

INTRODUCTION

This book has two primary goals:

- To provide you with a sound introduction to the components, materials and mechanics of chimneys and wood heating that you will encounter and evaluate as a home inspector;
- To provide you with a solid understanding of inspection processes, strategies and standards of practice that will help define the scope of your inspections. Specifically, the ASHI® (American Society of Home Inspectors) Standards of Practice are represented throughout.

The ASHI Standards are not the only standards for home inspectors, but they are widely used. Several states and other organizations have their own standards. The point is that standards help define a consistent scope of professional practice for home inspectors to use in their day-to-day work.

The depth is sufficient to allow the general practitioner home inspector to perform a standard inspection of chimneys and wood heating systems. There is always more material that can be studied and other courses that you can take.

In its discussion of wood heating methods, this book assumes that you already are familiar with more conventional systems, such as gas and oil furnaces, and with background concepts of heat transfer. For example, where components of wood furnaces are the same as gas or oil furnaces, we will merely list the problems that can occur, rather than discuss them in detail. If you feel you need a better background in those topics, we recommend that you read the *Gas and Oil Furnaces* volume of this series first.

FEATURES OF THIS BOOK

This book is structured to help you learn and retain the key concepts of home inspection. It also will help you form a set of best practices for conducting inspections. Learning features include:

- Learning objectives: At the beginning of each chapter you will find a list of concepts you should master by the end of the chapter.
- Chapter Review Questions: Each chapter ends with a set of review questions to help you test your understanding. Answers can be found at the end of the book so you can check your results.
- Key terms: Important terms appear in boldface within the text discussions so you can begin to understand them in context. A summary list of key terms appears at the end of each chapter.

- Inspection checklists: These tools summarize the important components you will be inspecting and their typical problems.
- Inspection procedures: This material helps you develop a systematic approach and best practices for your inspections.
- Standards of practice: ASHI has established a set of standards that are widely used to define the scope of inspection that practitioners should achieve.
- Inspection tools: This summary list will help you build your toolkit of “must have” and optional tools for the job.

CHAPTER 1

OVERVIEW OF CHIMNEYS

LEARNING OBJECTIVES

At the end of this chapter you should be able to:

- define chimneys, vents and flues
- list four common fuels
- list six things that affect chimney drafts

1.1 FUNCTIONS OF CHIMNEYS AND VENTS

Let's start by looking at what chimneys and vents are supposed to do.

1. Chimneys **remove** the **products of combustion** from the house.
2. Chimneys should **enhance** the **draft** from appliances, assisting in the combustion process and inducing exhaust gases to leave the building.
3. It is a chimney's job to contain a **fire** in the chimney. We don't want the chimney to spread a fire from a burner or fireplace to other areas of the home. In short, don't burn down the house.
4. Chimneys should **prevent** poison **gases** from **entering** the **house**—
 - through the appliances
 - through openings in chimney walls
 - through an adjacent idle flue
 - back through upper story windows after leaving the chimney
5. Good chimneys **minimize** the **heat loss** from the building, while in use **and** while idle.
6. Masonry chimneys must **support** their own **weight** and **live loads** such as wind. (But they aren't usually designed to carry the dead or live loads of the house structure).
7. Chimneys should **keep water out** of the house. They should not interrupt roof drainage systems. They should be flashed at roof penetrations. Chimneys should not allow water entry through the top, sides or bottom of the chimney.
8. Chimneys should help to **keep** animals, birds and other **pests out** of the house.
9. Chimneys should add to the architectural appeal of a home or, at the very least, not detract from it. Since this one is subjective, we don't have to comment on it!

1.2 DEFINITIONS

We'll Take Some Liberties

Terminology surrounding chimneys is very confusing. We'll simplify slightly to make things understandable. In doing so, we will omit some exceptions and be less than technically exhaustive. We'll also be wrong for some locations. We encourage you to check with local specialists to make sure you use the right terms for your area.

Chimneys

A **chimney** is a vertical device (usually masonry or metal) for **removing** the exhaust products from burning fuels from the house safely. Masonry chimneys may have more than one **flue** which may or may not be **lined**. Liners may be clay, asbestos or metal, for example. Metal chimneys are always single flue (Figure 1.1).

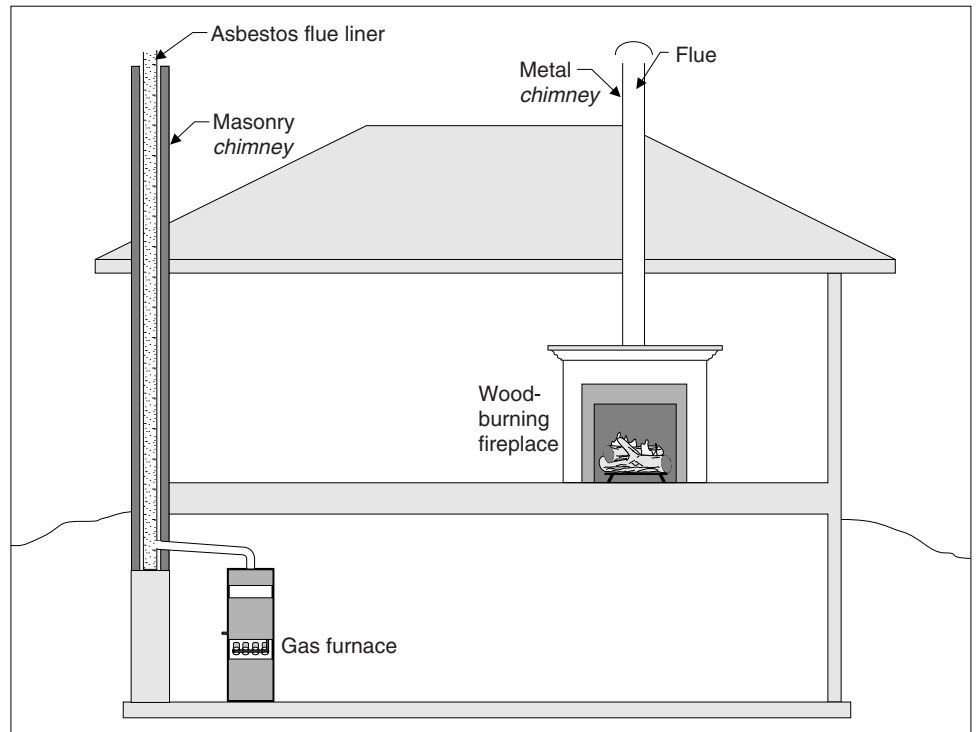
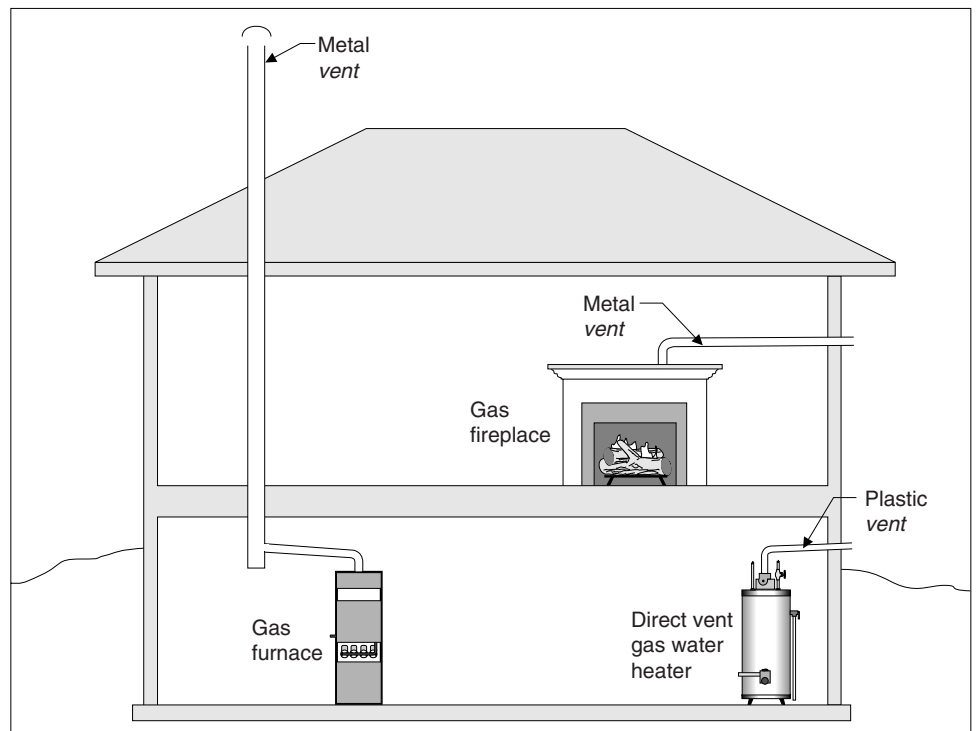
Flues

Flues are the interior passages in chimneys through which the gases move upward.

Vents

Vents are metal devices for getting exhaust gases from burning fuels out of the house safely. They may be single, double or triple wall vents and may be horizontal, vertical or a combination. Vents are always single flue, although the word **flue** is not normally used in conjunction with vents (Figure 1.2).

Some people call it a **metal chimney** if it's designed for wood or coal burning appliances, and call it a **vent** if it's designed for gas, propane or oil.

FIGURE 1.1 Chimneys**FIGURE 1.2** Vents

Site-Built or Factory Made

Masonry chimneys are built on site. Metal chimneys and vents are factory-made and assembled on site.

Vent Connectors

Vent connectors are also called **exhaust flues, vent pipes, stack pipes, flue pipes, chimney connectors** or **breechings**. Their function is to transfer the exhaust products from the appliance to the chimney. Fireplaces do not have vent connectors. Most wood stoves, furnaces, boilers and water heaters do have vent connectors.

What Clients Know

Most clients will have a mental picture of a “chimney.” They won’t understand terms like vents, flues and vent connectors.

Chimneys Require Air To Work

Chimneys need house air to maintain their draft. A fireplace, for example, can draw 300 to 400 cubic feet of house air per minute into the fireplace and up the chimney. This is enough to remove all the heated air out of a 1,200 square foot bungalow in about half an hour!

Not Energy Efficient

Fireplace chimneys need this much air to work properly, but it’s easy to see how fireplaces waste energy. Although fireplaces add some heat to a house, when you consider all the 70°F air that is lost up the chimney, most fireplaces use more heat than they provide.

Combustion and Draft Air

While not all appliances use as much air as fireplaces, virtually all chimneys need air. Most take their air from the house. Some use outdoor air to improve efficiency.

1.3 NOT ALL HOMES HAVE CHIMNEYS

Homes with electric heat, high-efficiency furnaces and some mid-efficiency furnaces may have no chimneys. Modern gas fireplaces may not have conventional chimneys. When you’re outside a building, don’t write up a missing chimney as a defect. One may not be needed.

1.4 CHIMNEYS ARE NOT SUPPORTING STRUCTURES

Chimneys are not intended to hold up other building components. It is not appropriate, for example, to strap a satellite dish, television antenna or tower to a chimney (Figure 1.3).

1.5 MATERIALS

Stone, Brick, Concrete Block, Steel, Alloys, Fiber Cement, Concrete

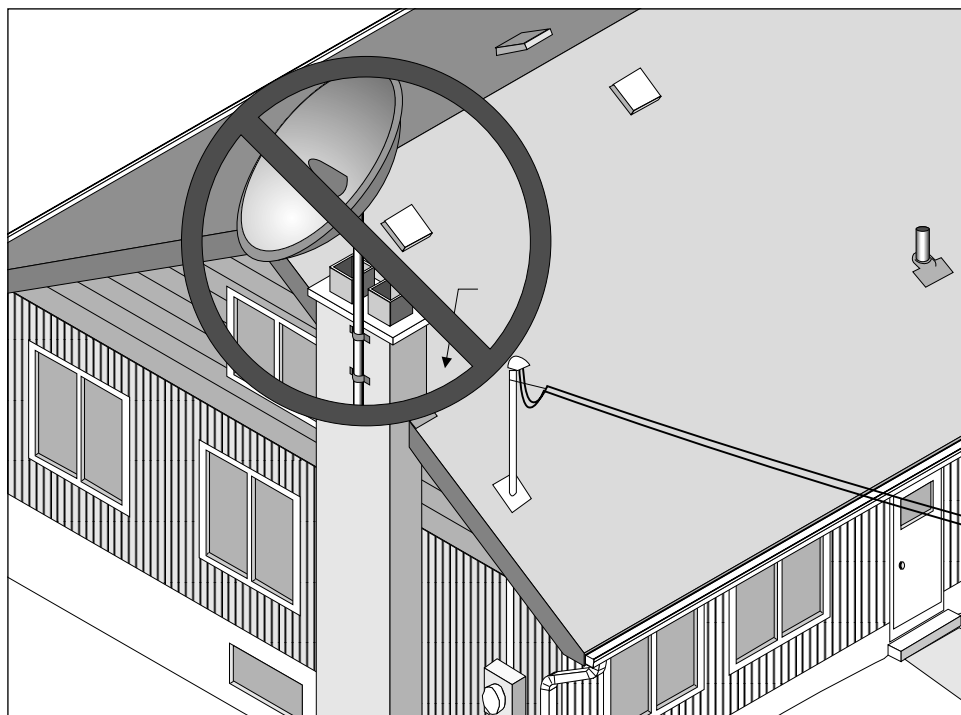
Masonry chimneys are made out of stone, brick or concrete block, typically. Metal chimneys may be made out of galvanized steel, stainless steel or other alloys. Chimneys may be made entirely of asbestos cement, (fiber cement) or the asbestos cement may be a chimney liner. Chimneys may also be poured concrete. Chimneys may be covered with wood, stucco, or metal siding, for example.

1.6 FUELS

Wood

Chimneys may see different fuels.

Wood is a fuel that burns hot and may be quite dirty. **Creosote** (the oily or tar-like combustible deposits condensed from the incomplete burning of wood) tends

FIGURE 1.3 Chimneys Are not Supporting Structures

to build up in chimneys serving fireplaces and wood stoves. It's not unusual for temperatures of 800°F to be found in chimneys for wood fireplaces or stoves. Most clay liners used in these chimneys are designed to withstand temperatures of up to 2,000°F. This temperature can be reached in a chimney fire where a buildup of creosote is ignited.

Oil

Oil is a cooler burning fuel than wood and is somewhat cleaner, although it can be sooty. Poorly tuned oil burners can generate lots of incomplete combustion products. Even on properly tuned burners, there is often some soot generated due to incomplete combustion on start-up and/or shut-down.

Temperatures of 500°

Typical chimney temperatures might be in the 500°F range (with maximums over 700°F) and condensation can be an issue with oil furnaces. The exhaust gases may cool near the top of the chimney. If they reach the dew point, condensation will form on the chimney walls. When the appliances are off, the condensation may freeze in the chimney and can do considerable damage.

Fuel oil contains sulfur. Sulfur can react with condensate to form sulfuric acid which attacks mortar, brick and clay tile.

Gas Temperatures of 350°

Gas appliances are the coolest of the three. Chimney temperatures are in the 350°F range. Gas is also the cleanest of the three fuels we've looked at. Condensation, however, is a major issue because of the low temperature and large volume of water produced by the combustion of natural gas. A 100,000 BTU/hr gas furnace operating continuously generates 1 **gallon** of water per hour. We don't want this condensing in the house or chimney!

Propane

Propane is very similar to natural gas.

1.7 DRAFT

Draft Quality

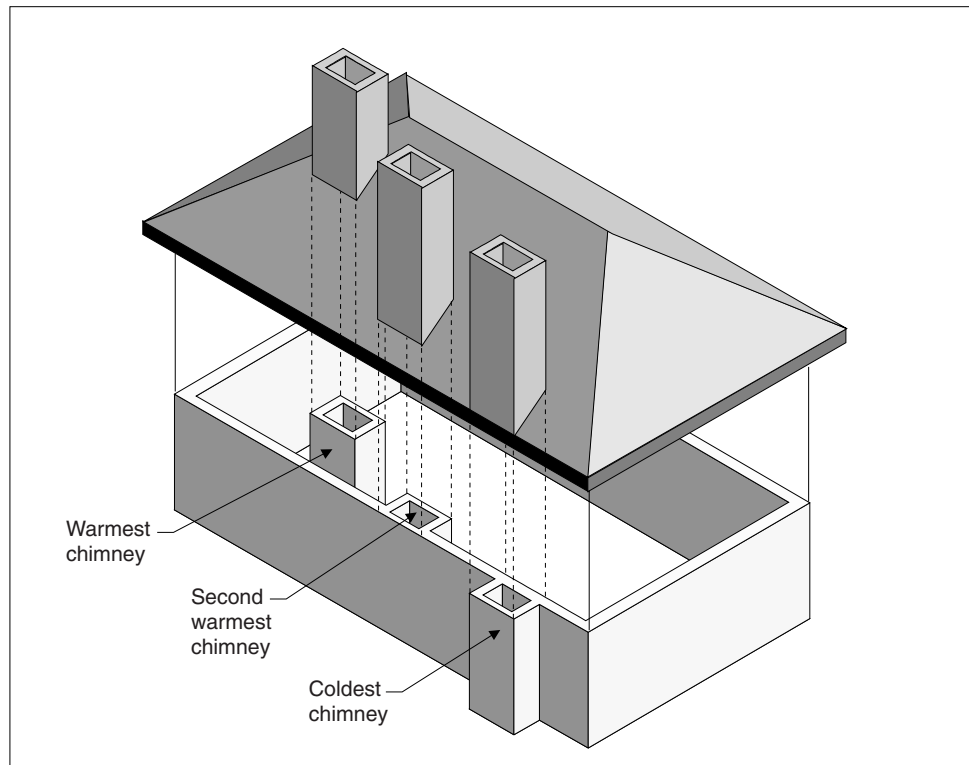
The ability of chimneys to carry exhaust gases away through **natural draft** (or **stack effect**) is a function of several things, including—

1. The chimney height
2. The flue size (Note: In a home inspection we don't evaluate the flue size adequacy.)
3. Any offset from vertical in the chimney
4. The appliance size
5. The number of appliances using the chimney
6. The temperature difference between indoors and out
7. The direction of the prevailing wind
8. Tall structures near the chimney
9. Whether the chimney is interior (running up the center of the building), or exterior (enclosed in, attached to, or adjacent to an exterior wall).
10. The smoothness or roughness of the flue passage.

Warm Chimneys Are Best

Generally speaking, the warmer the chimney, the easier it is to maintain good draft. A chimney going up through the center of the house will be warmest (Figure 1.4). A chimney on the exterior wall, but with three sides interior and only one exterior side (flush with the exterior wall), is the second warmest. The next coldest is a chimney built on an exterior wall, but projecting out from the wall with three exterior sides. The coldest is a free-standing chimney outside the house.

FIGURE 1.4 Warm Chimneys Are Best



Cold Chimneys

While it's not common with masonry chimneys, metal chimneys are sometimes separate from the house wall but supported by it. The entire outside diameter of these chimneys is exposed to the cold over most of the length of the chimney.

Tall Chimneys Are Better

Taller chimneys usually draw better than short chimneys, at least within the height ranges we usually see on houses.

One Story Chimney

Watch for homes that are partly one-story and part two-story. A chimney on the one-story section often drafts poorly because of the wind turbulence and downdraft created by the two-story section.

Draft Has To Be Established

It takes a while to establish positive draft when the appliance first comes on. There is often a column of cold air in the chimney and the weight of this cold air has to be overcome by the buoyancy of the warm air (combustion products). It's not unusual for appliances to spill or backdraft during start-up.

Natural Draft

The type of appliance also has some effect on draft. **Natural draft** appliances such as fireplaces and conventional furnaces and boilers rely simply on the buoyancy of warm air rising to create chimney draft. These appliances also need **dilution air** or **draft air** which helps keep things moving upward.

Forced Draft

Forced-draft appliances push fresh air into the combustion chamber and may help push the exhaust gases up the chimney. While it's possible to have a cold column of air overcome this, a forced-draft appliance is less likely to suffer draft problems than a natural draft appliance.

Induced Draft

An induced-draft appliance is similar to a forced-draft appliance, except that the fresh air is pulled through the combustion chamber from the exhaust side, rather than pushing it through from the intake side. Induced draft fans may also push the products of combustion up the chimney and may be less likely to suffer draft problems than natural draft appliances (Figure 1.5).

*Positive Vent Pressure**Negative Vent Pressure*

Note: Many induced draft fans are designed **not** to pressurize the chimney. The discharge is designed to be at or near atmospheric pressure.

Assisted Draft

In some cases, fans are provided in chimneys to overcome poor draft. These **draft-assisting** or **draft-inducer fans** are expensive and are exposed to a severe environment. They do not have a long life span. These should not be confused with **power venters** which are typically used **instead** of chimneys on sidewall vented appliances.

Correcting Draft Problems

There are several solutions to draft problems. The fans that we talked about are one example. Rain caps at the top of chimneys may also help by deflecting the naturally occurring downdrafts.

Swivel Top Chimney Extensions

In some cases, metal extensions are put on chimneys with a 90° bend and a "weather vane" on top (Figure 1.6). The vane or fin on the top is moved by the wind so that the discharge point of the elbow will be facing downwind. These swivel-type extensions may resolve draft problems, but like any mechanical device far from convenient service points, they may not work over the long term.

Other Solutions

Other strategies to improve draft include extending chimneys, changing flue sizes, changing appliance sizes, etc. Our task is to identify evidence of poor draft, rather than to design corrective action.

Flue Size

We mentioned that the size of the flue has a bearing on the quality of the draft. The flue size is determined by a number of factors, including—

1. The fuel that is used
2. The appliance size
3. The number of appliances
4. The chimney height

FIGURE 1.5 Three Kinds of Draft

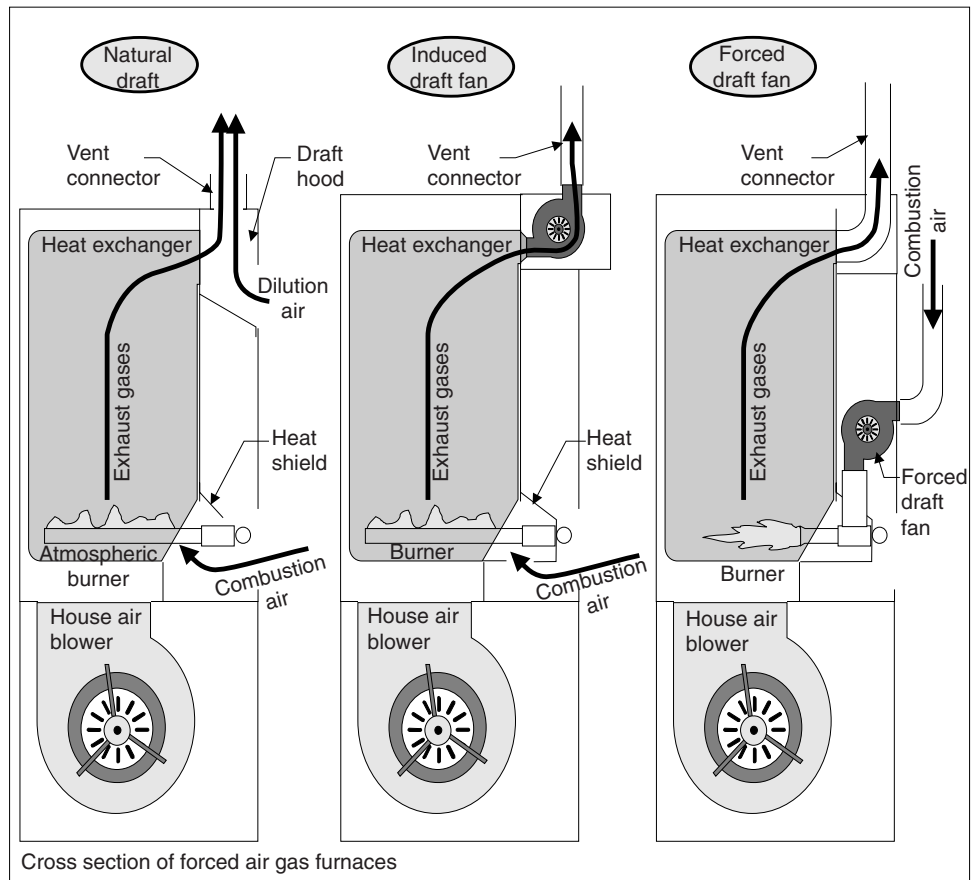
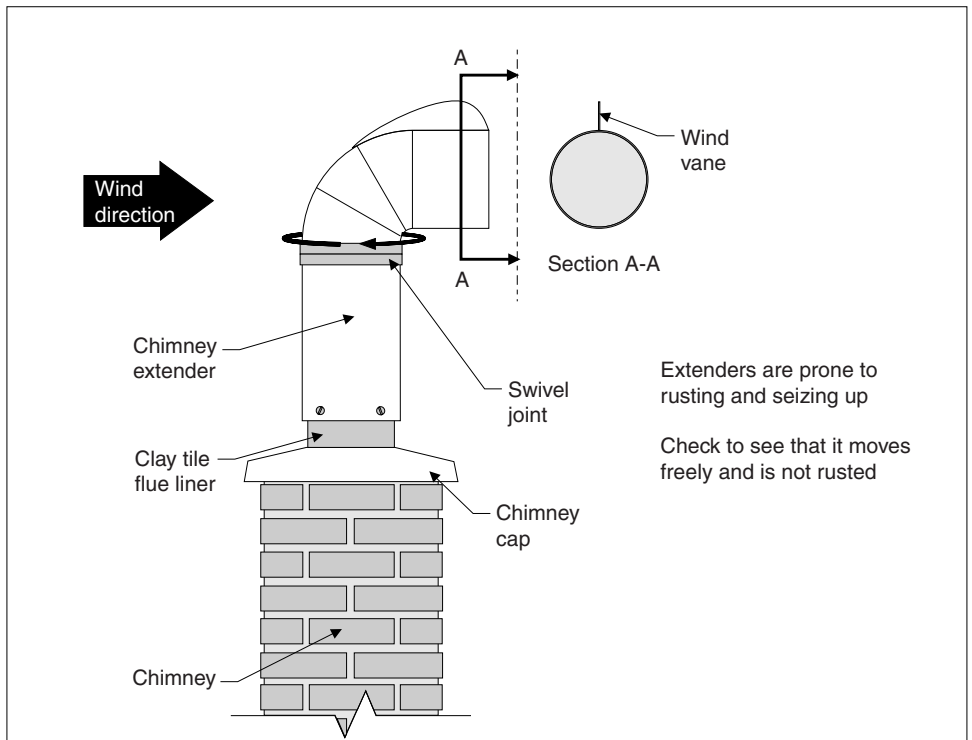


FIGURE 1.6 Chimney Extender



General Rules include—

1. Wood needs a larger flue than oil or gas
2. A larger flue is needed for larger appliances
3. A smaller flue is needed for taller chimneys, all other things being equal

IMPLICATIONS

Flues that are undersized or oversized will tend to backdraft and spill combustion products into the house. Condensation is more likely if the flue size is wrong.

1.8 NUMBER OF FLUES AND FLUE SIZE

Up to 8 Flues per Chimney

Brick Between Flues

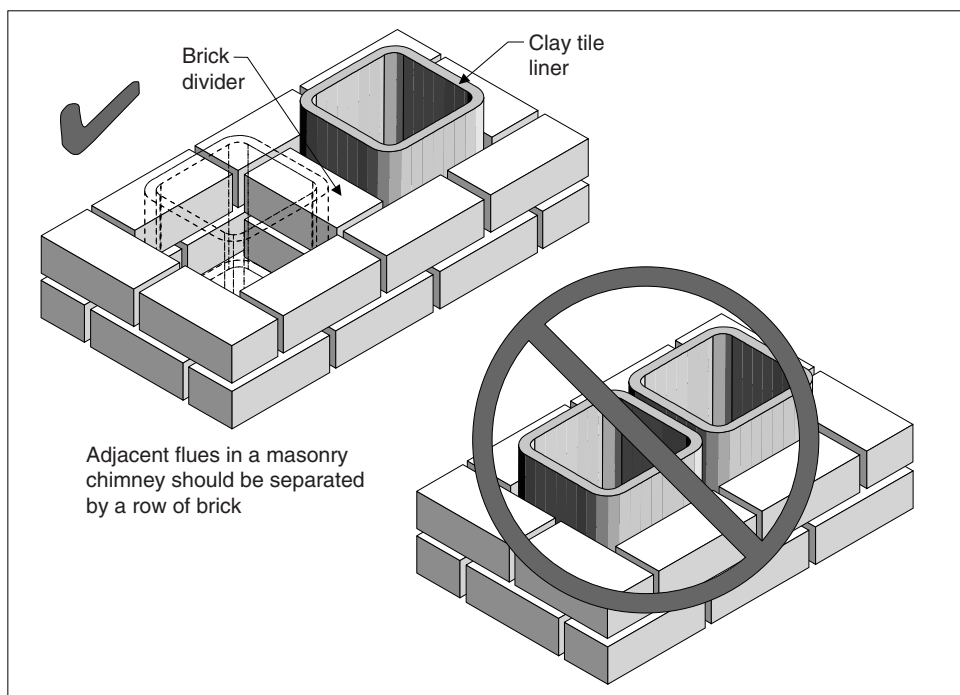
We Don't Check Flue Size

Metal chimneys typically have one flue each. Masonry chimneys may have several flues (Figure 1.7). Two or three flues is common and there can be six to eight flues, particularly in attached (e.g., row) houses.

Adjacent flues should be separated by a row of brick, typically. In most cases, adjacent clay tile liners forming two flues is considered poor practice.

We already mentioned this, but it's worth repeating—a home inspection does not include an evaluation of the suitability of the flue size for the appliance or appliances connected. This requires the consideration of a number of variables, and the expertise of a specialist. Where you have suspicions, call for others to check it out, but you should not normally give opinions on flue sizes.

FIGURE 1.7 Masonry Chimneys



CHAPTER REVIEW QUESTIONS

Answer the following questions on a separate sheet of paper, then check your results against the answers provided in Appendix E. If you have trouble with a question, refer back to the chapter to review the relevant material.

1. List six characteristics of a good chimney.
2. Give a short definition of:
 - a. Chimneys
 - b. Flues
 - c. Vents
3. Chimneys may have multiple flues.
True False
4. Masonry chimneys usually help support wood frame structures.
True False
5. List four common fuels that need chimneys.
6. List six things that affect chimney draft.

KEY TERMS

chimneys
flues

vents
vent connectors

draft