DuraVent®

FasNSeal® 80/90

Venting Solution Paves Way for High Efficiency Furnace Upgrades While Utilizing Existing Type B Gas Vent

Leaders in-Venting Innovation™

April 2019

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This paper is written with regard to applicable codes and standards and intended for use and application in the United States of America.

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Necessity is often the mother of invention, but it can also lead to the reimagining of a solution that already exists.

A product that has long been used to reline masonry chimneys is now being successfully applied as a venting solution in homes, enabling owners to upgrade to a higher efficiency condensing furnace or boiler in situations where such an upgrade might otherwise involve costly alterations to the home structure. The product includes, among other components needed to complete the installation, a stainless-steel flexible liner that can be installed inside an existing Category I Type B gas vent. It has been tested and shown to be compliant with relevant UL vent safety standards, as well as national fire and international fuel gas codes. Manufactured by DuraVent and marketed under the name FasNSeal® 80/90, this patented solution has also been rigorously tested and shown to be effective by Oak Ridge National Laboratory (ORNL) of the Department of Energy (DOE).

All of this has major implications for the DOE's embattled proposal to increase the efficiency standard for residential, non-weatherized gas furnaces and hot water boilers to 92% AFUE. The proposal and subsequent amendments have been in the throes of a complex federal rulemaking process since 2011. Those who oppose this increase frequently argue that the special venting requirements of high efficiency condensing equipment places burdensome retrofit cost to consumers.

The FasNSeal 80/90 takes much of the air out of these arguments.

Dilemmas of Existing Type B Common Vent Systems

It is a well-known fact that non-condensing and higher efficiency condensing furnaces/boilers have different venting requirements. Condensing equipment must be vented with material that can withstand the highly corrosive condensation that is produced as a result of lower temperature flue gases. This presents a perceived dilemma when an owner has two non-condensing gas appliances (e.g. an atmospheric water heater and a furnace) that are common vented with Type B vent and seeks to upgrade to a higher efficiency condensing furnace.

The traditional assumption has been that such an upgrade would require a separate vent to accommodate the new condensing appliance. This would entail penetration of an adjacent exterior wall or space to vertically run a second vent up through the roof. Depending on the level of finish within the home, this can add significant cost.

Adding a second vent creates another often overlooked problem. The orphaned water heater is left on its own to vent within an oversized chimney. If not corrected, exhaust from the hot water heater's outlet will simply spill right back into the structure. This is a health and safety concern that requires even more cost to fix.

These issues have become cornerstone arguments for those who oppose increases to efficiency standards for residential gas furnaces/boilers.

In 2013 the DOE set out on its own to find and test potential solutions, ultimately compiling the results in a 2-part study that was published in 2014/2015.

> *"In this study, a search for solutions was undertaken that included efforts devoted to inventing new solutions and monitoring developments by industry. Several prospective solutions were identified that appear to be simple and cost effective for retrofitting into Type B metal chimneys and/or masonry chimneys. Solutions for both metal and masonry chimneys are emerging from M&G DuraVent (DuraVent), the North American arm of M&G Group, believed to be the largest vent products company in the world."* [1]

[1] Ayyoub M. Momen, Jeffrey Munk, and Patrick Hughes, Condensing Furnace Venting Part 2: Evaluation of Same-Chimney Vent Systems for Condensing Furnaces and Natural Draft Water Heaters (Oak Ridge National Laboratory, February 2015), xiii.

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The solution submitted by DuraVent to the DOE was not exactly new. In fact, it had been used for years to reline masonry chimneys for the purpose of venting space-heating equipment like gas and wood stoves. Although this heating equipment is rated as non-condensing, condensation frequently occurs due to the cold surface temperature of the chimney at start-up. It is common practice to reline masonry chimneys with stainless steel flex to prevent condensate from eating away at the mortar. For these applications, DuraVent developed a two-ply flexible vent made of AL29-4C, a super-ferritic alloy that has excellent corrosion resistance to acidic condensation. The vent, which is simply inserted into the chimney, has a smooth inner wall that optimizes gas flow and facilitates condensate drainage.

It followed that the same material could be used to line B vent in a retrofit application involving an existing non-condensing water heater and a new condensing furnace/boiler where two non-condensing appliances were originally vented with B vent. The new condensing furnace/boiler would vent up through the flex liner. The existing non-condensing water heater would utilize the remaining perimeter of the B vent surrounding the liner.

Lab Results Support Effectiveness of DuraVent Solution

The ORNL set up full-scale evaluations in an experimental facility in which the venting performance of condensing furnaces and atmospheric combustion water heaters (vented through the same chimney) could be observed and recorded under various operating conditions. Laboratory workers had full control over the indoor depressurization so that various equipment solutions could be compared against a baseline configuration that consisted of a non-condensing furnace commonly vented with a natural draft water heater. The latter "baseline" configuration simulated a pre-retrofit scenario.

The solution submitted by DuraVent included a flexible, corrosion-resistant stainless-steel flex liner, a dual exhaust termination cap, and various fittings for connection to the condensing appliance. The flex liner was installed inside a Type B metal chimney just as it would be in the field. A Y-type fitting channels the flex off to the condensing appliance, while the existing Type B vent remains in place to vent the water heater (Figure 1).

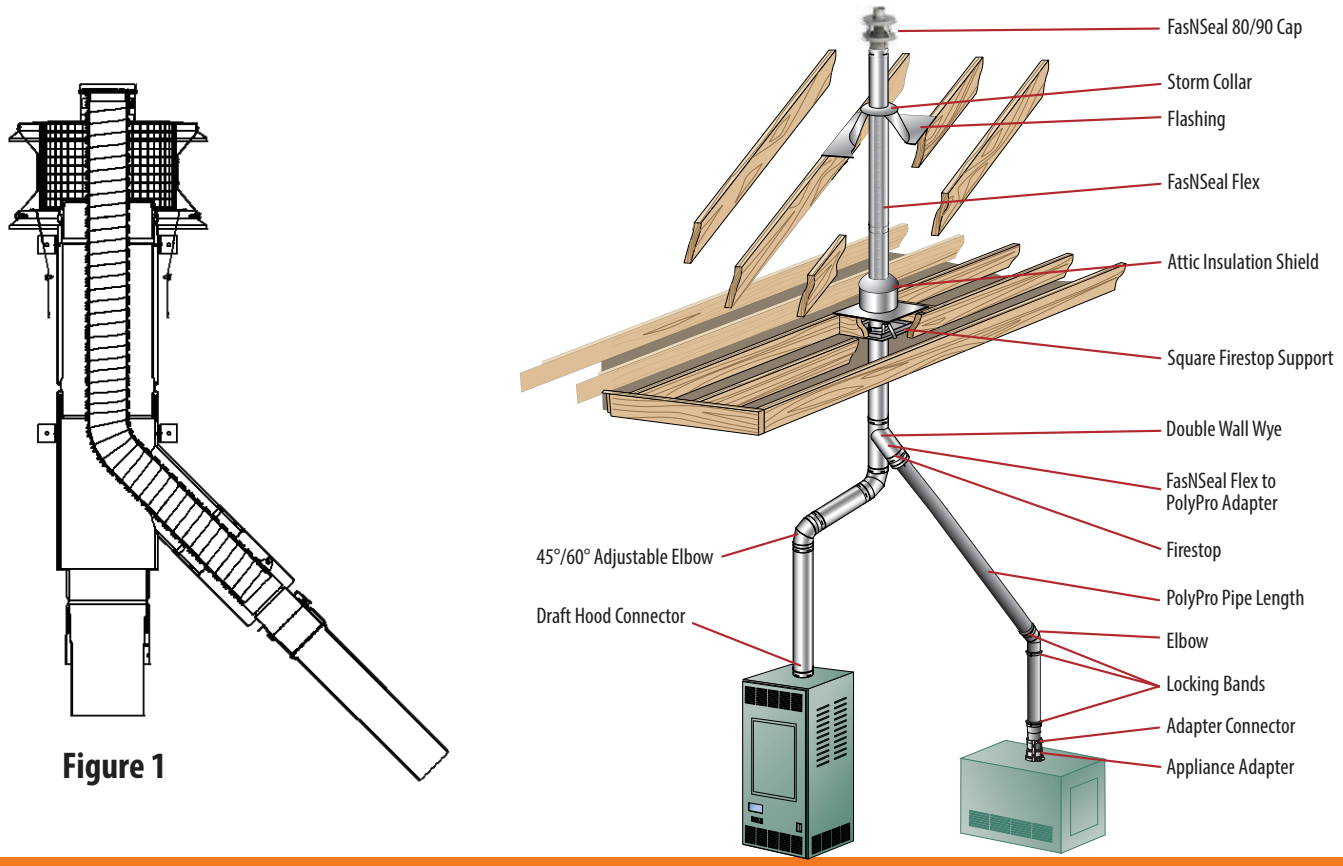

Figure 1

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The exhaust streams from the atmospheric water heater and the condensing furnace never mix. Rather, all of the exhaust from the furnace is contained within the stainless-steel flex, while the exhaust from the water heater is contained within the space between the flex and the B vent.

Properly sized, this configuration performs comparably to that of a non-retrofitted system. It performs better than a non-retrofitted system during warmer periods when the furnace is not in operation. Typically, when two non-condensing appliances are commonly vented, it takes the combined exhaust pressure from both appliances to efficiently vent. Of course, depending on the climate, there are many weeks or even months when the furnace doesn't operate at all, leaving it to the water heater alone to establish enough draft to overcome whatever depressurization exists in the home, plus a now oversized vent space.

All of this was authenticated by the tests performed by ORNL. The DuraVent solution was tested under three operating scenarios (water heater only, furnace and water heater, and furnace only) and compared with the baseline operation of the "pre-retrofit" configuration in terms of two specific metrics:

(1) Cold Vent Establishment Pressure (CVEP) - The lowest indoor negative pressure (depressurization level) at which the appliance can still establish and upward natural draft through a down-drafting cold vent.

(2) Warm Maximum Vent Depressurization (WVMD) – The depressurization level at which the operating appliance on a warm vent can still maintain a draft.

The results of the tests conducted by ORNL are shown in Table 1 and reflect the measured pressures under the various operating conditions of:

(1) An "existing" baseline system with Type B metal vent connected to two non-condensing appliances, and
(2) The DuraVent reline solution installed inside the original B metal chimney to vent a "new" condensing furnace.

Configuration	Operating Appliances	CVEP (Pa)	WVMD (Pa)
Baseline	Water Heater Only	-1.5 (ΔT=0°C)	-11.0 (ΔT=57.7°C)
	Water Heater + Noncondensing Furnace	-5.3 (ΔT=28.7°C)	-15.3 (ΔT=99.8°C)
	Noncondensing Furnace Only	-4.2 (ΔT=28.7°C)	-15.9 (ΔT=91°C)
Prospective Solution	Water Heater Only	-2.6 (ΔT=4.1°C)	-12.1 (ΔT=65.2°C)
	Water Heater + Condensing Furnace	-4.1 (ΔT=7.8°C)	-12.7 (ΔT=65.3°C)
	Condensing Furnace Only	No spillage or backdraft	No spillage or backdraft

Table 1. CVEP and WVMD performance comparison: Type B metal chimney baseline versus the M&G DuraVent B Vent reline solution (See Fig 1) installed inside the original Type B metal chimney.

According to the study,
"….it can be concluded that all of the baseline and solution cases have far more capability than needed to sustain draft on a warm vent. In the most challenging case—CVEP during water heater–only operation—the solution performs better than the baseline."[2]

[2] **Momen, Munk and Hughes, Condensing Furnace Venting Part 2, 19.**

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Safe, Simple and Relevant

As mentioned earlier, the DuraVent system uses tested and listed components that have a well-established safety record as a liner for masonry chimneys. All components bear the UL and ETL marks and the system is tested and compliant to UL1738, ULC S636, UL441, and UL1777 vent safety standards. It is also compliant with NFPA54 and IFGC gas codes.

"We have approval from UL to do this, even though building codes which only get rewritten every few years, do not yet reflect this. However, installers and contractors can see that the products are UL-labeled and once they understand how the system works – which is really quite simple – they are usually thrilled to know it exists," said Todd Lampey, Vice President of Residential Sales for DuraVent.
There are additional benefits to a FasNSeal 80/90 that are worth noting.

- Warm exhaust from the water heater reduces the potential for any icing to occur inside the condensing vent – a frequent problem in northern climates.
- The space taken up by the stainless-steel flex inside the existing Type B vent eliminates common oversizing issues of an "orphaned" B vent when it is left to exhaust only the non-condensing appliance.
- Since the venting system is vertical and exits from the roof, the installer and homeowner avoid common issues associated with side terminations, like wind, ice and building codes in certain jurisdictions where there is little space between housing.

Even though rule-making for new efficiency standards for residential furnaces/boilers will continue to play out for several more months (or even years), the FasNSeal 80/90 solution has significant relevance in the current market where 80% AFUE remains the standard.

Some states, including California, that have shown strong support for more stringent efficiency standards, have established their own prescriptive standards for high efficiency gas equipment that some contractors and consumers have embraced. Furthermore, utilities throughout the United States currently offer rebates that range from a few hundred dollars to over one thousand dollars to owners who choose gas fired appliances with efficiencies that exceed 90% AFUE. Finally, while some installers remain averse to change in general, an increasing number are using higher efficiency equipment as a way to differentiate their brand.

"Bottom line, installers and code officials need to know this solution exists and that it amounts to a fraction of the cost of a full-scale high efficiency upgrade," said Lampey.

For more information on venting solutions, visit:
www.duravent.com.

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