

Technical Bulletin

To: All Representatives, Distributors and Start-up Agents Subject: 28A and 28HE Stack Temperature

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Checking stack temperature is one of the simplest and least expensive methods to use to verify whether your boiler/burner unit is operating efficiently and within its rated capacity. All that is required is a thermometer. Smith Cast Iron Boilers is including a stack thermometer with every Series 28A and 28HE boiler. The stack thermometer is installed in a threaded opening located on the left side of the smoke-hood.

Normal expected high fire steady state operating temperatures on <u>newly</u> installed 28A or 28HE series boilers are noted on the chart shown below. Your new boiler should be operating near the recommended temperature.

	Recommended Stack Temperature			
	<u>Model #</u>	Nat. Gas	<u>#2 Oil</u>	
	28A	475°F ⁺²⁵	500°F ⁺²⁵	
	28HE	375°F ⁺²⁵	425°F ⁺²⁵	
All stack temperatures are Gross numbers				

Now, before anyone gets too excited if they see an elevated temperature let's discuss the details involved with stack temperature. A stack thermometer must be calibrated to guarantee accuracy. A calibrated gauge would show readings that will be close to the numbers provided on the above chart if the burner is properly adjusted and the boiler is new and clean. Gauges are sensitive to shock and vibration and may get out-of-calibration during shipping and handling operations.

Other elements that can effect stack temp are room temperature and excess air, which is indicated by the CO2 or O2 settings. The numbers represented on the chart above are the gross stack temperatures, since that is what the temp gauge reads. Gross stack temperature equals the actual stack reading plus the room temperature. We are assuming 75° F. room temperature. Any variance in room temperature will change the gross stack temp by the same amount. In addition, the excess air setting of the burner will effect the stack temperature. Many of today's power burners can operate cleanly down to 15% excess air. A good burner technician knows how to improve your fuel economy by optimizing the burner combustion adjustments.

We advocate using the listed stack temperatures as a guide. If the unit is new and has just been started up and the temp gauge is reasonably accurate the stack temperature should be close to the recommended temperature. A temperature reading of 25° F. or more above the advised temperature could indicate a problem such as a misadjusted burner, or the burner might be firing above the boiler's rated input. When the stack temperature is elevated it would be prudent to have a burner technician recheck the burner adjustment and firing rate. **Overfiring the boiler and improper burner adjustments violates the boiler warranty.**

Stack temperatures will rise over time as the unit gets dirty. This is due to scale and rust build-up in the heat exchanger. One method to utilize to verify if a boiler is getting dirty is to record the stack temperature when the unit is new or has just been cleaned and the burner is properly adjusted. When the temperature rises 100°F above the recorded (starting) number the unit needs to be serviced. A stack temperature that has increased 100° F is indicative of a dirty heat exchanger. This may originate from a smoky fire or condensing in the heat exchanger causing scale buildup but could be initiated by a host of other issues. No matter what the cause, it is time to have the unit serviced by a professional.

It is a common practice particularly with hot water boilers to under-fire them. Most boilers are oversized for their connected heating load during the majority of the heating season. This is because the boiler is sized for peak (coldest) demand, which is only reached a few times during the heating period. Because of the extra capacity the boiler has available during the "normal" winter temperatures the burner may short cycle numerous times in an hour. This syndrome is exacerbated when there are multiple boilers involved.

Even when modulating burners are used the units can short cycle. The ideal situation, especially if you have a low-hi-low or full modulation burner, is to have the burner operating in low fire most of the time. This keeps the on/off cycling to a minimum. Cycle rates in excess of 3-4 an hour are considered short cycling, which can have adverse effects on the boiler and burner, as well as diminishing efficiency and fuel savings. The way the building management control operates the burner/boiler also becomes a critical factor in preventing short cycling, but that is an issue for a future discussion. Under-firing the boiler is one way to minimize short cycling and increase fuel savings while not breaching the boiler warranty agreement.

Optimizing operating efficiency, minimizing fuel costs, and increasing fuel savings are subjects on everyone's minds these days. Monitoring stack temperature is a simple and inexpensive way to assure a properly adjusted heating unit, reduce service calls, save fuel, and is a valuable added feature that also helps ensure boiler warranty coverage.

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