation Instructions)

References

New 35" 90% Gas Furnace Installation Instructions

ANSI Z223.1/NFPA 54 for US

CAN/CSA B149.1 for Canada