InterNACHI

"How to Inspect Fireplaces, Stoves, and Chimneys" course
http://www.nachi.org/inspect-fireplace-stove-chimney-course.htm

Student Course Material

A visual inspection of the fireplace and chimney is required by the International Standards of Practice for Performing a General Home Inspection, which is available at http://www.nachi.org/sop.htm. According to the Standards, the inspector is required to inspect: readily accessible and visible portions of the fireplaces and chimneys; lintels above the fireplace openings; damper doors by opening and closing them, if readily accessible and manually operable; and cleanout doors and frames.

Goal

The goal of the inspection is to provide observations which may lead to the decrease of hazardous conditions associated with fireplaces and chimneys. If the inspection reveals that an existing chimney is not safe for the intended application, it must be repaired, rebuilt, lined, relined or replaced with a vent or chimney to conform to building standards.

Scope

The scope inspection is limited to readily accessible and visible portions of the fireplace and chimney. The inspection should not be considered all-inclusive or technically exhaustive. The inspection involves a visual-only examination the readily accessible portions of the chimney exterior, interior and accessible portions of the appliance and the chimney connection.

An inspector should look at the general structure of the chimney and any connections to appliances, stoves and heating systems. The inspector should also look for improper installation, obstructions, and combustible deposits.

The inspector should advise his/her client that all fireplaces, fuel-burning stoves, and chimneys should be inspected by a certified chimney sweep prior to the client's first use, and not less than annually.

Let's go over the major components of the fireplace and chimney systems, and then we'll go through the steps of performing an inspection of a fireplace.

Quiz 1

Chimney

A chimney is a vertical shaft through which exhausts smoke and gases from fuel-burning heating systems, stoves, appliances and fireplaces. The chimney could be built of masonry or metal pipe materials. The flue liner, chimney inner wall or vent inner wall must be continuous and free of cracks, gaps, perforations, or other damage or deterioration that would allow the escape of combustion products, including gases, moisture and creosote. A solid-fuel-burning fireplace, stove, or heating system must not connect to a chimney venting another fireplace, stove, or heating system.

Chimney Connection

Connectors are used to connect fireplaces, stoves, and heating system to the vertical chimney or vent, except where the chimney or vent is attached.

Connectors must be made of factory-built chimney material, Type L vent material or single-wall metal pipe having resistance to corrosion and heat and thickness not less than that of galvanized steel. Connectors must be accessible or removable for inspection and cleaning.

At a masonry chimney flue, the connector vent pipe must connect at a point at least 12 inches above the lowest portion of the interior of the chimney flue. Unused openings in chimneys and vents should be closed.

Connector vent pipes should be installed in accordance with the manufacturer's installation instructions. Stoves and heating systems shall be located as close as practical to the chimney. Connectors must be as short and straight as possible. Connectors should be sloped at least $^{1}/_{4}$ inch of rise per foot of run.

Connector joints should be fastened with sheet metal screws or rivets.

A single-wall metal pipe used as a vent connector passing through a wall, ceiling or floor must be guarded by a ventilated, noncombustible metal thimble and must maintain a minimum 6 inches of clearance between the thimble and combustibles. A noncombustible thimble must be used where a single-wall metal pipe passes through a roof constructed of combustible material.

For unlisted single-wall chimneys and vent connectors, a single-wall metal pipe used as a vent connector must maintain a minimum 18 inches of clearance between the metal pipe and combustibles.

Inlet

Inlets to masonry chimneys must enter from the side. Inlets must have a thimble made of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

3-2-10 Rule for Masonry Chimneys

Chimneys should be high enough to prevent downdrafts caused by wind. A masonry chimney should extend at least 3 feet above the highest point where the chimney passes through the roof, 2 feet above any portion of a building that is within a 10 feet horizontal distance. This is the 3-2-10 rule for masonry chimneys.

Clearance

House framing components should be at least 2 inches away from the chimney wall. Open spaces between the chimney wall and the combustible building material should be sealed and insulated with incombustible material.

Masonry Chimney Footing

A masonry chimney has its own footing and is built in such a way that the chimney provides no support to, nor receives support from, the house structure. The chimney footer may be connected with the house foundation and footing.

Footings for masonry chimneys must be made of concrete or solid masonry at least one foot thick. The footing should extend at least 6 inches beyond the face of the fireplace or foundation wall on all sides. Footings for masonry fireplaces must extend below the frost line. Footings must be installed on natural, undisturbed earth or engineered fill below frost depth. In climate areas not subjected to freezing, footings should be at least one foot below the finished grade.

Quiz 2

Chimney Lining

All masonry chimneys must lined. The chimney lining must be appropriate for the type of fireplace, stove, appliance, or heating system connected to it.

The walls of the masonry chimney with a clay interior flue should be at least 4 inches thick, considering a standard brick is 3 and 5/8th of an inch wide. The minimum standard thickness for a flue lining is 5/8 of an inch thick.

The size of the chimney depends on the number and size of the flues. The flue for a heating system or fireplace should have enough cross-sectional area and height to create a good draft.

Clay Lining

Masonry chimneys can have clay, ceramic, cast-in place, or metal conduit flue linings. Modern standards require liners to be installed in all masonry chimneys. Unlined chimneys are not safe. A home with a chimney without a flue lining is a material defect. The purpose of a flue is to contain the combustion products, direct them to outside, and protect the masonry chimney walls from heat and corrosion. Masonry chimneys without flue liners must be professional inspected and corrected by certified chimney contractors to meet modern safety standards.

Clay tiles are the most common type of masonry chimney liners. Clay tile flue linings can be square, rectangular and circular. They come in all different sizes, diameters and cross-sectional areas. The general rule is that a single flue should be used for only one heating system. You may find the vent from a gas-fired furnace and a gas-fired water tank connected into one flue.

The clay flue lining should extend above the top brick course or masonry crown a minimum of 4 inches. The masonry crown must be sloped in order to direct water away from the flue and off the chimney top.

Metal Flue Lining

Metal chimney flue liners are usually made of stainless steel or aluminum. They are used to upgrade and repair existing masonry chimneys. Stainless steel is suitable for wood-burning, gas, or oil applications. Aluminum is an inexpensive alternative only for certain medium-efficiency gas heating systems.

Cast-In Place Lining

A cast-in-place chimney flue liner is made of a lightweight cement-like product installed inside the chimney. The cast-in-place lining is a smooth, seamless stack. They can help correct the structural integrity of an old chimney. Cast-in-place are suitable for all fuels.

Fuel-Gas Vent Terminations



It is a common mistake to apply chimney termination-height requirements (3-2-10 rule) to fuel vents, which cause vents to extend above roofs much higher than needed, in most cases. For example, vent pipes terminating above roof slopes up to 6:12 need to be only 1 foot high.

The type of venting materials is dependent upon the operating characteristics of the appliance being vented. Appliances can be characterized with respect to:

- positive or negative pressure within the venting system; and
- whether or not the appliance generates gases that condense in the venting system.

Regardless, all appliances must be connected to venting systems. The venting system must never extend into or pass through any fabricated air duct or furnace plenum. It must convey an adequate, positive flow of flue or vent gases to the outdoors directly.

There are several types of venting system that can be used, including: plastic piping; special gas vents designed by the manufacturer; and masonry, metal, and factory-built chimneys.

Type of Venting System to Be Used	
Appliance	**Type of Venting System**
Category I appliances Appliances with draft hoods Appliances with Type B vents	Type B gas vent Chimney Single-wall metal pipe Listed chimney lining for gas venting Special gas vent listed for the appliance
Listed vent wall furnaces	Type B-W gas vent
Category II appliances	As specified by manufacturer of the appliance
Category III appliances	As specified by manufacturer of the appliance
Category IV appliances	As specified by manufacturer of the appliance
Unlisted appliances	Chimney
Decorative appliances in vented fireplaces	Chimney
Direct-vent appliances	As specified by manufacturer of the appliance
Appliance with integral vent	As specified by manufacturer of the appliance

Gas vents that are 12 inches or less in size and located at least 8 feet from a vertical wall or similar structure should terminate above the roof in accordance with the Gas Vent Terminations table below.

Gas Vent Terminations	
Roof Pitch	**Minimum Height in Feet (& in Meters)**
flat to 6/12	1 (0.30)
6/12 to 7/12	1-1/4 (0.38)
over 7/12 to 8/12	1-1/2 (0.46)
over 8/12 to 9/12	2 (0.61)
over 9/12 to 10/12	2-1/2 (0.76)
over 10/12 to 11/12	3-1/4 (0.99)

over 11/12 to 12/12	4 (1.22)
over 12/12 to 14/12	5 (1.52)
over 14/12 to 16/12	6 (1.83)
over 16/12 to 18/12	7 (2.13)
over 18/12 to 20/12	7-1/2 (2.27)
over 20/12 to 21/12	8 (2.244)

The table requirements indicate that a greater vent height above the roof is needed as the roof pitch approaches being a vertical surface. The greater the roof slope, the greater the effect of the wind hitting the roof's surface.

Gas vents that are greater than 12 inches in size or that are located less than 8 feet from a vertical wall or similar structure should terminate at least 2 feet above the highest point where they pass through the roof, and not less than 2 feet above any portion of a dwelling within 10 feet horizontally. There are other requirements for direct-vent fireplaces, appliances with integral vents, and appliances using mechanical draft fans.

Quiz 3

Type B and Type L

Type B or L gas vent must terminate at least 5 feet in vertical height above the highest connected appliance draft hood or flue collar. Type B-W gas vent must terminate at least 12 feet in vertical height above the bottom of the wall furnace.

Gas vents shall extend through the roof flashing, roof jack or thimble, and terminate with a listed cap or assembly.

Type B Vents

Type B vents are vents suitable only for listed, draft-hood equipped, gas-fired appliances, including most domestic heating and hot water systems.

They may not be used with any of the following appliances:

- wood-burning appliances, such as fireplaces and wood-burning stoves;
- incinerators;
- oil-fired equipment;
- coal-fired equipment;
- any appliance that burns anything other than liquid petroleum or natural gas; or
- any appliance that produces flue gasses that exceed 480° F (249° C).

Type B vents must be equipped with their own special chimney caps. If the cap is damaged or lost, it should not be substituted with something not recommended by the manufacturer. The clearance required from combustible materials is printed on the flue's exterior metal surface, and is generally 1 or 2 inches.

Type L Vents

Type L vents are designed for venting approved oil-fired and natural-gas appliances that produce draft hood flue gasses that do not exceed a temperature of 570º F, or 926º F for 10 minutes in an over-fire situation. The minimum clearance from combustible materials is generally 3 inches. Type L vents must not be used to vent coal- or wood-fired appliances.

It may be difficult to tell the difference between Type L and Type B vents because they are made from similar components, but the vent type should be clearly printed on the vent. Both are double-walled, although Type L vents generally have a stainless steel inner wall, while Type B vents do not.

Regardless of the vent type, InterNACHI inspectors may check for the following defects:

- deterioration of the outer wall, which is likely caused by failure of the inner metal lining;
- violation of roof clearance requirements. All metal vents must terminate at least 2 feet above the roof surface and at least 2 feet above any portion of the building within 10 horizontal feet.
- missing components, such as a chimney cap;
- firestops not installed at either the top or bottom side of the joist where the vent passes through floors or the roof. The firestop should allow a fire-resistance rating equal to or greater than the floor or roof assemblies through which the vent passes;
- blocked bird screens, often caused by freezing moisture in cooler climates;
- crucial joists, rafters or other load-bearing structural members that have been cut to allow for the vent to pass. Plumbing and electrical lines should also not be disturbed by the vent; and
- whether the vent is too high or too low. Manufacturers may set minimum and maximum height requirements for the whole vent assembly, such as the AirJet Type L vent, whose minimum height is 6 feet and maximum height is 30 feet.

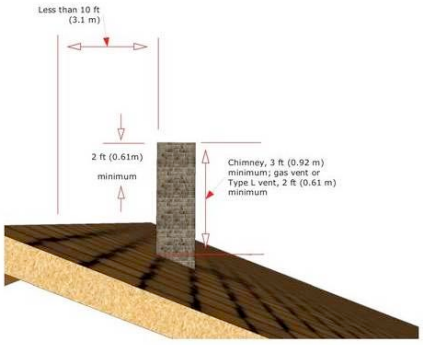
Inspectors may recommend that extra corrosion resistance for vents be provided by a stainless steel cap, stainless steel jacketed pipe sections, or stainless steel or aluminum flashings and storm collars. They may also recommend that clients use commercially available combustion-enhancing, acid-neutralizing fuel additives to prevent damage caused to vents from sulfuric acid.

In summary, Type B and Type L vents are designed to vent gasses from specific types of appliances and under certain conditions.

Masonry Chimney Termination (The 3-2-10 Rule):

Type L venting systems should terminate with a listed and labeled cap at least 2 feet above the roof and at least 2 feet above any portion of the building within 10 feet (Type L 2-2-10 rule).

Chimneys should extend at least 2 feet higher than any portion of a building within 10 feet, but shall not be less than 3 feet above the highest point where the chimney passes through the roof (Chimney 3-2-10 rule).



Quiz 4

Corbeling

Masonry chimneys are sometimes corbeled, which means that successive courses are extended outward for several courses. Sometimes corbeling is observed from the unfinished attic space. Corbeling is usually observed in a location of the chimney just before the chimneystack rises up through the roof.

Masonry chimneys shall not be corbeled more than one-half of the chimney′s wall thickness from a wall or foundation. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

Chimney Flashing

Chimney flashing is installed where the chimneys stack meets the roof covering to prevent water penetration. Flashing is typically made from corrosion-resistant metal such as copper. Counter flashing is installed into the mortar joints and is then folded downward to cover the step or base flashing.

Chimney Cricket

When the chimney has a dimension parallel to the ridgeline greater than 30 inches and does not intersect the ridgeline, a chimney cricket must be provided. Flashing and counter flashing must be installed at the intersection of the cricket and the chimney. The height of the cricket depends upon the slope of the roof. The lower the slope, the shorter the cricket height.

Chimney Crown (or Cap)

All masonry chimneys should have a concrete, metal or stone crown. The chimney crown (also referred to as the chimney wash or chimney cap) is the top element of a masonry chimney. It covers and seals the top of the chimney from the flue liner to the chimney edge. The crown should provide a downward slope that will direct the water from the flue to the edge of the crown. The overhanging drip edge, by directing the run-off from the crown away from the chimney, helps prevent erosion of the brick and mortar in the chimney's vertical surfaces.

Most masonry chimneys are built with an inadequate crown constructed from common mortar mix. The crown must be designed for years of weather abuse without cracking, chipping or deteriorating. A proper chimney crown should be constructed of a Portland cement-based mixture and cast or formed so it provides an overhang projecting beyond all sides of the chimney by a minimum of two inches. The flue liner tile should also project above the crown a minimum of 4 inches.

Quiz 5

Fireplace Hearth

The hearth is made up of two parts, front and back. The front hearth is located in the front of the fireplace combustion chamber, and the back hearth is located within the fireplace combustion chamber. The back hearth is made up of firebrick that can withstand heat from fire.

The hearth is typically completely supported by the fireplace structure. The hearth is built initially with framing components that make up a temporary support structure for the hearth. Then concrete is poured and reinforcement is installed in the pour. The temporary support is removed after the concrete is completely cured. No combustible material should remain in place under the hearth and hearth extension after construction.

The inspector should expect for hearths to be made of concrete or masonry. The inspector should inspect for hearths that have a thickness of less than 4 inches.

Fireplace Lintel

The lintel that is located over the fireplace opening and supports the masonry above must be made of noncombustible material. The minimum bearing length of on each end of the lintel is 4 inches.

Fireplace Size

The size of the fireplace is based upon the size of the room. Most fireplaces will be sized large enough to receive a 2-foot long piece of firewood. With few design exceptions, the firebox of a concrete or masonry fireplace should be at least 20 inches deep.

Firebox Side and Rear Walls

The space inside the fireplace is the combustion chamber or firebox. The firebox walls, which extend upward to the damper location, should be made of solid masonry units (firebrick) at least 2 inches thick or other approving lining. Width of the mortar joints of the firebrick should not exceed ¼ inch. The mortar is a special type of clay mortar just for fireplace combustion chambers that can withstand excessive heat.

The fireplace firebox walls are slanted to reflect heat energy into the room. This angle of the walls is referred to as splay. Splay slope is usually 5 inches per foot. The sloped walls help direct smoke into the throat of the fireplace.

Fireplace Throat

The throat of the fireplace is located above the combustion chamber. It controls the efficiency of the fireplace. The rising smoke passes through the throat and enters the front side of the smoke chamber.

Fireplace Damper

Manually operated dampers can be installed only in connectors or chimneys serving solid-fuel-burning fireplaces or stoves.

The damper is located above the fire and is used to control the combustion and to prevent conditioned room air from escaping up the flue.

The damper must be made of a ferrous metal. The damper must be operable from the room containing the fireplace.

When there is smoke rising through the throat opening above the combustion chamber, the open damper is designed to control the downdraft. When hot gases and smoke are rising up through the throat, it passes up into the front side of the smoke chamber. The rapid upward movement of the gases creates a downdraft on the rear side of the smoke chamber. One purpose of the opened damper door is to direct the downdraft back up into the smoke chamber and prevent the downdraft from pushing smoke into the room.

Fireplace Smoke Shelf

The smoke shelf is located behind the damper. The smoke shelf helps the open damper to change the direction of the downdraft. A fireplace will work well when the smoke shelf is deep. Some smoke shelves are curved.

Fireplace Smoke Chamber

The smoke chamber is located between the top of the throat to the bottom of the flue. Smoke would enter the room without this smoke chamber. Its size is large enough to hold a lot of smoke.

The interior surfaces of the smoke chamber are usually sloped and coated with about ½ inch thick layer of cement mortar.

Fireplace Ash Dump

The ash dumps are not required for every fireplace. It depends on the type of fireplace and foundation. Cleaning of the fireplace may be possible from the fireplace opening.

The ash dump is usually located in the rear hearth when there is an ash pit constructed below the fireplace. The ash dump is essentially an opening in the rear hearth through which ashes and debris are passed. The ash dump is a pivoting metal door installed on a metal frame. The ash dump is often made of cast iron. The homeowner cleans the fireplace by sweeping the cold ashes into the ash dump. The ashes fall downward and end up in the ash pit below. The ash pit must have a clean-out door.

When the house has a slab-on-grade foundation, the ash pit might not be as deep. But it would still require a clean-out of some type, usually accessed from the exterior. This design of having the fireplace clean-out door accessible from the exterior may be used when the fireplace is located on an outside wall.

For slab-on-grade foundations, a raised hearth will provide enough space for an ash pit under the fireplace. The clean-out door would have to be elevated high enough above grade in cold weather climates to help prevent the door being blocked by snow.

Ash Dump Cleanout

Cleanouts for ash dumps must be made of ferrous metal or masonry doors and frames built to stay closed tightly. Access the cleanout door should be provided and made readily available so that removal of ashes will not create a hazard.

Cleanout openings shall be provided within 6 inches of the base of each masonry chimney flue.

Exterior Air

Factory-built or masonry fireplaces must be provided with an exterior air supply to assure proper fuel combustion unless the room is mechanically ventilated.

The exterior air intake must supply all of the combustion air from the exterior of the dwelling or from spaces within the dwelling ventilated with outside air such as ventilated crawlspace or ventilated attic spaces.

The exterior air intake must not be located within the garage or basement of the house.

Chimney Flue Size

The cross-sectional area of a chimney flue is based upon the area of the fireplace opening. One rule of thumb is that the flue area should be at least 1/10th of the total fireplace opening.

Glass Doors

Glass door enclosures can be installed on a fireplace opening. The enclosure helps reduce the amount of heated room air from escaping up the chimney. The rate of combustion can be controlled with the glass enclosure and by adjusting the damper and draft vents that might be installed.

Quiz 6

Factory-built (Prefabricated) Fireplaces

Factory-built fireplaces are commonly installed in homes, because they are less expensive than a masonry fireplace to install, and they come in a wide range of styles. Some factory-built fireplaces have a zero clearance to combustibles, which means that the house wooden framing can come in contact with the fireplace components.

Factory-built fireplaces operate in the same way that masonry fireplaces do. They share the same components. Room air can enter a factory-built fireplace at the bottom of the unit, near the floor, and wrap around the firebox through chambers. As the air is heated around the firebox, it flows upward. At the top of the factory-built fireplace, air registers allow the warm circulating air to exit and enter the room. Some fireplaces are equipped with circulating fans.

Factory-built fireplaces do not require a concrete foundation. Although most factory-built fireplaces are metal, pre-manufactured, modular, masonry fireplaces are also available. These masonry models incorporate special engineering techniques, including venting systems.

Factory-built Chimneys

A factory-built chimney should be installed according to the manufacturer's instructions. All pre-fabricated chimneys must have a label from an approved agency. The label should state the type of appliance with which the chimney was tested for use, a reference to the manufacturer's instructions, and the minimum clearances to combustibles. The manufacturer's instructions should contain every aspect of the installation of the chimney, including component assembly, clearances, supports, terminations, fire-blocking or fire stops, and connections.

Factory-built chimneys require no masonry construction. Factory-built chimneys are made of double or triple-walled sections of metal pipe. Flanges and fittings are used to secure the fireplace and flue to the house framing. Spacers provide proper clearances from combustible materials. The top of the factory-built chimney has a storm collar to divert rainwater from the chimney pipe to the chimney flashing. A chimney cap must be installed on the top of the flue pipe.

When a factory-built chimney is used with a solid-fuel burner or an appliance with corrosive gases, the inside flue pipe should be made of stainless steel or have a porcelain coated surface.

Chimneys for factory-built fireplaces will often require specific clearances and support components. Openings through the ceiling and roof should be carefully sized and constructed to provide the correct clearances. The openings through which the chimney passes should be blocked with fire-stop spacers and support boxes.

When the factory-built fireplace is located on an exterior wall, a chase can be constructed around the chimney to contain and protect it. The exterior walls of the chase are often sided with the same exterior-covering materials as the rest of the house.

Panel Walls

The refractory panel walls of a factory-built fireplace require replacement when a nickel, on end, can be inserted into the crack or when the surface of the refractory panel has abraded more than 1/4" from the original surface. Replacement of the refractory panels should be completed by a qualified professional.

Quiz 7

Wood-Burning Stoves

A wood-burning stove (also known as a wood stove) is a heating appliance made from iron or steel that is capable of burning wood fuel. Unlike standard fireplaces, wood stoves are typically contained entirely within the living space, rather than inset in the wall.

Wood stoves come in many different sizes, each suited for a different purpose:

- Small stoves are suitable in single rooms, seasonal cottages or small, energy efficient homes. These models can also be used for zone heating in large homes where supplemental heating is needed.
- Medium-size stoves are appropriate for heating small houses or mid-size homes that are intended to be energy-efficient and as inexpensive as possible to maintain.
- Large stoves are used in larger homes or older homes that leak air and are located in colder climate zones.

To ensure safe and efficient use of wood-burning stoves, inspectors can pass along the following tips to their clients:

Never:

- burn coal. Coal burns significantly hotter than wood, posing a fire hazard;
- burn materials that will emit toxic chemicals, such as wood that has been pressure-treated or painted, colored paper, gift wrap, plastic, plywood, particleboard, or questionable wood from furniture;
- burn wet wood. Generally speaking, it takes six months for cut, stored wood to dry out and be ready for use in wood-burning stoves;
- burn combustible liquids, such as kerosene, gasoline, alcohol or lighter fluid;
- let small children play near a lit wood-burning stove. Unlike standard fireplaces, the sides of which are mostly inaccessible, all sides of wood stoves are exposed and capable of burning flesh or clothing; or
- let the fire burn while the fire screen or door is open.

Always:

- use a grate to hold the logs so that they remain secured in the stove and the air can circulate adequately to keep the fire burning hot;
- keep the damper open while the stove is lit;
- dispose of ashes outdoors in a water-filled, metal container;
- check smoke alarms to make sure they are working properly; and
- periodically remove the stovepipe between the stove and the chimney so that it can be inspected for creosote. Homeowners may want to hire a professional to perform this service.

Efficiency and Air Pollutants

While federal and state governments crack down on vehicle and industrial emissions, they do relatively little to limit the harmful air pollution emitted from wood stoves. The problem is so bad that, in many areas, the smoke from wood stoves is the largest single contributor to that city's air pollution. Smoke from wood stoves can cause a variety of health ailments, from asthma to cancer.

To mitigate these concerns, the EPA sets requirements for wood-stove emissions based on the design of the stove: 4.1 grams of smoke per hour (g/h) for catalytic stoves, and 7.5 g/h for non-catalytic stoves. Some state laws further restrict airborne particulates, and many new models emit as little as 1 g/h. These two approaches -- catalytic and non-catalytic combustion -- are described briefly as follows:

- In catalytic stoves, the smoky exhaust passes through a coated, ceramic honeycomb that ignites particulates and smoke gasses. Catalysts degrade over time and must eventually be replaced, but they can last up to six seasons if the stove is used properly. Inadequate maintenance and the use of inappropriate fuel result in an early expiration of the catalyst. These stoves are typically more expensive than non-catalytic models, and they require more maintenance, although these challenges pay off through heightened efficiency.
- Non-catalytic stoves lack a catalyst but have three characteristics that assist complete, clean combustion: pre-heated combustion air introduced from above the fuel; firebox insulation; and a large baffle to create hotter, longer air flow in the firebox. The baffle will eventually need to be replaced as it deteriorates from combustion heat.

The following indicators hint that the fire in a wood-burning stove suffers from oxygen deprivation and incomplete combustion, which will increase the emission of particulates into the air:

- It emits dark, smelly smoke. An efficient stove will produce little smoke.
- There is a smoky odor in the house.
- There is soot on the furniture.
- The stove is burning at less than 300º F. A flue pipe-mounted thermometer should read between 300º F and 400º F.
- The flames are dull and steady, rather than bright and lively.

To ensure efficiency, practice the following techniques:

- Purchase a wood-burning stove listed by Underwriters Laboratories. Stoves tested by UL and other laboratories burn cleanly and efficiently.
- Burn only dry wood. Wood that has a moisture content (MC) of less than 20% burns hotter and cleaner than freshly cut wood, which may contain half of its weight in water.
- Burn hardwoods, such as oak, hickory and ash once the fire has started. Softwoods, such as pine, ignite quicker and are excellent fire starters.
- Make sure the stove is properly sized for the space. Stoves that are too large for their area burn inefficiently.
- Burn smaller wood rather than larger pieces. Smaller pieces of wood have a large surface area, which allows them to burn hotter and cleaner.

In summary, wood-burning stoves, if properly designed and used appropriately for the space, are efficient, clean ways to heat a home.

Quiz 8

Visual Inspection

Initial Inspection

The inspector should inspect for solid fuel-burning appliances or fireplaces improperly located where gasoline or other flammable vapors or gases are present.

The inspector should inspect for unused openings in chimneys and flues.

The inspector should inspect for lack of a smoke detector. A smoke detector should be installed in the same room as the fireplace.

The inspector should inspect for lack of a carbon-monoxide detector. A carbon-monoxide detector should be installed in the same room as the fireplace.

Fireplaces

The inspector should inspect for combustible lintels above fireplace openings.

The inspector should inspect for combustible material within 6 inches above fireplace openings that projects out 1½ inches or less from the face of the fireplace.

The inspector should inspect for combustible material within 12 inches above fireplace openings that projects out more than 1½ inches from the face of the fireplace.

The inspector should inspect for throats or dampers located less than 8 inches above fireplace openings.

The inspector should inspect for manually operated dampers that do not operate or close properly.

The inspector should inspect for dampers and damper components that have rust or corrosion.

Hearths, Hearth Extensions and Fire Chambers

The inspector should inspect for hearths that are not made of concrete or masonry.

The inspector should inspect for hearths that have a thickness of less than 4 inches.

The inspector should inspect for hearth extensions that have a thickness of less than 2 inches.

The inspector should inspect for hearth extensions that are less than 16 inches in front of or less than 8 inches beyond each side of fireplace openings (6 square feet or less).

The inspector should inspect for hearth extensions that are less than 20 inches in front of or less than 12 inches beyond each side of fireplace openings (greater than 6 square feet).

The inspector should inspect the hearth, hearth extension and chambers for joint separation, damage or deterioration.

Single-Wall Metal Chimneys

Initial Single-Wall Metal Chimney Inspection

The inspector should inspect for single-wall metal chimneys in one- and two-family dwellings. Single-wall metal chimneys should not be used in one- and two-family dwellings.

The inspector should inspect for wall protectors (heat shields) with less than 1-inch air gaps.

Interior Single-Wall Metal Chimneys

The inspector should inspect for exposed interior single-wall metal chimneys that are not continuously enclosed where they extend through closets, storage areas, or habitable spaces, or where the surface of a chimney could come into contact with people or combustible materials.

The inspector should inspect for interior single-wall metal chimneys for distances less than 18 inches from wood frame walls or combustible materials.

The inspector should inspect for interior single-wall metal chimneys 18 inches or under in diameter that are less than 2 inches from non-combustible walls.

The inspector should inspect for interior single-wall metal chimneys over 18 inches in diameter that are less than 4 inches from non-combustible walls.

Exterior Single-Wall Metal Chimneys

The inspector should inspect for distances between exterior-mounted, single-wall metal chimneys that are less than 2 feet from doors, windows or walkways.

The inspector should inspect for distances between exterior-mounted, single-wall metal chimneys that are less than 18 inches from wood-frame walls or combustible materials.

The inspector should inspect for distances between exterior-mounted, single-wall metal chimneys 18 inches or under in diameter that are less than 2 inches from non-combustible walls.

The inspector should inspect for distances between exterior-mounted, single-wall metal chimneys over 18 inches in diameter that are less than 4 inches from non-combustible walls.

Chimney Outlets

The inspector should inspect for missing thimbles where chimneys pass through combustible roofs.

The inspector should inspect for chimneys that terminate less than 3 feet above the highest point where they pass through the roof surface.

The inspector should inspect for chimneys that terminate less than 2 feet above any portion of a building within 10 feet.

The inspector should inspect for chimneys that terminate less than 3 feet from adjacent buildings or building openings.

The inspector should inspect for chimneys that terminate less than 10 feet above grade or walkways.

The inspector should inspect for chimney outlets that jeopardize people, overheat combustible structures, or that might cause flue gases to enter nearby building openings.

The inspector should inspect the crowns of masonry chimneys for slopes that direct water into flues.

Flues and Liners

The inspector should inspect for galvanized flues and connectors. Flues and connectors should not be galvanized.

The inspector should inspect readily accessible and visible flues for rust or corrosion.

The inspector should inspect for masonry chimneys that are not lined. All masonry chimneys should be lined.

The inspector should inspect for linings that don't extend the entire length of the chimney to a level of 4 inches or more above the crown, splay or wash.

The inspector should inspect for liners that are visibly softened, cracked, deteriorated or damaged.

The inspector should inspect readily accessible and visible flues and liners for excessive accumulation of creosote, soot, or other combustible material.

The inspector should inspect for flues that have two or more openings at the same level.

The inspector should inspect for venting into the space around and between liners. The remaining space surrounding a chimney liner should not be used as a vent.

Flue Size

The inspector should inspect the size of the flue, if visible, and compare it to the size of the fireplace opening. This relationship is the most important factor in achieving sufficient draft. A flue that is too small relative to the fireplace opening will be unable to lift and remove hazardous flue gases to the outside.

Maximum Fireplace Opening for Round Flues

Round Flues	Maximum Fireplace Opening
4 inches in diameter	150 square inches
5 inches in diameter	235 square inches
6 inches in diameter	339 square inches
7 inches in diameter	461 square inches
8 inches in diameter	603 square inches
9 inches in diameter	763 square inches
10 inches in	942 square inches

diameter	
11 inches in diameter	1,140 square inches
12 inches in diameter	1,357 square inches
13 inches in diameter	1,592 square inches
14 inches in diameter	1,847 square inches
15 inches in diameter	2,120 square inches
16 inches in diameter	2,412 square inches
17 inches in diameter	2,723 square inches
18 inches in diameter	3,053 square inches
19 inches in diameter	3,402 square inches
20 inches in diameter	3,769 square inches
21 inches in diameter	4,156 square inches
22 inches in diameter	4,561 square inches
23 inches in diameter	4,985 square inches
24 inches in diameter	5,428 square inches
25 inches in diameter	5,890 square inches
26 inches in diameter	6,371 square inches
27 inches in diameter	6,870 square inches

28 inches in diameter	7,389 square inches
29 inches in diameter	7,926 square inches
30 inches in diameter	8,482 square inches

Maximum Flue Size, in Square Inches, for Rectangular Flues

Find the maximum size of the fireplace opening by matching the flue dimensions to the left column and top row of chart.

	6"	**7"**	**8"**	**9"**	**10"**	**11"**	**12"**	**13"**	**14"**	**15"**	**16"**	**17"**	**18"**	**19"**	**20"**	**21"**	**22"**	**23"**	**24"**	**25"**	**26"**	**27"**	**28"**
4"	240	280	256	288	320	352	384	416	448	480	512	544	576	608	640	672	704	736	768	800	832	864	896
5"	300	350	400	450	400	440	480	520	560	600	640	680	720	760	800	840	880	920	960	1000	1040	1080	1120
6"	360	420	480	540	600	660	576	624	672	720	768	816	864	912	960	1008	1056	1104	1152	1200	1248	1296	1344
7"	420	490	560	630	700	770	840	910	784	840	896	952	1008	1064	1120	1176	1232	1288	1344	1400	1456	1512	1568
8"	480	560	640	720	800	880	960	1040	1120	1200	1024	1088	1152	1216	1280	1344	1408	1472	1536	1600	1664	1728	1792
9"	540	630	720	810	900	990	1080	1170	1260	1350	1440	1530	1296	1368	1440	1512	1584	1656	1728	1800	1872	1944	2016
10"	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1700	1900	1600	1680	1760	1840	1920	2000	2080	2160	2240
11"	660	770	880	990	1100	1210	1320	1430	1540	1650	1760	1870	1980	2090	2200	2310	1936	2024	2112	2200	2288	2376	2464
12"	576	840	960	1080	1200	1320	1440	1560	1680	1800	1920	2040	2160	2280	2400	2520	2640	2760	2304	2400	2496	2592	2688
1	62	91	10	11	13	14	15	16	18	19	20	22	23	24	26	27	28	29	31	32	27	28	29

3"	4	0	40	70	00	30	60	90	20	50	80	10	40	70	00	30	60	90	20	50	04	08	12
14"	672	784	1120	1260	1400	1540	1680	1820	1960	2100	2240	2380	2520	2660	2800	2940	3080	3220	3360	3500	3640	3780	3136
15"	720	840	1200	1350	1500	1650	1800	1950	2100	2250	2400	2550	2700	2850	3000	3150	3300	3450	3600	3750	3900	4050	4200
16"	768	896	1024	1440	1600	1760	1920	2080	2240	2400	2560	2720	2880	3040	3200	3360	3520	3680	3840	4000	4160	4320	4480
17"	816	952	1088	1530	1700	1870	2040	2210	2380	2550	2720	2890	3060	3230	3400	3570	3740	3910	4080	4250	4420	4590	4760
18"	864	1008	1152	1296	1800	1980	2160	2340	2520	2700	2880	3060	3240	3420	3600	3780	3960	4140	4320	4500	4680	4860	5040
19"	912	1064	1216	1368	1900	2090	2280	2470	2660	2850	3040	3230	3420	3610	3800	3990	4180	4370	4560	4750	4940	5130	5320
20"	960	1120	1280	1440	1600	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600
21"	1008	1176	1344	1512	1680	2310	2520	2730	2940	3150	3360	3570	3780	3990	4200	4410	4620	4830	5040	5250	5460	5670	5880
22"	1056	1232	1408	1584	1760	1936	2640	2860	3080	3300	3520	3740	3960	4180	4400	4620	4840	5060	5280	5500	5720	5940	6160
23"	1104	1288	1472	1656	1840	2024	2760	2990	3220	3450	3680	3910	4140	4370	4600	4830	5060	5290	5520	5750	5980	6210	6440
24"	1152	1344	1536	1728	1920	2112	2304	3120	3360	3600	3840	4080	4320	4560	4800	5040	5280	5520	5760	6000	6240	6480	6720
25"	1200	1400	1600	1800	2000	2200	2400	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	5750	6000	6250	6500	6750	7000

26"	1248	1456	1664	2080	2288	2496	2496	2704	3640	3900	4160	4420	4680	4940	5200	5460	5720	5980	6240	6500	6760	7020	7280
27"	1296	1512	1728	1944	2160	2376	2592	2808	3780	4050	4320	4590	4860	5130	5400	5670	5940	6210	6480	6750	7020	7290	7560
28"	1344	1568	1792	2016	2240	2464	2688	2912	3136	4200	4480	4760	5040	5320	5600	5880	6160	6440	6720	7000	7280	7560	7840
29"	1392	1624	1856	2088	2320	2552	2784	3016	3248	4350	4640	4930	5220	5510	5800	6090	6380	6670	6960	7250	7540	7830	8120
30"	1440	1680	1920	2160	2400	2640	2880	3120	3360	3600	4800	5100	5400	5700	6000	6300	6600	6900	7200	7500	7800	8100	8400

Connectors (Solid Wood-Burning Appliance to Chimney)

The inspector should inspect for connectors from solid fuel-burning appliances that have a rise to the chimney of less than ¼-inch per foot.

The inspector should inspect for connectors that are not as short or straight as possible.

The inspector should inspect for connectors that are covered with insulation.

The inspector should inspect for connectors of natural-draft appliances connected to the positive pressure-side of a mechanical draft system.

The inspector should inspect for larger connectors entering a flue above smaller connectors.

Cleanouts

The inspector should inspect cleanouts for doors and frames that are not made of ferrous metal, pre-cast cement, or other non-combustible material.

The inspector should inspect combustible materials projecting beyond the faces of chimneys that are within 18 inches of cleanout openings.

The inspector should inspect for combustible materials stored within 18 inches of cleanout doors.

The inspector should inspect cleanout doors that are obstructed or do not close tightly.

The inspector should inspect the interior cleanout's lower edge for heights above the lowest accessible floor level that are less than 16 inches.

The inspector should inspect the exterior cleanout's lower edge for heights above grade that are less than 16 inches.

The inspector should inspect the bases of chimney flues for distances that are not between 6 and 12 inches below the bottom edges of their cleanout openings.

Quiz 9

Sample Reporting Language

Fireplace and Chimney Inspection Report

Client: _____

Location of fireplace and chimney: _____

This inspection was performed in substantial compliance with the International Standards for Performing a General Home Inspection. The inspection shall include examination of readily accessible and visible portions of solid fuel-burning, low-heat fireplaces and chimneys. The inspection is not all-inclusive or technically exhaustive. The goal of this inspection is to provide observations which may lead to the decrease of the hazards associated with fireplaces and chimneys.

___The inspector noted solid fuel-burning appliances or fireplaces located where gasoline or other flammable vapors or gases were present.

___The inspector noted unused openings in chimneys or flues.

___The inspector noted missing smoke detectors. A smoke detector should be installed in the same room as the fireplace.

___The inspector noted missing carbon-monoxide detectors. A carbon-monoxide detector should be installed in the same room as the fireplace.

___ The inspector noted a combustible lintel over the fireplace opening.

___The inspector noted combustible material within 6 inches above the fireplace opening that projected out less than 1½ inches from the face of the fireplace.

___The inspector noted combustible material within 12 inches above the fireplace opening that projected out more than 1½ inches from the face of the fireplace.

___The inspector noted the throat or damper was located less than 8 inches above the fireplace opening.

___The inspector noted that the manually operated damper did not operate or close properly.

___The inspector noted that the damper or damper components had rust or corrosion.

___The inspector noted that the hearth extension had a thickness of less than 2 inches.

___The inspector noted that the hearth extension was less than 16 inches in front of or less than 8 inches beyond each side of the opening (fireplace opening less than 6 square feet).

___The inspector noted that the hearth extension was less than 20 inches in front of or less than 12 inches beyond each side of the opening (fireplace openings 6 square feet or greater).

___The inspector noted hearths, hearth extensions or chambers that had joint separation, damage or deterioration.

___The inspector noted single-wall metal chimneys in one- or two-family dwellings. Single-wall metal chimneys should not be used in one- and two-family dwellings.

___The inspector noted wall protectors (heat shields) with less than 1-inch air gaps.

___The inspector noted an exposed interior single-wall metal chimney that was not continuously enclosed where it extended through closets, storage areas, or habitable spaces, or where the surface of the chimney could come into contact with combustible materials or people.

___The inspector noted an interior single-wall metal chimney less than 18 inches from a wood-frame wall or combustible material.

___The inspector noted an interior single-wall metal chimney 18 inches or under in diameter less than 2 inches from a non-combustible wall.

___The inspector noted an interior single-wall metal chimney over 18 inches in diameter less than 4 inches from a non-combustible wall.

___The inspector noted that the distance between an exterior-mounted, single-wall metal chimney was less than 2 feet from a door, window or walkway.

___The inspector noted that the distance between an exterior-mounted, single-wall metal chimney was less than 18 inches from a wood-frame wall or combustible material.

___The inspector noted that the distance between an exterior-mounted, single-wall metal chimney 18 inches or under in diameter was less than 2 inches from a non-combustible wall.

___The inspector noted that the distance between an exterior-mounted, single-wall metal chimney over 18 inches in diameter was less than 4 inches from a non-combustible wall.

___The inspector noted a missing thimble where a chimney passed through a combustible roof.

___The inspector noted a chimney that terminated less than 3 feet above the highest point where it passed through a roof surface.

___The inspector noted a chimney that terminated less than 2 feet above a portion of a building (ridge, wall or parapet) within 10 feet.

___The inspector noted a chimney that terminated less than 3 feet from an adjacent building or building opening.

___The inspector noted a chimney that terminated less than 10 feet above grade or a walkway.

___The inspector noted a chimney outlet that jeopardized people, overheated combustible structures, or that might cause flue gases to enter nearby building openings.

___The inspector noted the slope of a crown of a masonry chimney that directed water into the flue.

___The inspector noted galvanized flues or connectors. Flues and connectors should not be galvanized.

___The inspector noted a rusted or corroded flue.

___The inspector noted a masonry chimney that was not lined. All masonry chimneys should be lined.

___The inspector noted a lining that didn't extend the entire length of the chimney to a level of 4 inches or more above the crown, splay or wash.

___The inspector noted a liner that was visibly softened, cracked, deteriorated or damaged.

___The inspector noted a liner that had excessive accumulation of creosote, soot, or other combustible material.

___The inspector noted a flue that had two or more openings at the same level.

___The inspector noted an appliance venting into the space around and between liners. The remaining space surrounding a chimney liner should not be used as a vent.

___The inspector noted that the size of the flue was too small relative to the size of the fireplace opening. This relationship is the most important factor in achieving sufficient draft. A flue that is

too small relative to the fireplace opening will be unable to lift and remove hazardous flue gases to the outside.

___The inspector noted a connector from a solid fuel-burning appliance that had a rise to the chimney of less than ¼-inch per foot.

___The inspector noted a connector that was not as short or straight as practicable.

___The inspector noted a connector that was covered with insulation.

___The inspector noted a connector of a natural-draft appliance connected to the positive pressure-side of a mechanical draft system.

___The inspector noted a larger connector entering the flue above a smaller connector.

___The inspector noted a cleanout door or frame that was not made of metal, pre-cast cement, or other non-combustible material.

___The inspector noted combustible materials projecting beyond the face of the chimney that were within 18 inches of a cleanout opening.

___The inspector noted combustible materials stored within 18 inches of a cleanout door.

___The inspector noted a cleanout door that was obstructed or did not close tightly.

___The inspector noted that the height of an interior cleanout's lower edge was less than 16 inches above the lowest accessible floor level.

___The inspector noted that the height of an exterior cleanout's lower edge was less than 16 inches above grade.

___The inspector noted that the base of a chimney flue was not between 6 and 12 inches below the bottom edge of its cleanout opening.

This inspection was performed by: _____

Signature: _____

Date: _____

Water Damage

All masonry and factory-built fireplaces and chimneys can be adversely affected by direct contact with water. All chimneys can deteriorate from prolonged contact with water. Masonry materials deteriorate quickly when exposed to the freeze/thaw process, in which moisture that has penetrated the materials periodically freezes and expands causing undue stress. Water can also cause rust in steel and cast iron.

An inspector can look for:

- Efflorescence
- Rusted dampers
- Deteriorated masonry
- Rusted and corroded metal
- Wood rot at nearby framing
- Water stains
- Clogged clean-outs
- Deteriorated mortar joints
- Cracked flue lining
- Damaged hearth
- Tilted chimney stack
- Settlement cracks

Water-Damaged Mortar Joints

Water can easily penetrate deteriorated mortar joints on the chimneys. Deteriorated mortar joints can appear cracked, weathered away, and have loose chunks of material. A common repair for deteriorated mortar joints is called repointing, where the existing mortar joint is cut out and the join is repacked with new mortar.

Install a Cricket to Stop or Prevent Leaks

If the chimney is located on the low side of the roof where water run-off is directed against the chimney, the installation of a cricket will afford additional protection against water leaking into the home. A cricket is a water deflector that serves to direct rainwater away from the chimney. Crickets are recommended on chimneys more than 30-inches wide and they are especially important on steep roofs.

Efflorescence

Efflorescence is the white chalky powder that you might find on the surface of a concrete or brick wall. It can be a cosmetic issue, or it can be an indication of moisture intrusion that could lead to major structural and indoor air quality issues. A home

inspector should understand what efflorescence is in order to recognize potential moisture problems.

Indications of Moisture

Efflorescence is the dissolved salts deposited on the surface of a material (such as concrete or brick) that are visible after the evaporation of the water in which it was transported. The moisture that creates efflorescence often comes from groundwater, but rainwater can also be the source. Efflorescence alone does not pose a major problem, but it can be an indication of moisture intrusion.

Porous Building Materials

Building materials, such as concrete, wood, brick and stone, are porous materials. Porous materials can absorb or wick water by a process called the capillary action. As water moves through the porous material, salts can be drawn with it.

Concrete, wood, brick, stone and mortar are porous materials that contain salts. The ground in which these materials can come into contact also contain salts. Capillary action can literally suck water and transport it through porous building materials.

Capillary Action

Porous building materials are capable of wicking water for large distances due to capillary action with a theoretical limit of capillary rise of about 6 miles. That's 6 miles directly up. Think of a tree and how a tree can transport water from its roots to its leaves. That's capillary action. And it's very powerful. When you add salt to that capillary process, it can be destructive.

Salts dissolved by groundwater can be transported by capillary action through porous soil. Building materials in contact with soil will naturally wick the water inward and upward. Take concrete footings -- they are typically poured directly onto soil without any capillary break. Sometimes this is called rising damp. This is the beginning of how water can wick upward into a structure.

Destructive Pressures

When the capillary flow of water reaches the surface of a building material, evaporation occurs. As the water evaporates, salt is left behind. As this evaporation of capillary flow continues, the salt concentration increases, which creates an imbalance, and nature abhors imbalance and always wants to put things back into equilibrium. This is process is called osmosis. To re-establish equilibrium through osmosis, water rushes toward the salt deposit to dilute the concentration. This rush of water creates massive hydrostatic pressures within the porous material, and these pressures are destructive.

The pressure from osmosis can create incredibly strong hydrostatic pressure that can exceed the strength of building materials, including concrete.

Here are some examples of how that pressure translates:

- Diffusion vapor pressure: 0.3 to 0.5 psi
- Capillary pressure: 300 to 500 psi
- Osmotic pressure: 3,000 to 5,000 psi

.

As you can see from the list above, osmosis can create pressure that is greater than the structural strength of concrete, which can be from 2,000 psi to 3,000 psi. The action of water rushing to the surface due to capillary action creates incredible forces that can cause materials to crack, flake and break apart.

Spalling

When efflorescence leads to strong osmotic pressures—greater than the strength of the building material—and the material literally breaks apart, the resulting damage is called spalling. Hydrostatic pressure can cause spalling, but spalling can also be caused by freeze-thaw cycles in building materials that have a high moisture content.

Both efflorescence and spalling can be prevented with capillary breaks, such as by installing a polyethylene sheeting under a concrete slab.

Identifying Efflorescence

InterNACHI inspectors should already know how to distinguish mold from efflorescence (at right), but it is possible for homeowners to confuse the two. The expense of a mold test can be avoided if the substance in question can be identified as efflorescence.

Here are a few tips that inspectors can offer their clients so that they understand the differences:

- Pinched between the fingers, efflorescence will turn into a powder, while mold will not.
- Efflorescence forms on inorganic building materials, while mold forms on organic substances. However, it is possible for mold to consume dirt on brick or cement.
- Efflorescence will dissolve in water, while mold will not.
- Efflorescence is almost always white, yellow or brown, while mold can be any color imaginable. If the substance in question is purple, pink or black, it is not efflorescence.

Aside from mold, the following conditions can result from excess moisture in a residence:

- fungi that rot wood;
- water damage to sheetrock;
- reduced effectiveness of insulation.

Inspectors should note the presence of efflorescence in their inspection reports because it generally occurs where there is excess moisture, a condition that also encourages the growth of mold.

Prevention and Removal of Efflorescence

Prevention

- An impregnating hydrophobic sealant can be applied to a surface to prevent the intrusion of water. It will also prevent water from traveling to the surface from within. In cold climates, this sealant can cause material to break during freeze/thaw cycles.
- During home construction, bricks left out overnight should be kept on pallets and be covered. Moisture from damp soil and rain can be absorbed into the brick.
- Install capillary breaks, including polyethelene sheeting between the soil and the building material, such as concrete.

Removal

- Pressurized water can sometimes be used to remove or dissolve efflorescence.
- An acid, such as diluted muriatic acid, can be used to dissolve efflorescence. Water should be applied first so that the acid does not discolor the brick. Following application, baking soda can be used to neutralize the acid and prevent any additional damage to the masonry. Muriatic acid is toxic, and contact with skin or eyes should be avoided.
- A strong brush can be used to simply scrub the efflorescence off.

Note: The use of water to remove efflorescence may result in the re-absorption of crystals into the host material, and they may later reappear as more efflorescence. It is advisable that if water is used in the removal process that the masonry is dried off very quickly.

In summary, efflorescence is a cosmetic issue, but it indicates a potential moisture problem. Inspectors should know the how capillary forces can cause structural damage to building materials and educate their clients about efflorescence and the potential problems it may cause.

Preventing Collapse

Chimneys are among the heaviest and most structurally vulnerable of all exterior components of a building. Accidents caused by their collapse can lead to death. A collapse can also cause costly structural damage to the building and its surroundings. Inspection, maintenance and preparedness are critical safeguards against chimney collapse.

Wind and other elements may cause an already weakened chimney to collapse. An elderly man in Britain was crushed by a wind-toppled chimney as it fell from the roof of the managed-care facility where he lived. This case is, unfortunately, fairly unremarkable, as such accidents occur often for a variety of reasons -- from weathering and wind, to falling tree limbs and poor design.

Chimneys collapse by the hundreds during major earthquakes, typically snapping at the roofline. More than half of the homes in Washington State inspected by the Federal Emergency Management Agency (FEMA) following the Nisqually Earthquake in 2001 sustained chimney damage. Chimney collapses were widely reported following the massive-magnitude 7.1 earthquake that struck New Zealand in September 2010.

Earthquake damage and injuries can be caused, in large part, by bricks and stones as they fall from chimneys onto vehicles, structures and people. These collapses happen suddenly and without warning. Collapses can also cause implosion-type destruction as the chimney makes its way through the roof and attic, demolishing part of the living space and injuring occupants below. For these reasons, it is crucial that chimneys, especially in seismically active regions, be inspected periodically for signs of weakening. Following an earthquake, it is even more vital that chimneys be inspected for indications of imminent or future collapse.

Chimneys should be inspected for the following defects:

- mortar between the bricks or stones that crumbles when poked with a screwdriver;
- missing or insufficient lateral support -- typically, steel straps -- used to tie the chimney to the structure at the roof and floor levels. Building codes in some seismically active regions require internal and external bracing of chimneys to the structure;
- mechanical damage to the chimney, such as that caused by falling tree limbs or scaffolding;
- visible tilting or separation from the building. Any gap should be frequently measured to monitor whether it is increasing; and
- chimney footing defects, including the following:
    - undersized footing, which is footing cast so thin that it breaks, or does not sufficiently extend past the chimney's base to support its weight;
    - deteriorated footing, caused by weathering, frost, loose or poor-quality construction; and
    - poor soil below footing, including eroded, settled or otherwise weakened soil, frost heaves or expansive clay beneath the footing.

A more thorough inspection performed to the International Phase I Standards of Practice for Inspecting Fireplaces and Chimneys may also be considered.

The following additional precautions may be taken:

- Attach plywood panels to the roof or above the ceiling joists to act as a barrier between falling masonry and the roof.
- Strengthen the existing chimney by repairing weak areas.
- Tear down the chimney and replace it with a flue or a stronger chimney. Keep in mind that tall, slender, masonry chimneys are most vulnerable to earthquakes, weathering, and other forms of wear. However, even newer, reinforced or metal flue chimneys can sustain significant damage and require repair.
- Relocate children's play areas, patios and parking areas away from a damaged chimney.
- Instruct family members to get away from chimneys during earthquakes.

Homeowners should contact their local building departments to obtain required permits before starting any significant construction that may affect the chimney structure and/or its supports.

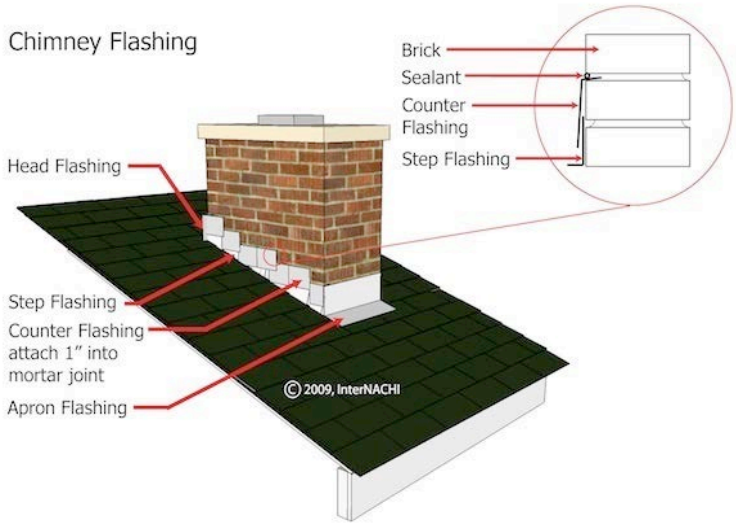
In addition to collapse hazards, leaning chimneys can also make using the fireplace dangerous. Hearth cracks, side cracks in the fireplace, openings around the fireplace, and chimney damage all present the risk that sparks or smoke will enter the living space or building cavities. Check for evidence of fireplace movement. Following an earthquake, homeowners should have their chimney inspected before using the fireplace.

Commercial chimney collapses are rare, but they deserve mention due to the devastation they cause. In one terrible incident in central India, more than 100 workers were killed when a 900-foot tall chimney collapsed on a construction site. One of the worst construction site disasters in recent history, the collapse was blamed on heavy rain. While safety standards are generally more stringent outside of India, commercial chimneys everywhere require inspection.

In summary, chimneys should be inspected to prevent deadly, expensive collapses.

QUIZ 10

Flashing



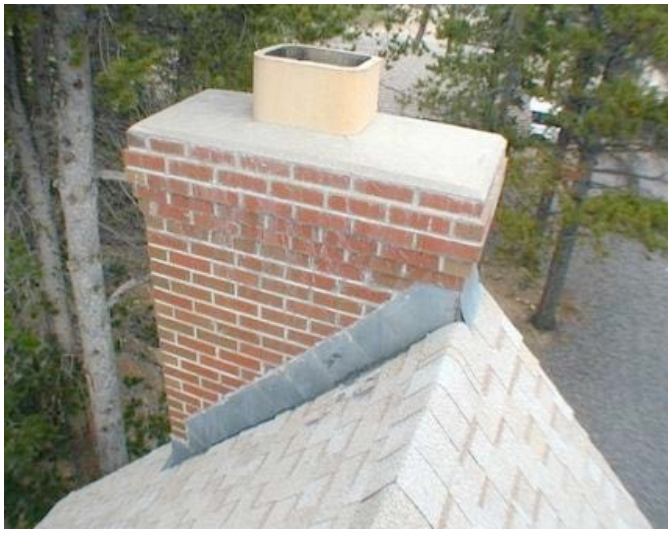
This illustration shows counter-flashing installed correctly. It fits into grooves cut into the mortar joints. After the counter-flashing is installed, the grooves are sealed with an appropriate sealant.

From this photo, you can see the counter-flashing installed in slots cut onto the mortar joints and on the low side of the chimney. The apron flashing, which is basically a headwall condition, overlaps the shingle covering.

This is a photo of a common chimney flashing installation.

Installing flashing is especially difficult at stone chimney exteriors.

This is incorrectly installed flashing. The step and counter flashing components are missing.



The flashing is improperly installed. The counter flashing is missing.

Improperly installed flashing. The flashing is loose and corroded. There is step and counter flashing. The sealant is not permanent.

If you see counter-flashing attached with a sealant only, look for signs of moisture intrusion, such as stains or decay in the roof sheathing around the penetration. You'll see it best from the unfinished attic space.

A cricket is a small roof designed to keep water from pooling on the higher-side of the chimney. Framing the cricket will create a couple of little valleys, which need to be flashed correctly.

This very-wide chimney is missing a cricket.

This cricket valley flashing has visible corrosion and accumulated debris. When you see this condition -- and it’s common -- scrape away the debris and check the condition of the flashing. Debris will hold moisture against the flashing, and corrosion is likely to advance more quickly in these areas.

Cap

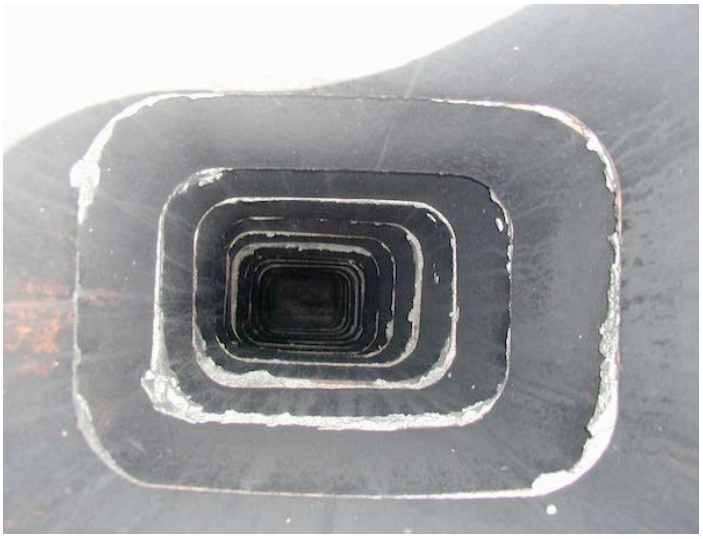
You’ll see chimney caps made of sheet metal, usually galvanized, but sometimes copper.

Mortar at the chimney crown is not durable and tends to crack.

This chimney is missing a cap. Wood must never be used for a crown or cap.

This crown is very deteriorated.

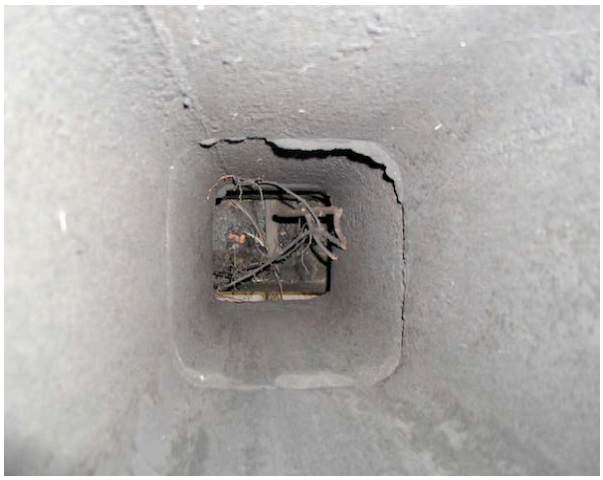
An inspector may look down into the chimney flue.



Look for cracks, separations, damage, and creosote.

This masonry chimney is missing a flue liner.

All masonry chimneys must have flue liners installed.



This flue has debris inside it.

This is a stainless steel spark arrestor. The screen openings should be sized no greater than ½ inch.

If a spark arrester is installed, it should meet certain standards:

- The net free area of the spark arrester should be at least four times the net free area of the flue outlet. The "net free" opening is the size of the opening after the dimensions of any obstructions are subtracted.
- Openings should not block the passage of a 3/8-inch sphere or permit the passage of a 1/2-inch sphere.
- The spark arrester should be accessible for cleaning, and be removable so that the flue can be cleaned.

This chimney, observed from the attic space, has an unused opening. This is a fire hazard.

The abandoned chimney might collapse through the ceiling and cause serious or fatal injuries. This is a material defect.

Safe Practices for Fireplaces

The fireplace damper must be fully open before starting a fire and left open until the fire is out.

Fireplaces should not be overloaded.

Green or wet wood should never be used.

Screens should be closed to prevent sparks from flying out into the room.

Glass door enclosures can be closed to reduce heat loss from the room into the chimney.

Glass doors on a factory- built fireplace must be tested and listed for that particular fireplace. It can be dangerous to use the wrong set of glass doors on the fireplace.

A wood stove, free-standing or insert style, should never be installed in a factory-built fireplace system, unless the insert has been tested and listed for such use.

Annual chimney inspections and sweeping is recommended.

Fireplace Safety for Homeowners

More than one-third of Americans use fireplaces, wood stoves and other fuel-fired appliances as primary heat sources in their homes. Unfortunately, many people are unaware of the fire risks when heating with wood and solid fuels.

Heating fires account for 36% of residential home fires in rural areas every year. Often these fires are due to creosote buildup in chimneys and stovepipes. All home heating systems require regular maintenance to function safely and efficiently.

InterNACHI encourages homeowners to practice the following fire safety steps to keep those home fires safely burning. Remember, fire safety is a personal responsibility.

Keep Fireplaces and Wood Stoves Clean

Have your chimney or wood stove inspected and cleaned annually by a certified chimney specialist.

Clear the area around the hearth of debris, decorations and flammable materials.

Leave glass doors open while burning a fire. Leaving the doors open ensures that the fire receives enough air to ensure complete combustion and keeps creosote from building up in the chimney.

Close glass doors when the fire is out to keep air from the chimney opening from getting into the room. Most glass fireplace doors have a metal mesh screen, which should be closed when the glass doors are open. This mesh screen helps keep embers from getting out of the fireplace area.

Always use a metal mesh screen with fireplaces that do not have a glass fireplace door.

Install stovepipe thermometers to help monitor flue temperatures.

Keep air inlets on wood stoves open, and never restrict air supply to fireplaces. Otherwise you may cause creosote buildup that could lead to a chimney fire.

Use fire-resistant materials on walls around wood stoves.

Safely Burn Fuels

Never use flammable liquids to start a fire.

Use only seasoned hardwood. Soft, moist wood accelerates creosote buildup. In pellet stoves, burn only dry, seasoned wood pellets.

Build small fires that burn completely and produce less smoke.

Never burn cardboard boxes, trash or debris in your fireplace or wood stove.

When building a fire, place logs at the rear of the fireplace on an adequate supporting grate.

Never leave a fire in the fireplace unattended. Extinguish the fire before going to bed or leaving the house.

Allow ashes to cool before disposing of them. Place ashes in a tightly covered metal container and keep the ash container at least 10 feet away from your home and any other nearby buildings. Never empty the ash directly into a trashcan. Douse and saturate the ashes with water.

Protect the Outside of Your Home

Stack firewood outdoors at least 30 feet away from your home.

Keep the roof clear of leaves, pine needles and other debris.

Cover the chimney with a mesh screen spark arrester.

Remove branches hanging above the chimney, flues or vents.

Protect the Inside of Your Home

Install smoke alarms on every level of your home and inside and outside of each sleeping area. Test them monthly and change the batteries at least once a year. Consider installing the new long life smoke alarms.

Provide proper venting systems for all heating equipment.

Extend all vent pipes at least three feet above the roof.

Fire Extinguishers

Fire extinguishers are devices commonly found indoors and are used to douse fire and prevent its spread. They are small metal canisters that contain compressed gas (usually nitrogen) that, when activated, propel a directed spray of flame-retardant chemicals. Fire extinguishers are only effective if building occupants understand where and why they are used.

Fire Type

Fire extinguishers are distinguished based on the types of fires on which they are effective. These fires are classified by their fuel source and assigned identifying letters as follows:

- "A" class – Fires that result from ordinary combustibles, such as wood and paper.
- "B" class – Fires that result from combustible liquids, such as kerosene, gasoline, oil, and grease.
- "C" class – Fires of an electrical nature. These result from the combustion of circuit breakers, wires, outlets, and other electrical devices and equipment. Extinguishers designed to handle this type of fire cannot use chemicals that are conductive since conductive agents increase the risk of electric shock to the operator.
- "D" class – Fires resulting from combustible metals, such as sodium, potassium, titanium, and magnesium. These fires occur mostly in chemical laboratories and are rare in most other environments.
- "K" class – These types of fires consume vegetable oils, animal fats, and generally happen in kitchens.

Note Although, technically, the letter rankings listed above refer to fire types, these symbols can also be used to identify the extinguishers themselves. For instance, an extinguisher that uses CO2 can be called a "CO2 extinguisher" or a "BC extinguisher."

Extinguisher Types

No fire extinguisher can be safely and effectively used for every type of fire. Some contain chemicals that are ineffective in certain situations and can even cause harm to the operator if misapplied. To prevent confusion, extinguishers are classified by the type of chemical agents they contain. A few of the most common extinguisher types are listed below:

- Dry Chemical – There are two types of fire extinguishers that use a dry chemical. One is called "multi-purpose dry chemical" and uses ammonium phosphate as the extinguishing agent, which is effective on "A," "B," and "C" class fires. This chemical is corrosive and must be scrubbed from surfaces after use. These types of extinguishers are very common and are found in schools, homes, hospitals and offices. Sodium bicarbonate is used in extinguishers known as "regular dry chemical," which are capable of handling "B" and "C" class fires. These extinguishers are found in garages, kitchens and laboratories. Sodium bicarbonate is easy to clean and non-toxic.
- Carbon Dioxide – These extinguishers contain liquid CO2 that is expelled as a gas. They are effective against "B" and "C" class fires. Unlike other chemicals, CO2 does not leave a harmful residue and is environmentally friendly. It also poses very little danger to

electronics and is effectively employed in laboratories, computer rooms, and other areas with sensitive equipment.

- Water Extinguishers – These extinguishers are most suited for "A" class fires. However, they cannot be used in "B," "C" or "D" class fires. In "B" and "D" class fires, the water will spread the flames. In a "C" class fire, the water is conductive and poses a risk of electric shock to the operator. However, the misting nozzle of a "Water Mist" extinguisher breaks up the stream of deionized water so that there is no conductive path back to the operator. Since the agent used is water, these types of extinguishers are inexpensive and environmentally friendly.
- Wet Chemical Fire Extinguishers – These devices are designed to combat "K" class fires and commonly use potassium acetate. They are appropriately employed in commercial kitchens and restaurants, especially around deep fryers. The chemical is emitted as a fine mist that does not cause grease to splash onto other surfaces. They can also be used in "A" class fires.

Inspection

InterNACHI inspectors should:

- check that a portable fire extinguisher exists within a 30-foot travel distance of commercial-type cooking equipment that uses cooking oil or animal fat.
- check that a portable fire extinguisher is within 75-feet of travel on every floor.
- check for the presence of portable extinguishers, and determine that they are located in conspicuous and readily available locations immediately available for use, and not obstructed or obscured from view.
- confirm that access to extinguishers is not obstructed.
- make sure that the hose (if so equipped) is intact and not obstructed.
- make sure the pressure dial reads in the green or "charged" area. It should also be clear and readable.
- check that the pull pin is securely fastened within the handle and held in place by the tamper seal.
- check for visible dents or cracks in the extinguisher body.
- check that the extinguisher is in its proper location and mounted correctly.
- check for modifications that might reduce the extinguisher's functionality.
- make sure that the fire extinguisher has a label and that is is legible.

Inspectors should not do the following:

- test fire extinguishers.
- determine the adequate number of fire extinguishers needed or their ratings.
- ignite or extinguish fires.

Extinguisher Testing and Replacement

The National Fire Protection Agency (NFPA) recommends that extinguishers should be tested

every twelve years or five years, depending on the type. The standard method of testing, "hydrostatic," is conducted underwater where the cylinders are subjected to pressures that exceed their ratings. Vessels that fail the test are condemned and destroyed, while the rest are reassembled and put back into service.

According to the NFPA, extinguishers should be destroyed if any of the following conditions are present (they should not be tested):

a. where repairs by soldering, welding, brazing, or use of patching compounds exist.
b. where the cylinder threads are worn, corroded, broken, cracked or nicked.
c. where there is corrosion that has caused pitting, including pitting under a removable nameplate or nameband assembly.
d. where the fire extinguisher has been burned in a fire.
e. where a calcium chloride-type of extinguisher agent was used in a stainless steel fire extinguisher.
f. where the shell is of copper or brass construction joined by soft solder or rivets.
g. where the depth of a dent exceeds 1/10 of the greatest dimension of the dent if not in a weld, or exceeds 1⁄4 in. (0.6 cm) if the dent includes a weld.
h. where any local or general corrosion, cuts, gouges or dings have removed more than 10 percent of the minimum cylinder wall thickness.
i. where a fire extinguisher has been used for any purpose other than that of a fire extinguisher.

When should a fire extinguisher be used?

Small fires can be controlled through the use of household or commercial fire extinguishers. A household extinguisher can often completely douse a very small fire and prevent the need for professional assistance. Even if a fire cannot be completely doused, a homeowner can potentially control a blaze long enough with an extinguisher for firefighters to arrive. Fire extinguishers should not be used if the operator is not sure they have the proper type of extinguisher, if they are not sure how to use it, or if they cannot avoid smoke or are in imminent danger. If the operation of an extinguisher will place building occupants in danger, they should evacuate the building and wait for fire crews to arrive.

What is on an extinguisher's label? You'll find:

- essential information about the types of fires they can combat. Newer devices have pictures that correspond directly to the fire types listed above. Older models have letters serve the same purpose.
- a numerical rating that designates the extinguishing potential for that particular model (class "A" and "B").
- instructions for operation.
- a tag that indicates if and when an inspection occurred.

Do fire extinguishers expire?

Fire extinguishers expire and they do this for a few different reasons. One common way is that, over time, the seal on the neck will weaken and allow compressed gas to escape. Extinguishers that have lost much of their pressure will not operate. Pressure within an extinguisher can be conveniently checked through a pressure gauge. "ABC" class extinguishers (ammonium phosphate) have the tendency to fail due to solidification of the chemical in the canister base. Homeowners and inspectors can delay this process by periodically shaking the extinguisher. Expensive extinguishers that have expired, especially those designed for commercial use, can be refilled and resealed by companies who specialize in this service. Inexpensive models are disposable.

Unfortunately, an expiration date cannot be fully trusted and there is no foolproof way to know if an extinguisher is no longer functional. Due to the extremely destructive potential of fires and the relatively low cost of extinguishers, it is advisable to replace or recharge questionable extinguishers.

In summary, extinguishers are classified based on their chemical ingredients, all of which have their own strengths and limitations. It is important to know what type of extinguisher combats what type of fire. Fire extinguishers are critical indoor components that must be maintained and inspected regularly.

Take InterNACHI's free, online "**Inspecting Portable Fire Extinguishers**" course.

Fireplace Fuel

Fireplaces and wood stoves are designed to burn only one type of fuel. Used as all-purpose incinerators, these devices can pose the following hazards:

- Harmful vapors can vent into the living space. Even the most efficient fireplaces will vent directly into the living space while they're opened and closed for cleaning and refueling, exposing everyone in the house to potentially dangerous fumes.
- Harmful vapors will vent to the outdoors. Most newer fireplaces and wood stoves do an excellent job of funneling smoke and fumes to the outdoors, but the problem doesn't end there; this pollution persists, contaminating household and environmental air.
- Burning inappropriate fuel can cause mechanical damage. Chimneys can become lined with residue from inappropriate items, which may lead to a dangerous chimney fire. The fumes from certain items will quickly wear out sensitive components, such as catalytic combustors in wood stoves.

Read the following guidelines to better understand what can and cannot be safely burned in a residential fireplace or wood stove.

What can be burned in a fireplace?

- dried, cut firewood. An adequate fuel supply will consist of a mixture of hardwoods, such as maple and oak, and softwoods, such as fir and pine. Softwoods ignite quickly and are useful in the early stages of the fire, while hardwoods provide a longer-lasting fire, and are best used after preheating the chimney. Despite the different burning characteristics of hardwoods and softwoods, which can be attributed to differences in density, the heat-energy released by burning wood is the same, regardless of species. To dry out wood, it should be stacked in an open area so the sun can warm the pieces and the breezes can carry away the moisture. Poplar, spruce and other softwoods generally dry quickly, as do wood that has been split small. Adequately seasoned wood has a moisture content of less than 20%, which can be checked using the following indicators:
    - The wood has darkened from white or a cream color to yellow or grey.
    - There are cracks or checks in the end grain.
    - A hollow sound is produced when two pieces of wood are banged together.
    - You can split a piece and feel if the new surface is damp or dry.
    - The wood does not hiss while burning.
    - You can check its moisture content with a moisture meter.

- pallets. Generally, pallets are safe to burn in fireplaces, although those that are treated with the fumigant methyl bromide (labeled with the initials MB) are unsafe to burn. Also, pallets may have been exposed to a variety of chemicals while they were in use. Aside from these concerns, pallets produce a hot flame because they're usually very dry and their segments are thin. Be careful to check for nails while cutting pallets, as they may

damage a saw blade. You may also wind up with nails in your ash, which should be disposed of far from roads and driveways.
- fallen tree limbs. These can generally be collected and used for kindling, provided they have been given time to dry.
- wood collected from housing developments. If it is truly trash and not someone's property (including the housing contractor's), using scavenged wood that has been cleared away for housing developments is good for burning. Try to obtain it before the non-lumber grade wood is pushed into massive piles and burned as a means of disposal by the contractor.
- fire logs. These artificial logs burn relatively cleanly and release less ash than their natural wood counterparts.

What should never be burned in a fireplace?

- painted wood. Paint contains heavy metals, such as lead, chromium and titanium, which are used to make the different colors. These metals, especially lead, can be toxic even in small quantities if inhaled. If you're unsure if your paint has lead, be sure to consult with your InterNACHI inspector during your next scheduled inspection.
- pressure-treated wood. Wood is commonly made resistant to fungus and insects through the addition of copper, chromate and arsenic, in a process known as CCA treatment. CCA treatment places roughly 27 grams of arsenic in every 12-foot 2x6, which is sufficient to kill about 250 adults, which is why it is illegal in the U.S. to burn pressure-treated wood. Vaporized CCA wood, known as fly ash, is extremely toxic; in one case, as reported by the American Medical Association, a family was stricken with seizures, hair loss, debilitating headaches, blackouts and nosebleeds from fly ash released when they unknowingly used CCA wood to burn in their fireplace. Even the family's houseplants and fish succumbed to the toxic fumes.
- plywood, particleboard, chipboard or OSB. These manmade woods release formaldehyde, and potentially hydrochloric acid or dioxin, when burned. Some states have outlawed the incineration of some or all of these artificial wood products.
- rotted, diseased or moldy wood. This wood will not burn as long as normal wood, may produce bad smells when burned, and could bring insects into the house.
- damp wood. Wood that has a moisture content higher than 20% will burn inefficiently and will contribute to a greater accumulation of creosote in the chimney, as well as air pollution.
- allergenic plants. Urushiol, which is the chemical that induces the typically minor allergic reaction when skin is exposed to poison ivy, poison sumac or poison oak, is far more dangerous when inhaled. Urushiol is not destroyed by fire and can quickly cause life-threatening respiratory distress if any of these plants are burned.
- dryer lint. While it's often used effectively as a fire-starter, lint can contain a wide array of dangerous chemicals that come from your clothes and fabric softener.
- trash. Never burn household garbage, as it contains a range of potentially hazardous materials and chemicals that react in unpredictable ways when burned together. Newspaper ink, plastics, aluminum foil, plastic baggies, and whatever else constitutes your particular trash can create a deadly chemical cocktail.

- driftwood. Wood found on the beach of an ocean or salty lake will release salt when burned, which will quickly corrode any metal and etch the glass of a wood stove or fireplace. Catalytic converters are especially vulnerable to salt corrosion. In addition to potential damage to the stove or fireplace, the EPA claims that driftwood releases toxic chemicals when burned.

In summary, use only approved and appropriate fuel to burn in your fireplace or wood stove, because certain items should never be burned because they can cause problems ranging from minor irritation to a hazardous health threat to your family.

QUIZ 11

Ventless Fireplace Inspection

Ventless fireplaces, more accurately known as duct-free fireplaces and room-venting fireplaces, are a type of residential gas-heating device. Ventless fireplaces are preferred because they burn at nearly 100% efficiency, release far less harmful gasses than most other heating alternatives, and their installation is restricted little by architectural constraints.

They are controversial, however. Despite their name, they vent unburned combustion byproducts directly into the living space. Traditional fireplaces, by contrast, are equipped with a flue that vents to the outdoors, saving humans and their pets from exposure to the bulk of the carbon monoxide (CO) and airborne particulates created by the fire. As a less serious yet still important side note, ventless fireplaces create high levels of water vapor, which can lead to mold growth and a variety of other moisture-related building problems. Mold can be a serious health hazard for at-risk individuals, and it can damage fabric, photographs, books and building materials.

To mitigate CO dangers, manufacturers instruct customers to keep a window open while ventless fireplaces are in operation –- advice that is easy to ignore, as an open window allows the entry of cold air, defeating the efforts of the fireplace to warm the living space. Many manufacturers also install an oxygen-detection sensor (ODS) in their ventless fireplaces that will automatically shut down the appliance if oxygen levels in the home become dangerously low. Critics point out that this sensor is typically located at the lower part of the unit near the floor, where it detects cool, fresh, oxygen-filled air and misses hot combustion gasses as they rise and pool toward the ceiling. And if the sensor fails, any CO-producing abnormality experienced by the fireplace will continue unnoticed and potentially harm building occupants.

Massachusetts, California, and a number of other states in the U.S., as well as Canada and other countries, have outlawed ventless gas fireplaces due to the aforementioned safety concerns. Many individual municipalities, too, have outlawed these appliances in states where they are otherwise legal. The U.S. Department of Housing and Urban Development bans ventless fireplaces in their housing, and advisements against the use of these appliances have been issued by various watchdog groups, such as the American Lung Association, the Centers for Disease Control, the Environmental Protection Agency, and even the Mayo Clinic. In particular, these organizations warn against exposure of individuals who are particularly vulnerable to CO, namely, the elderly, pregnant women, small children, those with pre-existing cardiovascular difficulties, and small pets. To be fair, though, there have been no documented cases of fatalities caused by ODS-equipped ventless fireplaces, according to the U.S. Consumer Product Safety Commission.

Ventless fireplaces can be inspected for the following safety defects:

- a gas leak. During production, installation or servicing, a leak can be created;

- plugged burner ports. The contractor may accidentally plug the burner ports while spreading ceramic tile over the burners, or they may be painted over at the factory. The resulting unbalanced burn will create excessive carbon monoxide;
- a clogged burner. Dust, carpet lint and pet hair can gradually choke off the fireplace's air supply, leading to incomplete combustion and high amounts of CO that are vented into the living space;
- high gas-input rate. Excessive CO ventilation or overheating of the unit will result from firing the gas higher than the input rate set by the manufacturer's specifications. This can be caused by high gas-supply pressure, an incorrect orifice drill size done at the factory, or if the installer gives the customer's unit a larger flame for aesthetic reasons;
- the fireplace is oversized for the square footage of the area to be heated.
- a cracked burner. The gas burner may develop a crack over time and function erratically, producing high levels of CO;
- the fireplace contains items other than the artificial logs designed for the unit. Problems caused by the incineration of firewood or other flammable items will be immediate and extreme. A more likely and less obvious hazard is created by adding pebbles, lava rocks, and other non-combustible aesthetic touches to the fireplace, as their exposure to flames will cause an unsafe rise in levels of CO; and
- a missing or defective ODS. As these components may fail, it is advisable to install a CO detector near a ventless fireplace and, ideally, in other rooms, as well.

In summary, ventless fireplaces, while attractive and portable, suffer from a design flaw that may allow dangerous gases to enter the living space.

QUIZ 12

Kickout Flashing

Kickout flashing, also known as diverter flashing, is a special type of flashing that diverts rainwater away from the cladding and into the gutter. When installed properly, they provide excellent protection against the penetration of water into the building envelope.

Several factors can lead to rainwater intrusion, but a missing kickout flashing, in particular, often results in concentrated areas of water accumulation and potentially severe damage to exterior walls. InterNACHI inspectors should make sure that kickouts are present where they are needed and that they are installed correctly. Water penetration into the cladding can occasionally be observed on the exterior wall in the form of vertical water stains, although inspectors should not rely on visual identification. There may be severe damage with little or no visible evidence.

Inspectors may observe the following problems associated with kickout flashing:

The kickout was never installed.

- The need for kickout flashing developed fairly recently and the builder may not have been aware that one was required. The increased amount of insulation and building wrap that is used in modern construction makes buildings less breathable and more likely to sustain water damage. Kickout flashing prevents rainwater from being absorbed into the wall and is more essential than ever.

The following are locations where kickout flashing is critical:

- anywhere a roof and exterior wall intersect, where the wall continues past the lower roof-edge and gutter. If a kickout flashing is absent in this location, large amounts of water may miss the gutter, penetrate the siding, and become trapped inside the wall; and
- where gutters terminate at the side of a chimney.

The kickout was improperly installed.

- The bottom seam of the flashing must be watertight. If it is not, water will leak through the seam and may penetrate the cladding.
- The angle of the diverter should never be less than 110 degrees.

The kick-out was modified by the homeowner.

- Homeowners who do not understand the importance of kickouts may choose to alter them because they are unsightly. A common way this is done is to shorten their height to less than the standard six inches (although some manufacturers permit four inches), which will greatly reduce their effectiveness. Kickout flashings should be the same height as the side wall flashings.
- Homeowners may also make kickout flashings less conspicuous by cutting them flush with the wall.

In summary, kickout flashing should be present and properly installed in order to direct rainwater away from the cladding.

InterNACHI

"How to Inspect Fireplaces, Stoves, and Chimneys" course
http://www.nachi.org/inspect-fireplace-stove-chimney-course.htm

Student Course Material