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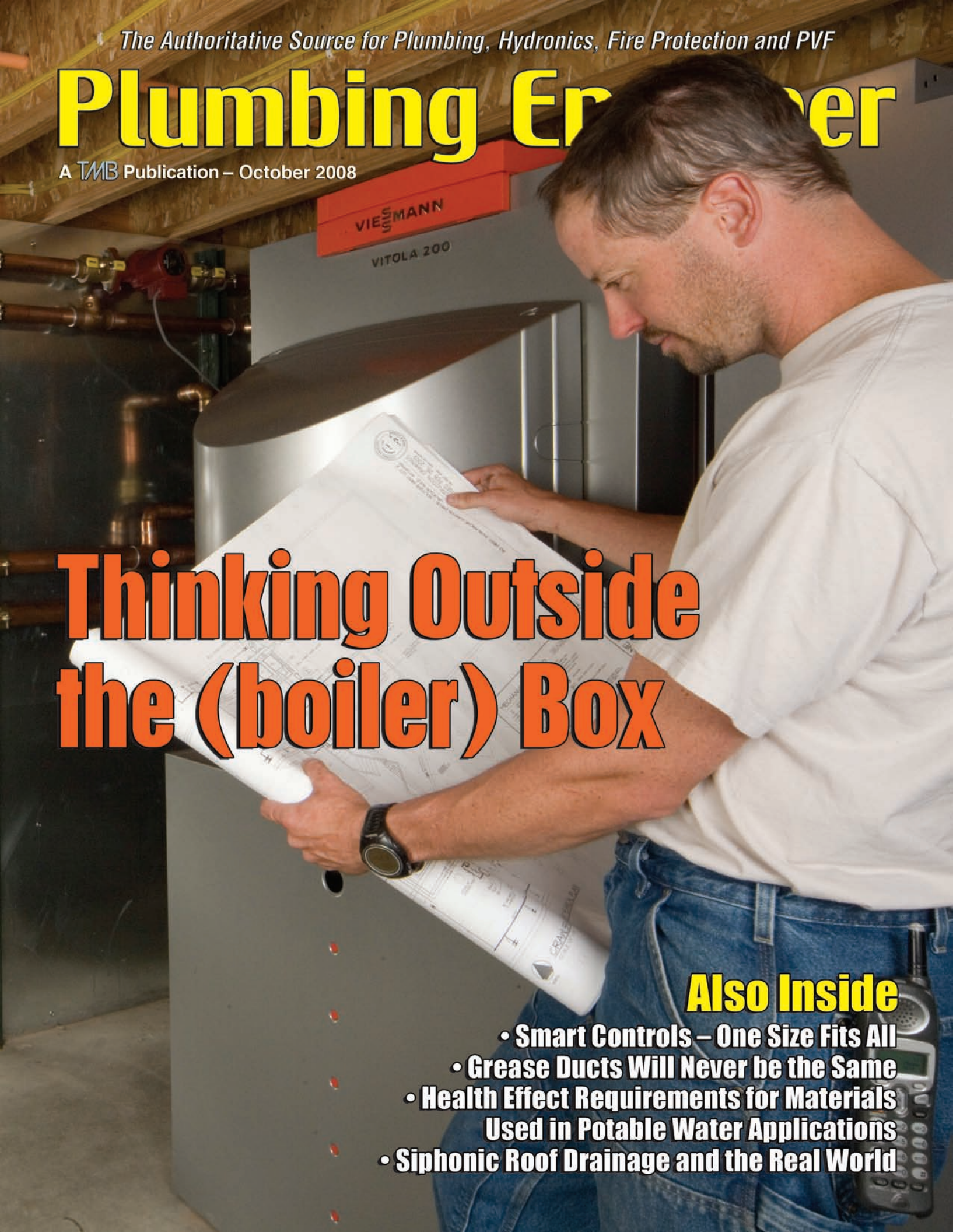

Thinking Outside the (boiler) Box

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Thinking outside the (boiler) box

By Stephen David

When it comes to choosing the right high-efficiency oil-fired commercial hydronic system, here's a piece of advice fueled by building owners' need to dramatically reduce routine maintenance charges and stratospheric fuel oil prices, "Think outside the boiler box."

In the race to achieve the best value amid skyrocketing oil prices and labor rates to maintain older, inefficient heating plant systems, certain variables and specifications come into play, many of which are external to the boiler itself. According to the Hydronic Institute division of the Gas Appliance Manufacturers Association, the industry standard for oil-fired systems is between 82 and 83 percent efficiency. When natural gas is not an option, engineers are looking to maximize on that IBR rating.

So where are they looking?

The control system is an ideal place to start. Common design shows older boilers maintaining a 180 - 200 F water temperature throughout the distribution system. One way to increase system efficiency is basically cruise control for boilers: It's called *outdoor reset*, a simple but ingenious control that varies hydronic supply water temperature based on outdoor ambient temperature. This function not only improves system efficiency but it also affects the overall comfort level due to the longer time period the zones are open. This technology allows the system to keep up with the heat loss instead of catching up with it. However, we still need to be aware of a boiler design's required minimum temperatures.

Consider, also, hydronic accessories. The four-way valve offers finite incremental adjustment to further enhance system performance. The valve is piped so that the system supply and return and the boiler supply and return meet at a crossroads. The boiler control senses the system supply water temperature, and the valve blends the appropriate amount of warmer boiler water with the system return water to achieve the required setpoint temperature.

A portion of the boiler supply water also blends with returning water to ensure that the water temperature is not too cold, which could cause thermal shock or flue gas condensation. This arrangement can be especially effective when a building has multiple risers; for instance, north and south sides naturally exposed to widely differing temperatures.

Consider the chimney or metal flue system as well. The boiler-return water temperature has a direct relationship with the flue gas temperature. The larger the delta T between the flue gas and the boiler water, the cooler the flue gas will become. The cooler the flue gas, the slower it goes up and the more time it has to form condensation on the cold walls of the stack. An exposed exterior chimney will cool the flue gas much faster than one within a building's interior. The condensate that may form contains sulfuric acid that, over time, will deteriorate the venting system. With this condition, the risk of carbon monoxide poisoning increases dramatically.

A well-insulated, properly sized venting system or stack liners will help to ensure that the flue gas leaves the system at a temperature above the dew point.

Do your homework

A valuable practice in the engineering trade is to specify system design and components as though we ourselves would own and be paying for operation of the building for life.

Some consideration should be given to the idea of replacing older, inefficient systems. In the United States thousands of older, fuel oil guzzling commercial boilers survive on "life support," chugging fuel greedily, sending massive amounts of carbon into the atmosphere and delivering a system efficiency of only 50 to 75 percent. At today's cost for fuel, it's no longer a "cut our losses" decision - it's a call to action with a very real and calculable payback.

Oil burner selection

Commercial oil burners are commonly configured with single or two stages depending on the boiler sizing. It's common that in low fire we'll cover the load, but if we need just a little more heat, a system may switch to high fire, during which the burner quickly makes temperature and shuts off. In a few minutes it would need to restart and re-purge the boiler, then these short cycles are repeated. A "low-high-low" burner, however, would keep the burner running to avoid inefficient short cycling. There is also the option of full modulation to achieve the best combustion results and dramatically reduce cycles.

Multiple boilers a better option?

If you want a high-efficiency system, it makes sense to start

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with a high-efficiency boiler. Without question, a key emphasis among manufacturing engineers designing these systems today is to maximize heat transfer to water. Designing systems with staged firing, modulation, and/or multiple boilers set up for lead-lag operation may produce higher *system* efficiency than trying to use a single boiler that claims higher *combustion* efficiency.

The key to combustion is to reach a steady state of efficiency; that is, to keep the burners running to minimize cycle losses. This ideal state saves on component wear as well. One way to achieve it is called "size to load." Some institutions will require 100 percent redundancy with multiple boilers, but a more strategic approach is to have varying sizes that handle different percentages of load so that one is kept running at maximum efficiency at all times.

The options outside of the boiler box can make your system run at a higher efficiency and achieve the best return on investment. A note about your installation procedures, fuel delivery systems and maintenance: These are areas where you don't need to think outside of the box; the installation and upkeep are exactly the same for a high-efficiency hydronic system.

In the crystal ball: oil condensing systems?

Present sulfur content of the #2 fuel creates highly acidic condensate. Condensing oil-fired systems will require the use of low-sulfur fuel currently used for diesel vehicles. The understanding is that fuel dealers would sell the low-sulfur diesel and, by law, would charge "road taxes." They would then file for the tax exemption, rebating the customer.

Neutralization of the condensate will need to be addressed. No doubt, venting material and design will play important roles. Oil-fired condensing boilers are currently available in Europe, so it may just be a matter of time and continuing fuel increases before we see them here in the United States. ■

For example

Viessmann's Vitorond VD 2A series, for example, is a commercial oil-fired boiler that operates at 87 percent efficiency firing on oil. Its triple-pass heat exchanger design allows it to accept cold return water. The boiler vessel is heavily insulated so that standby losses are minimized. The Viessmann Vitotronic control platform for single and multiple boiler applications uses an integrated low temperature protection. Sophisticated integrated electronics and sensors monitor and control mixing valves and system pumps, bringing the burner to full fire until the boiler minimum setpoint temperature is reached during start-up, preventing the formation of flue gas condensation and allowing for maximum heat transfer to the system. Once minimum setpoint is reached, the control system modulates the burner and system accessories to maximize overall system efficiency.

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