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Condensing Boiler Venting Material (Part 2)

Monday Morning Minutes | by R. L. Deppmann

Proper venting of hydronic condensing boilers is critical for the safety of occupants and the successful operation of the heating plant. Part one of this two-part series introduced the materials available and what some of the code language allows. This article will provide information so the engineer and contractor can make an informed decision about what to use in condensing boiler venting materials.

Note: This article reviews the pros and cons of many materials available for venting in 2022. We will mention some key points from various codes in Michigan and Ohio. This is not an in-depth study of codes. It is important for the reader to verify all state and local codes as well as the requirements of the boiler manufacturer.

Part One of this series introduced the vent materials of PVC, CPVC, Polypro., and AL29-4C stainless. It also showed some maximum operating temperatures for each material. Let us focus on those temperatures.

Condensing Boiler Venting Temperatures

The nature of condensing hydronic boilers is their ability to operate at return water temperatures low enough to cross the dewpoint. This allows the vapor contained in the flue gas to become condensate and drain out of the boiler and vent. It drops the temperature of the flue gas.

When a boiler is condensing properly, the flue gas is about 20^0F to 30^0F above the return water temperature. What happens when the engineer designs the system, and the owner operates the system with a deep temperature difference or ΔT? Here is an example from a previous R. L. Deppmann Monday Morning Minutes (MMM) titled Condensing Boiler Temperature Rest for Increased Efficiency.

We design the system for a supply temperature of 180^0F and a return temperature of 140^0F. At design, the vented gas temperature would be about 160^0F to 170^0F. As the return temperature drops due to boiler temperature reset, the gas temperature follows.

Will the Vent Temperature Always be Slightly Higher Than the Return?

The engineer selects the venting materials to specify for condensing boilers. Can the engineer depend on the vent temperature being 20^0F higher than the design return water temperature? The simple answer is NO.

To start, there is an assumption that the terminal units will collectively provide the heat transfer scheduled at the temperatures scheduled. The terminal units are step-sized and for a given flow rate and supply temperature, the return temperature will be the variable.

Another critical issue is fouling of the heat exchanger and maintenance. Every condensing boiler manufacturer has an important maintenance schedule. Most owners do not do the required maintenance. The maintenance helps keep the efficiency high, allowing less excess temperature up the vent. Poor maintenance or boiler operating issues will show up in significant raises in flue temperatures. Temperatures well above 250^0F is possible.

Another concern is whether the condensing boiler your client owns operates at the efficiency it published. One of the manufacturers we represent tested their product and a well-known competitive product. At full fire and a 130^0F water temperature our boiler flue temperature was 160^0F. The competitor was at 230^0F!

So Why Do People Use the Poor Choice: PVC and CPVC?

Why does PVC get installed on condensing boilers? The starting statement is no surprise in the world of construction. The PVC materials are cheaper.

Many state and local codes will not allow PVC. Some do. Many manufacturers will not allow PVC. Many do but there are statements hidden in the IOM about temperatures and maintenance. In addition, there are safety sensors available. Many engineers do not specify the allowable materials to protect their clients. They allow the contractor to choose.

It is interesting that if the contractor properly cleans the PVC products and properly glues it with the proper glue, the labor hours may be more than the gasketed Polypropylene pipe.

You will see a vent system with sagging or discolored PVC material if you are in the industry long enough.

What Safety Measures are Available?

All condensing boiler manufacturers have an air temperature sensor available to sense the flue temperature. This sensor will throttle the boiler output if the flue temperature gets too hot. The engineer should verify their specification includes this sensor.

Why would this not be sufficient to use the lower temperature, lower priced, plastic vent materials? Think about it. Assume you have a high delta T system with a deep reset schedule. Most of the time everything will be fine since the return temperature is low. However, the situations when this safety feature may keep the boilers operating at full capacity is the exact same time when the weather conditions will require full capacity. This will not provide good service for the client.

There is concern – even in boiler systems with 100% radiant or snow melt. What if the boiler maintenance is completely ignored? What if the use of the boiler is changed? What if someone changes the settings? The occupants of the building could be in danger.

What Does Deppmann Recommend?

R.L. Deppmann prides itself on ***helping people make better decisions***. Be sure to follow local and state codes first. We strongly recommend limited the venting materials of construction to Polypropylene or AL29-4C in condensing boiler applications. Do not use PVC or CPVC.

Later this year we will offer some installation tips for condensing boiler applications in the R. L. Deppmann Monday Morning Minutes.

Series Part One: Condensing Boiler Venting Material