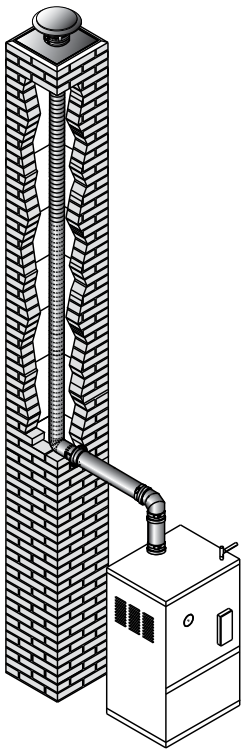
HOME SAFETY - Chimney Lining for Oil Fired Equipment

VENTINOX®

CHIMNEY LINING FOR OIL FIRED EQUIPMENT



When Congress passed the National Appliance Energy Conservation Act (NAECA) in 1987, it set in motion resurgence in the chimney relining industry. As gas and oil heating equipment manufacturers raced to meet the 1992 deadline imposed by NAECA, little attention was paid to the effects these higher efficiency appliances would have on their respective vent systems. It didn't take long for problems to arise in American homes, as lower stack temperatures emitted into conventional chimneys by these well engineered boilers or furnaces began taking their toll. The Gas Industry reacted quickly to these unexpected problems and sponsored a research project at Battelle Laboratories. The conclusions from the study led to the gas sizing charts and chimney relining opportunities we all enjoy today. Unfortunately, one segment of the heating market was overlooked in the original studies ... the Oil Industry and its venting needs.

Based on research at Brookhaven National Laboratories, sizing guidelines were finally made available for oil-fired appliances in 1997. After being accepted by the Standards Council of the National Fire Protection Association (NFPA), sizing tables were included in NFPA -31, the "Standard for the Installation of Oil-Burning Equipment". While many faithful VENTINOX® dealers may never see oil fired appliances, oil remains a significant heating option in twenty-two states. The updates to NFPA-31 and the sizing charts in its Appendix E, offer a wonderful opportunity for the chimney professional in oil heating regions. DuraVent is in the position to help with solid technical advice and offer a product in VENTINOX® that is economical and provides the perfect exhaust system for any heating equipment. Informational material is available through our distributors or directly from us. As always we appreciate your feedback.

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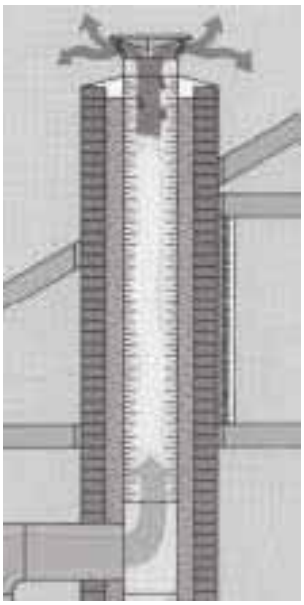

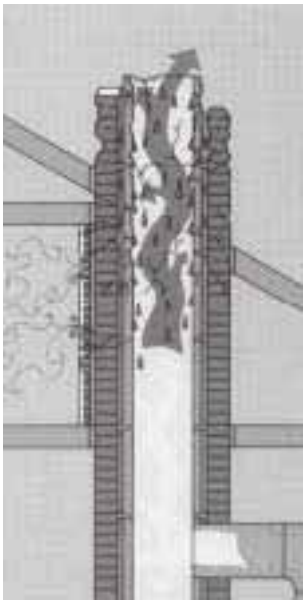

BROOKHAVEN NATIONAL LABS PRODUCE SIZING CHARTS & MORE!

After an extensive study conducted at Brookhaven National Laboratories, venting charts became available for oil-fired appliances for the first time in 1997. Before the results of the study were published and included in NFPA-31 Appendix E, the oil industry utilized a most basic approach to venting or paid no attention to venting at all. At best, oil vent recommendations were: "flue collar size must equal vent size". Of course, there was always the traditional "Bigger is Better" way of thinking. If an appliance featured an 8" flue collar and the chimney had an 8"X 12" tile liner, all the better!

When heating equipment manufacturers first introduced their new generation of high efficiency appliances, it was to meet federal standards. Today however, high efficiency has become a marketing strategy designed to offer the consumer products that promise reduced heating costs.

Keeping more available heat within the home rathQr than sending it up the chimney, increases efficiency. This is great for reducing energy consumption, but the resulting lower flue gas temperatures are often insufficient to sustain adequate draft in conventional masonry chimneys. As we all know, flue gases rise within a chimney, as long as they are warmer than the ambient outside temperature. The greater the temperature differential is, the better the draft that is generated and available to evacuate flue gases. We also have to realize that getting rid of flue gases on the exhaust side is only one part of the equation. As flue gases exit from one end of the heater, fresh air is drawn into it from the other side to provide oxygen for the combustion process. If a chimney creates only marginal or sluggish draft, oxygen supply may not be sufficient for the heater to perform to the expected efficiency ratings.
Consider VENTINOX® the breathing apparatus for any heating equipment. The exhaust system and heater have to be matched so that they can perform as a team and deliver performance and efficiency ratings established in the test labs.

Equipment performance is not the only concern when venting oil-fired heaters into conventional masonry chimneys. Today, the temperature range at the flue collar of an oil heater is commonly between 350 degrees F and 450 degrees F. By the timeflue gases flow through the connector pipe and from the bottom of a chimney to the top, they move along great surface areas and often cool below the dew point.

Let's look at a typical scenario and its consequences: the thermostat calls for heat and the boiler or furnace fires up. A plume of hot flue gases enters the bottom of the chimney and based on the strength of the draft, moves up and out of the home. This flue gas stream is maintained until the thermostat is satisfied and the heater shuts down. During the "on" cycle, flue surface temperatures increase from the bottom towards the top, as heat from the gases is absorbed into the chimney walls. Quite often, there is not enough latent heat available to elevate and keep surface temperatures above dew point (about 140°F). Flue gases cool down as they rise and may condense. Water accumulates on the walls of various inside portions of the chimney. This process of warming and cooling, (drying up and condensing), begins with every "on" and "off" cycle of a heater. These water deposits alone can cause significant damage to any chimney structure, as freeze and thaw cycles on the upper portion of a chimney can repeat themselves 10 to 15 times per day.

As if this was not enough cause for trouble, we have to deal with sulphur, a by-product of oil combustion that is also routinely deposited on flue surfaces. Combined with water (condensation), a highly aggressive acid forms that destroys traditional flue tiles, bricks & aluminum in short order.

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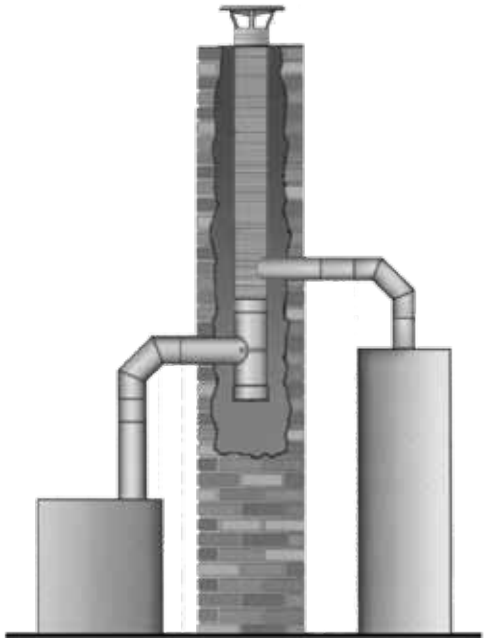

Poor draft, poor equipment performance and structural damage to chimneys were recognized as big problem areas caused by improper venting. The oil industry realized that these issues needed to be addressed, or its rightful place in the market would be lost.

The Brookhaven National Laboratories began to study the causes, effects, and solutions for venting oil appliances. Their conclusions were submitted to the NFPA and subsequently published for the first time as "Appendix E Relining Masonry Chimneys" of the 1997 edition of NFPA 31. The latest edition includes more than twenty revisions or new sub sections relating to venting oil appliances, including the acceptance of NFPA-211 's requirements for and definitions of a chimney. The sheer number of revisions reflected the changing attitude in this industry and its recognition that properly maintained and constructed vents were vital to the overall systems performance.

"SHOW ME THE MONEY""

About 130,000 oil-heating units are sold in the United States per year. These figures include replacement burners, new heating units and conversions from other heating systems, hot water heaters and new home construction. While a number of these units use alternative venting methods (Direct Vents, Class A Chimney Systems, etc.), the largest percentage is being installed into existing or new masonry chimneys with no consideration to vent size. These installations are tomorrow's business. But why not be proactive, instead of waiting until the systems fail and require extensive repairs to the chimney structure?

NFPA-31, 6.6.4. directs oil appliance installers (heating contractors) as follows: "prior to an installation of an oil burner or oil-fired appliance, the chimney or flue gas venting system to which it is to be connected shall be examined by a qualified person in accordance with the requirements of Chapter **11 of NFPA 211**, Standard for Chimneys, Fireplaces Vents and Solid Fuel Burning Appliances. If the chimney or flue gas venting system is found to inhibit the performance of the oil burner or oil-burning appliance, as specified by the manufacturer, or shows signs of imminent problems, the owner of the oil burner or oil-burning appliance shall be notified in writing."

Are you the "qualified person" that is being referred to in NFPA 31? The oil industry is looking for competent assistance. In past issues of "Oil Heating", one of the most widely read trade publications in that industry, articles have described the difficulties heating contractors had faced in regards to venting issues. They also mentioned how problems had been resolved or avoided in the first place by teaming up with professional chimney sweeps before every installation. These reports were read by thousands of heating contractors, who may seek out your special skills. But first, you must understand certain aspects specific to oil heating equipment and know how to design and install proper vent systems. By educating yourself, you too can tap into this growing market.

NEED A SALES TOOL?

See NFPA 31, APPENDIX E. E1."A tile-lined masonry chimney serving an oil-fired appliance should comply with applicable building codes such as NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances. An additional listed metal chimney liner could be needed to reduce transient low draft during start-up and acidic water condensation during cyclic operation. This is particularly true for high mass masonry chimneys serving oil-fired appliances producing relatively low flue-gas temperatures."

E.6 "After installation of a new oil-fired appliance or upgrade, if no chimney modifications were required at the same time of installation, the condition of the chimney should be re-checked after three months and

after six months of normal heating appliance operation to verify that the chimney is still in good condition and suitable for continued use. If any doubt exists regarding the condition of the chimney, examination by an experienced professional is again highly recommended and any problems must be corrected."

NFPA 31 refers to Appendix E on numerous occasions. There are three points that should stand out to any heating contractor:
1) By installing an oil-fired heater, he becomes responsible for the chimney system! Not just for the condition at the time of the installation, but its performance and condition over time. That is why the contractor should return after "three months and after six months" to check the chimney.
2) Installers are asked to seek the advice of "an experienced professional" .. That could be YOU!
3) Installers are told " ..... any problems must be corrected," That word "must" is very important, since it is not a request or a suggestion, but a directive.
National Fire Protection Association, NFPA-31

This book is a "must buy" for a chimney pro. For your copy call .800.344.3555 or visit their Web Site: catalog.nfpa.org

NFPA 31, 6.6.1 ***"Masonry and Metal Chimneys shall be erected in accordance with applicable building code requirements. Masonry chimneys also shall meet the requirements of Chapter 4 of NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances".***
NFPA 31, 6.6.5 "***Masonry chimneys shall be lined with an approved clay tile liner or a listed chimney lining system installed in accordance with the manufacturer's instructions***. "
With the acceptance of the standards established in NFPA 211, heating contractors must be made aware that connecting oil-fired appliances into unlined or damaged chimneys can have severe negative consequences for their business. Today, there are still thousands of unlined chimneys throughout the United States. This is especially true in many areas where oil is still a dominant heating option. Working in conjunction with local oil companies can open the doors for lining opportunities. Oil service companies are already servicing these accounts. They should be able to recognize vent problems and are now required to bring the systems up to code.

VENTINOX® -THE SOLUTION!

NFPA 31, 6.6.6 "When chimneys are relined, the liner shall be listed or shall be of an approved material that will resist corrosion, softening or cracking from the flue gases at a temperature appropriate to the class of service".
This sounds like a job for VENTINOX®. It has all the UL listings, approvals and the track record for this type of application.

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HOW TO SIZE A LINER?

Like gas tables that have been available for years, oil sizing tables have limitations and require you to get specific data to determine the proper size liner for a particular appliance. On the last page of this newsletter you will find the five sizing tables included in NFPA 31, Appendix E. The tables show Steady State Efficiency, Gross Temperature, Chimney Height, Lateral Distance, and Liner Sizes. At least 4 pieces of information are needed to determine the proper vent size. Most of this information is readily available, but the tables do present limitations:

1. Steady State Efficiency or AFUE-sizing tables are only available for appliances rated between 80% and 88% efficiency.

2. Chimney Height-tables are calculated only for chimneys that are between 10 and 45 feet tall.

3. Lateral Run-the appliance can't be located more that 10 feet from the chimney thimble.

4. GPH (Gallons per Hour)· The tables reflect nozzle sizes from .25 to 2.25 GPH. Remember, 1 GPH equals 140,000 BTU and you can convert information available on the appliance plate or product literature. Quite often, an appliance gives a range of nozzle sizes that can be used. If the exact information is not available, size to the maximum nozzle size or BTU rating.

5. Gross Temperature-sizing tables reflect only temperatures between 275 degrees F and 575 degrees F.

IMPORTANT NOTE: Oil sizing tables of Appendix E were calculated based on smooth liner surfaces. When using VENTINOX or any other flexible liner, the installer must take the corrugations into account. In NFPA 31, E.g it states as follows: « In common practice, a flexible liner might be used, which is rougher than the liner used in the analysis. In this application, to meet chimney capacity requirements, a reduction of about 15 percent in firing rate is in order". A simple way of applying this principle is to multiply the GPH (Gallons/Hour) or Btu by 1.15. Apply this new figure to the tables on the back page.

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METHODS OF EVALUATING OIL APPLIANCES

In order to use the tables, the user should first determine the approximate Steady-State Efficiency of the appliance being vented. This approximation can be made using one of three methods for a specific appliance.

NFPA 31, E10.1 THE FLUE LOSS METHOD involves adjusting the appliance burner for a satisfactory maximum flue gas C02 level minimum excess combustion air and a trace of No.1 smoke (Bacharach scale). To put it another way, the burner is run with a minimum of excess combustion air. The idea is to create a situation where the appliance operates at its lowest efficiency level possible and still sustains combustion. To create this condition, the appliance is allowed to burn for ten minutes before the flue gas temperature is taken at the appliance outlet. Be sure to readjust the burner to its original setting once the temperature has been obtained. The temperature thus measured is the gross temperature reflected at the top of the tables. This method is used with older appliances where efficiency ratings are not readily available or new burner systems may have been installed over the years.

NFPA 31, E10.2 THE HEATING CAPACITY METHOD is another means of obtaining the steady- state Efficiency of an appliance, using information normally found on the appliance plate. Take the appliance heating capacity (usually given in BTU's per hour) and divide that number by the input rate (1.0 GPH equals 140,000 BTU). Multiply the result by 100 and you get an approximate Steady State Value with which you can choose the proper sizing table.

NFPA 31, E.10.3 THE AFUE METHOD is the simplest method, but is usually available only when installing a new appliance and from information provided in sales literature from the heating appliance manufacturer. As part of the National Appliance Energy Conservation Act, all boilers and furnaces must have an AFUE (Annual Fuel Utilization Efficiency) of at least 80% and 78% respectively and that information must be posted on all new appliances. If you need to calculate the SteadyState Efficiency, add 1 percentage point to the AFUE value of a hydronic boiler and 2 percentage points to the AFUE value of a warm air furnace. With the SteadyState Efficiency so determined, you can select the proper sizing table to get to the recommended vent size.

TO INSULATE OR NOT TO INSULATE?

If you read NFPA 31, Appendix E, no direct reference to insulating liners is made. However, in the computational analysis done by strasser and Krajewski using the Oil Heat Vent Analysis Program (OHVAP) to calculate the vent tables, certain rules that were applied, indicate that stable flue surface temperatures are critical for systems performance and to assure applicability of the vent tables.

NFPA31, E.9 "In interpreting the OHVAP simulation results to develop the recommendations, two criteria for successful system performance are applied during the fourth cycle at the end of the appliance burner "on" period. These criteria are as follows:

(1) A minimum available winter time (42 degree F outside ambient temperature) pressure at the appliance of about -0.03 in. of water column and a negative pressure at all times at the appliance during burner "on".

(2) A minimum liner surface temperature at the top of the chimney at the end of the burner ·on" period of about 95 degree F (water dew point of diluted flue gas)".

The first point refers to the presence of proper drafting conditions; the second point assumes that condensation within the flue system is largely avoided. If you plan on using the sizing charts, these temperatures must be maintained throughout the system. Always keep in mind the location of the chimney (interior/exterior), chimney height, length of connector pipe, and winter ambient air temperature. If you have any doubts about keeping flue surface temperatures within assumed limits, ***INSULATE*** with **TherMix®** or **ProFoil®.**

Recommended **FIRING RATE CAPACITIES** and **METAL LINER SIZE** for Retrofitting Clay Tile-lined Masonry Chimneys. To be used when field inspection indicates relining is required. Base Case: Exterior Residential Clay TIle-lined Masonry Chimney Complying with NFPA211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances, subsections 3-2.2 through 3-2.7. Minimum Liner Temperature = 95 Degree F, Minimum Draft = 0.03 Inches of Water.

Table E-7 (a)

Steady-State Efficiency = 88%
(12 percent CO_2, 300°F gross)

HEIGHT FT	LATERAL FT	LINER 6 IN.	LINER 5 IN.	LINER 4 IN.
10	4	0.5-1.0	0.4-0.65	0.25
	10	0.4-0.75	NR	NR
15	4	0.65-1.25	0.4-0.75	0.4
	10	0.5-1.0	0.4-0.75	0.4
20	4	0.65-1.5	0.5-0.85	0.4
	10	0.65-1.25	0.65-0.85	0.4-0.5
25	4	0.75-1.5	0.65-1.0	0.5
	10	0.85-1.25	0.65-0.85	0.5
35	4	1.0-1.75	0.75-1.0	0.5
	10	1.0-1.5	0.75-1.0	0.5
45	4	1.25-1.75	0.85-1.0	0.65
	10	1.25-1.75	0.85-1.0	0.65

Table E-7 (b)

Steady-State Efficiency = 86%
(12 percent CO_2, 370°F gross)

HEIGHT FT	LATERAL FT	LINER 6 IN.	LINER 5 IN.	LINER 4 IN.
10	4	0.4-1.25	0.4-0.85	0.25-0.5
	10	0.4-.1.25	0.4-0.75	0.25
15	4	0.5-1.5	0.4-1.0	0.4-0.5
	10	0.5-1.25	0.4-0.85	0.4-0.5
20	4	0.65-1.75	0.5-1.0	0.4-0.5
	10	0.65-1.5	0.5-1.0	0.4-0.5
25	4	0.75-1.75	0.5-1.0	0.4-0.5
	10	0.75-1.75	0.65-1.0	0.4-0.5
35	4	0.85-2.0	0.65-1.25	0.5-0.65
	10	0.85-2.0	0.65-1.25	0.5-0.65
45	4	1.0-2.25	0.75-1.25	0.65-0.75
	10	1.0-2.0	0.85-1.5	0.65-0.75

Table E-7 (c)

Steady-State Efficiency = 84%
(12 percent CO_2, 440°F gross)

HEIGHT FT	LATERAL FT	LINER 6 IN.	LINER 5 IN.	LINER 4 IN.
10	4	0.4-1.5	0.25-.085	.025-0.5
	10	0.4-.1.25	0.25-0.85	0.25-0.4
15	4	0.5-1.75	0.4-1.0	0.25-0.65
	10	0.65-1.5	0.4-1.0	0.4-0.5
20	4	0.65-1.75	0.5-1.25	0.4-0.65
	10	0.65-1.75	0.5-1.0	0.4-0.5
25	4	0.65-2.0	0.5-1.25	0.4-0.75
	10	0.65-2.0	0.5-1.25	0.4-0.65
35	4	0.85-2.25	0.65-1.5	0.5-0.75
	10	0.85-2.25	0.65-1.25	0.5-0.75
45	4	1.0-2.25	0.75-1.5	0.65-0.75
	10	1.0-2.25	0.75-1.5	0.65-0.75

Table E-7 (d)

Steady-State Efficiency = 82%
(12 percent CO_2, 505°F gross)

HEIGHT FT	LATERAL FT	LINER 6 IN.	LINER 5 IN.	LINER 4 IN.
10	4	0.4-1.5	.025-1.0	0.25-0.5
	10	0.4-1.5	0.25-0.85	0.25-0.5
15	4	0.4-1.75	0.4-1.25	0.25-0.65
	10	0.4-1.75	0.4-1.0	0.25-0.65
20	4	0.5-2.0	0.4-1.25	0.4-0.75
	10	0.5-2.0	0.4-1.25	0.4-0.75
25	4	0.5-2.25	0.5-1.5	0.4-0.75
	10	0.65-2.0	0.5-1.25	0.4-0.75
35	4	0.65-2.25	0.65-1.5	0.5-0.85
	10	0.75-2.25	0.65-1.5	0.5-0.85
45	4	0.75-2.25	0.75-1.5	0.5-0.85
	10	0.85-2.25	0.75-1.5	0.5-0.85

Table E-7 (e)

Steady-State Efficiency = 80%
(12 percent CO_2, 575°F gross)

HEIGHT FT	LATERAL FT	LINER 6 IN.	LINER 5 IN.	LINER 4 IN.
10	4	0.25-1.75	0.25-1.0	0.25-0.65
	10	0.4-1.5	0.25-1.0	0.25-0.65
15	4	0.4-2.0	0.4-1.25	0.25-0.75
	10	0.5-2.0	0.4-1.25	0.25-0.75
20	4	0.4-2.25	0.4-1.5	0.4-0.85
	10	0.4-2.0	0.4-1.25	0.4-0.75
25	4	0.4-2.25	0.4-1.5	0.4-0.85
	10	0.65-2.25	0.5-1.5	0.4-0.85
35	4	0.5-2.25	0.5-1.75	0.4-0.85
	10	0.65-2.25	0.65-1.5	0.4-0.85
45	4	0.65-2.25	0.65-1.75	0.5-1.5
	10	0.65-2.25	0.65-1.75	0.5-0.85

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Ventinox
Ventinox VFT, made from 316Ti stainless steel, can withstand high temperatures associated with solid fuel fired heaters, as well as the corrosive environments typical in gas or oil vents. Tested and listed for all-fuel, and can also be used for wood, gas, or oil-fired equipment.

Ventinox VG is the ultimate choice for venting gas fired appliances, where highly corrosive condensate formation (hydrochloric acid) within the flue is likely. The super-ferritic alloy exhibits extreme resistance to chloride pitting, crevice, and stress corrosion and cracking.

Ventinox Components
Ventinox components are made from either 316SS (VFT) or super-ferritic stainless steel (VG). Components feature an integral locking band, avoiding the use of pop rivets. Liners and components provide a penetration free top to bottom connection.

When venting solid fuel heaters, Ventinox VFT must be insulated with either TherMix or ProFoil blankets to meet UL 1777 requirements. For all other applications, insulation is highly recommended for increased efficiency and draft performance. See the end of the DuraFlex SS for the insulation section to find information on our offering: TherMix, ProFoil, AluFoil Tape and ProMesh.

TherMix
Use to fill space between a liner and inside masonry chimney. Ready-mix formula cures into lightweight. Semi hard mass that insulates the liner and dissipates the intense heat created in a chimney fire.

ProFoil
Use as insulator for stainless steel liners in masonry chimneys. UL Listed insulation. Size is based on vent diameter.