

Heating Choices

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Abstract:

Based on Building America experience, this report is about selecting furnaces, water heaters, both or sometimes just one to accomplish both space heating and domestic hot water.

Heating Choices

Since we use gas hot water heaters for space heating in some of our Building America houses we thought it appropriate that we weigh in on the discussion relating to using gas hot water heaters for space heating. We do not believe they are bad choices, nor do we believe they should be outlawed by the code.

There are two main reason we considered combo systems. The first reason are the problems of combustion air and backdrafting issues relating to cheap, crummy, commodity item, crappy, horrible, etc. standard gas water heaters. The second reason are the problems associated air handler leakage and duct leakage of furnaces located outside of the thermal envelope (i.e. in garages and vented attics).

Let us point out a couple of obvious facts, unpleasant though they may be:

- Standard gas water heaters are a commodity item that can be purchased for \$150. These water heaters are prone to spillage and backdrafting and we view them to be a health hazard. We do not allow them to be installed inside of the conditioned space of Building America houses. Accordingly, in climate zones that permit, we insist that these water heaters be located in garages. In cold climates where this is not possible, we insist on power vented or sealed combustion water heaters located within the conditioned space. This decision is made independently of any other consideration. If you want hot water from gas, the water heater goes inside or outside. Outside is safer, therefore it is better. Period. Where climate does not allow this, the water goes inside and it is always power vented or sealed combustion. Period.
- Air handlers and ducts leak. We do not allow them to be installed outside of the conditioned space of Building America houses. No furnace in a vented attic. No air conditioner in a vented attic. No furnace or air conditioner in a garage. Ever. Period.

These obvious facts limit options. So what do we recommend? Here goes, pick one of the following:

1. Power vented water heater located inside with a power vented 80 plus furnace located inside.
2. Power vented water heater located inside with a 90 plus sealed combustion furnace that also happens to be power vented located inside.
3. Standard gas water heater located outside in garage with a 90 plus sealed combustion furnace located inside.
4. Standard gas water heater located outside in garage with a fan-coil air handler located inside.
5. Power vented water heater located inside with a fan-coil air handler located inside.

That's it folks. The choice is now a shopping and marketing exercise. Let us tell you how it seems to be going. In cold climates with basement houses we tend to go with the power vented water heater and the 80 plus power vented furnace located in the basements on the low end houses and the power vented water heater and the 90 plus sealed combustion furnace located in the basements for the high end houses. Except in Minnesota, where all houses use the power vented water heater and the 90 plus sealed combustion furnace.

What we like about the 90 plus sealed combustion furnaces is that we do not need to provide combustion air (i.e. a hole with a duct dumping air close to the furnace and water heater). With some power vented water heaters (the Bradford White ones in particular) we have shown that they do not need the combustion air either. So we don't have to put holes in the building to meet codes. In basement houses this isn't much of a problem (putting in the hole with a duct), so we live with the 80 plus furnace and the combustion air duct. We don't like it, but we live with it. We prefer the 90 plus units, but we can't always afford them.

In warm climates we have a mix of standard water heaters located in garages coupled with fan-coil air handlers located inside or standard water heaters located in garages with 90 plus sealed combustion furnaces located inside. We can get the 90 plus sealed combustion furnace for an approximate \$400 incremental cost over a standard gas furnace. If the plumber is unreasonable about cost (i.e. charges more than a \$400 incremental cost over a standard furnace) we go with the 90 plus furnace.

We get some amazing situations. For example, we are finding it less expensive in Tucson to install 90 plus furnaces inside with standard water heaters located in garages than to install standard gas water heaters located in garages with fan-coil air handlers located inside. In Las Vegas we have a mix, depends on who's bidding the job. What's amazing about this is that we are sometimes installing 47,000 Btu 90 plus furnaces to handle 15,000 Btu design heat losses. Go figure.

We have found that in order to size a combo system correctly, you take the design heat loss and multiply it by 2 to get the size of water heater (normal industry practice is a multiple of 1.3 to 1.5, danger, danger, danger, don't follow normal industry practice, if you do, you run out of hot water). A standard water heater is typically 40,000 Btu input. Working backwards, we never recommend a combo unit when the design heat loss is greater than 20,000 Btu/hr. We could get a larger water heater, but that increases the cost by approximately \$150 and when you add that to the cost of the fan-coil unit and the associated plumbing, a 90 plus furnace is less expensive.

Notice in warm climates we do not go with any of the 80 plus furnaces. The reason is the requirement for the combustion air requirements. It doesn't make sense to us to tighten up the building and then put a hole in the building that is sized incorrectly by the mechanical code. And the requirements for the holes are bizarre. Sometimes the codes want two holes, sometimes one. Sometimes a hole high, and a hole low. A pox on the mechanical code. We avoid the discussion with the 90 plus furnace.

In multi-family construction out east, sometimes we go with a power vented water heater inside with a fan-coil inside, sometimes we go with a power vented water heater located inside with a 90 plus sealed combustion furnace located inside. Cost drives the decision.

But notice in the multi-family case we are never, never, ever installing the cheap, minimum efficiency water heater. It's not safe. The efficiency discussion is irrelevant.

In terms of the tenant paying the heating bills in multi-family construction, the big operating cost problem and comfort problem is the envelope design, windows and provision for controlled ventilation, not whether a fan-coil connected to a water heater is used to provide heating as opposed to a more efficient gas furnace. If we get the envelope, windows and ventilation right, the big utility cost is the energy used for domestic hot water, not the energy used for space heating. The problem in multi-family construction has never been the heat supply side, it has always been the heat demand side. This is not yet recognized, nor understood.

The only situations where standard gas water heaters are used with fan-coils in Building America houses are where the design heat loss is less than 20,000 Btu's per hour and where the standard gas water heater is installed outside (i.e. in a garage). This means hot-dry and hot-humid climates only. In our definition of hot-dry and hot-humid climates the monthly average outdoor temperature remains above 45 degrees F. throughout the year. These climates have typically less than 2,500 degree days of heating. For all intents and purposes, the heating cost is negligible and the energy usage for heating is negligible. The difference in efficiency between a combo system using a lousy water heater and a higher efficiency furnace is really meaningless in this type of climate.

However, the duct leakage issues and the air handler leakage issues relating to air conditioning are huge in these climates. These issues are in themselves dwarfed by the combustion safety issues.

As to having building codes outlawing the practice. Danger, danger, danger. They have yet to get any of the combustion stuff right. If you want to outlaw something, outlaw the standard gas water heater, and all the rest will work itself out. The problem is not hydronic heating. The problem is the lousy, unsafe standard gas water heater.

About this Report

This report was produced in cooperation with the Building America Program.

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