

BY TED CUSHMAN

The Trouble With High-Efficiency Heat

In the winter of 2014, homeowners in the Raleigh, N.C., area encountered an inconvenient truth. In the depths of a cold snap, their new, 90% efficient condensing furnaces were shutting down, depriving their homes of heat at the very moment when heat was most needed.

What happened? Condensate draining from the furnaces had been piped through an outside wall to drain onto the ground. With temperatures in the teens, the sidewall pipes were freezing, the drains were backing up, and switches inside the furnaces were locking out the equipment.

The experience came as a surprise—as it has for other homeowners in the South, where high-efficiency furnaces are relative newcomers. But freezing condensate drains aren't just a Southern problem. In Northern states, where hard freezes are a winter reality, outdoor condensate drains are less common—and so, naturally,

are freeze-ups. But it does happen, even in states like Michigan or New York.

North Carolina codes have changed to allow furnace condensate to drain through house plumbing into municipal sewers, as is the rule in most Northern states, instead of outside onto the ground. But draining condensate into plumbing drains, basement floor drains, or foundation sumps doesn't solve all the problems—because furnace condensate can damage any of those drain systems.

CORROSIVE CHEMISTRY

Although furnace condensate is mostly water (which, along with carbon dioxide, is the main product of gas combustion), it's not pure water. Gas combustion also produces nitrogen compounds, which collect in the condensing water vapor and turn the condensate into a dilute solution of nitric acid. Over time, the acid eats away at metal and even dissolves some plastics. And if it sits in a drain and evaporates, the effluent concentrates into an even more potent brew.

And it's not just a trickle of condensate, says home inspector Richard Aiello, of I-Spy Home Inspection, in Boston, Mass. "It's a lot of water," he says. "If I'm in the house running the furnace for an hour, I hear the condensate pump go on a couple of times while I'm there."

Mike Bernasconi, a 40-year veteran of the heating industry, now manufactures a condensate neutralizer called Neutra-Safe, designed to make condensate safe before it's directed into a drain pipe. Bernasconi says, "One gallon of condensate is produced for every 100,000 Btus of input, providing the appliance is operating in full condensing mode." That means a typical furnace could easily produce 2,000 gallons or more of the acidic fluid every year.

That could be a problem for the house, Richard Aiello points out. New PVC plumbing isn't vulnerable to furnace condensate, but cast-iron drain pipes are. "In an old house, even if there are new PVC plumbing drains, there could be old cast-iron lines in the basement, and the drain line that runs from the trap and the cleanout to the street is cast iron," says Aiello.

If the condensate is directed into a floor drain, Bernasconi notes, "It could sit in the trap and rot out the floor drain, and then who knows where it goes? I've seen it eat through a concrete footing."



Furnace condensate is highly corrosive and gets stronger from evaporation. Here, a trickling condensate drain has eaten away a basement floor drain grille—just as it could destroy an underfloor cast-iron drain pipe or even a municipal sewer under the street.

Photo: Mike Bernasconi

“You have to look at the big picture,” argues Aiello. “The old pipes under the street are cast iron. And eventually everybody’s going to have a condensing system. Well, now you’re talking gallons and gallons of the stuff running through the city systems, and all these pipes are going to start corroding and they’re going to have to start digging up the streets.”

Plumbing codes require corrosive fluid to be neutralized or diluted before it’s sent into the drain. But many HVAC installers aren’t complying with the rule. Some don’t understand it. Aiello recently inspected a remodel with an air conditioner and a condensing furnace that shared a condensate drain. Both units produce condensate, but the air conditioner’s condensate is harmless atmospheric humidity, not corrosive combustion products. “The guy put a neutralizer on the condensate for the air conditioner, but not the furnace,” says Aiello. “So he kind of had an idea that he had to do something, but ...”



Photo: Billy Sweet

WATER HEATERS

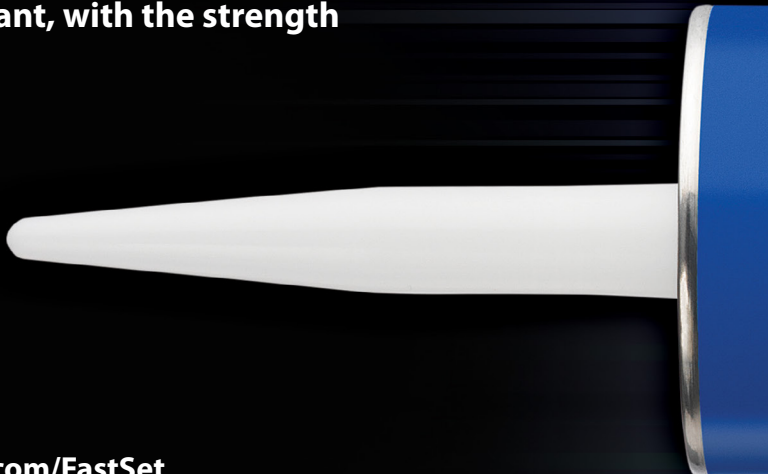
Acidic combustion products also figure in another kind of trouble: the widespread

Condensing acidic exhaust vapor from a water heater has attacked this chimney interior after the old, non-condensing furnace was replaced with a sidewall-vented unit. The water heater by itself can’t heat up the flue enough to keep it dry.

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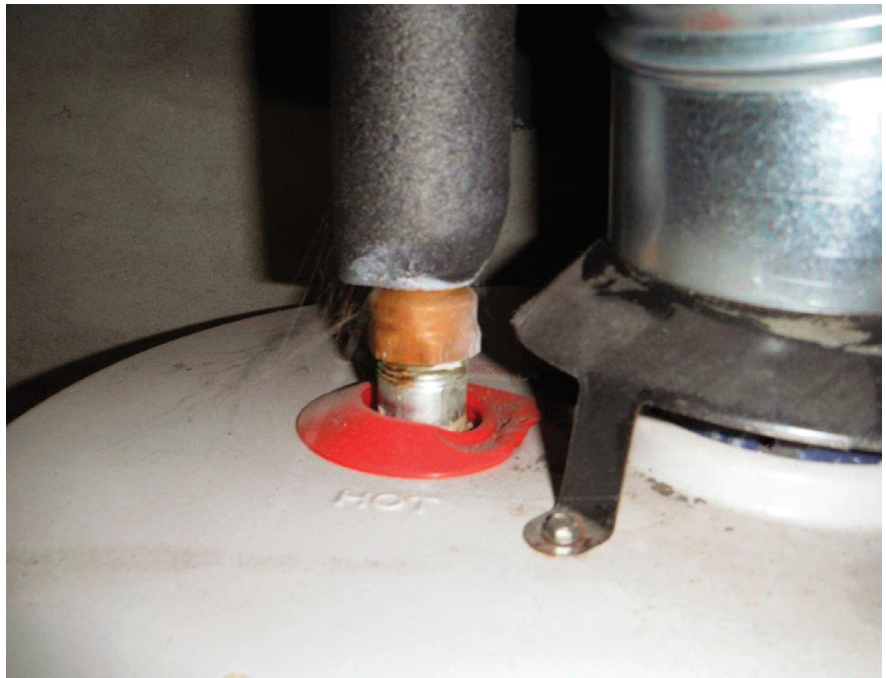
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problem of orphaned water heaters. When an old, low-efficiency furnace is taken off a chimney and is replaced with a modern, sidewall-vented unit, the old water heater is sometimes left alone on the big chimney. By itself, the water heater is unable keep the big flue hot—so flue gases condense more readily on the sides of the flue, attacking the masonry (see photo on facing page).

Chimney damage often starts long before the furnace is taken out of the equation, says Boston chimney sweep Billy Sweet—“but then the water heater operating alone accelerates that.”

Sweet’s biggest concern isn’t the chimney damage—that, he says, can be repaired. The bigger risk is back-drafting caused by a weak draft in an over-sized flue. “Deterioration of the flue is not good. It’s bad,” he says. “But nobody died from that. But if the flue gases flow back into the house, and the water heater re-breathes that? Eventually carbon monoxide can be generated. That’s the most dangerous part of it.”

Ted Cushman is a senior editor at JLC.



In a tell-tale sign, hot combustion gases backdrafting from the vent hood of this water heater have melted the red plastic water-line marker. This water heater, left alone on a large chimney, does not create enough draft to properly vent up the flue.

Photo: Joseph Aletto

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