

# Does it matter what size the boiler is?

If you want to make a 20 year warranty boiler fail in less than five years...short cycle it!

**Design conditions**...it's what the heating industry makes a living on...we have to be able to heat the house to a set indoor temperature when the outdoor temperature is at the "design" conditions...the lowest temperature you would normally expect during the heating season. It makes sense; you obviously want to be able to keep your customer's home warm all winter long...especially during cold nights in January and February. So how do we size for the proper boiler?

The correct answer is—it depends. Is it a steam system or a hot water system? If it is a steam system, the best way to size the boiler is by counting the connected load. What I mean by that is figuring out the square foot of rating of all the radiators in the building and then selecting the boiler that has the closest square foot rating compared to what you calculated.

When tackling a steam system, the rules are a little different: First, it is an existing system, because **THERE ARE NO NEW** residential steam systems; and two, the reason to count the radiators is because steam is a gas and this gas desperately wants to turn back into its liquid state. When the steam leaves the boiler and en-

counters anything cooler than the temperature of the steam, it **WILL** condense back into water. And if your new replacement boiler can't produce enough steam to fill all of the radiators before the thermostat turns the boiler off, you will have cold rooms and unhappy customers.

If it is a hot water system, then the best approach to establish the proper boiler size (whether new home or replacing an existing boiler) is to perform a heat loss calculation on the home. With a hot water system, the heating medium is water, which will stay water as it leaves the boiler, flows through the radiation and comes back to the boiler. There are no "change of state" issues to deal with, unlike our steam system.

Unfortunately, often the replacement boiler is sized by either the "label" method or by counting the

amount of baseboard in the house. Either method is incorrect. Unless you were the one who installed the previous boiler and had performed a heat loss calculation to determine its size, can you trust the guy or company that had come before? Are you willing to place the reputation of you and your company at the feet of someone else who perhaps doesn't believe in sizing the boiler to the appropriate design conditions? What about the guys that count the amount of baseboard radiation in the house and size the boiler accordingly, stating that you have to have a boiler big enough to support the radiation? As we said earlier, true if you are talking a steam system, but absolutely false with hot water systems! I know guys that have been sizing hot water boilers like this for years and when we have a discussion about calculating a heat loss, they say it takes too long and it's too complicated. That may have been true in the past, but with a computer and some simple heat loss software, it has become very quick and straightforward.

One of the best lines I've heard to point out the flaw in this approach is radiation isn't heat loss. What does it matter how much baseboard or cast iron radiators are installed in an existing home heated with hot water? The heat loss is a function of several items, not the least of which are the R-values of the various building materials used in the construction of the house. These will influence the rate at which the heat manufactured by the boiler will leave the house, not the amount of baseboard installed along the walls. **HEAT GOES TO COLD!**

Unfortunately it is more common than not to find baseboard installed almost wall to wall in every room in the house. Also, over the years, windows can be upgraded to a higher thermal efficiency; insulation can be added or changed. All these changes will reduce



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the heat loss in a home. Think about some of the older homes you have been that are heated with cast-iron radiators. Those systems were installed a long time ago and most of those homes have gone through some type of renovation and upgrade that has changed the homes' original heat loss. Plus, the methods they used years ago to establish their original heat loss were "conservative" to say the least.

What's the big deal anyway if the boiler is too big? For years, boilers have almost always been oversized. The thought being, "Hey, if it's too big, they won't call complaining the house isn't warm enough on a very cold day." And while that statement is true and you can almost understand the logic, the "street smarts" behind it, times are changing. Energy costs are continuing to rise, people are becoming very aware of what it costs to heat their homes, the economy is struggling, people are worried about their employment and income. These are very different and also some very difficult times.

When a customer gets a new replacement boiler that is oversized, they are getting a disservice from the installing company. Why? Two words: Short Cycling! What's wrong with short cycling, you say? Well, there are two problems that occur, one is economical and the other is mechanical.

The mechanical problems occur because of the rapid on-off cycling of the boiler. All of the various components found on an oil-fired boiler have an expected life cycle. When a boiler is short cycling, the components are seeing all these cycles in a very short time span. This leads to premature control failures, nui-

sance lock-outs, service calls and frustrated customers. If you want to make a 20 year warranty boiler fail in less than five years—and frustrate you along the way—short cycle it!

The economical problem is often unknown and certainly under-appreciated. There exists in the industry an old rule of thumb that says that a short cycling boiler will operate at least 15 percentage points below its rated efficiency when the boiler is not short cycling. The loss of fuel efficiency can be staggering. Which means the wasted fuel consumption is paid for by the unsuspecting homeowner with the new high efficiency (oversized) boiler.

This is nothing new; it's just that energy costs are forcing homeowners to look at the heating bills. In years past, if a boiler short cycled, the consumer rarely complained and because the cost was relatively insignificant, the bills were paid. Things are different now and I don't think they will be changing back to the old ways. There is also pressure from the other fuel source and they are heavily promoting high efficiency condensing boiler technology. It is in your best interest to take care of your customer and one of the ways is by making sure you don't install an oversized boiler.

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