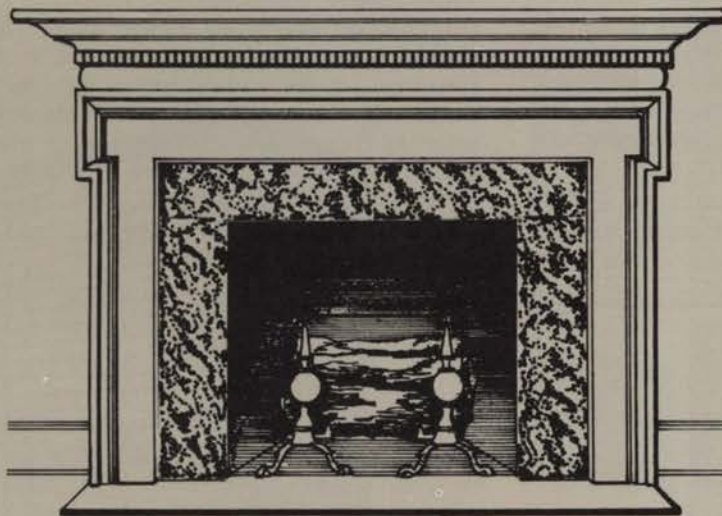


CIRCULAR SERIES
INDEX
NUMBER **F7.0**

CHIMNEYS and FIREPLACES



ISSUED BY THE
SMALL HOMES COUNCIL – BUILDING RESEARCH COUNCIL

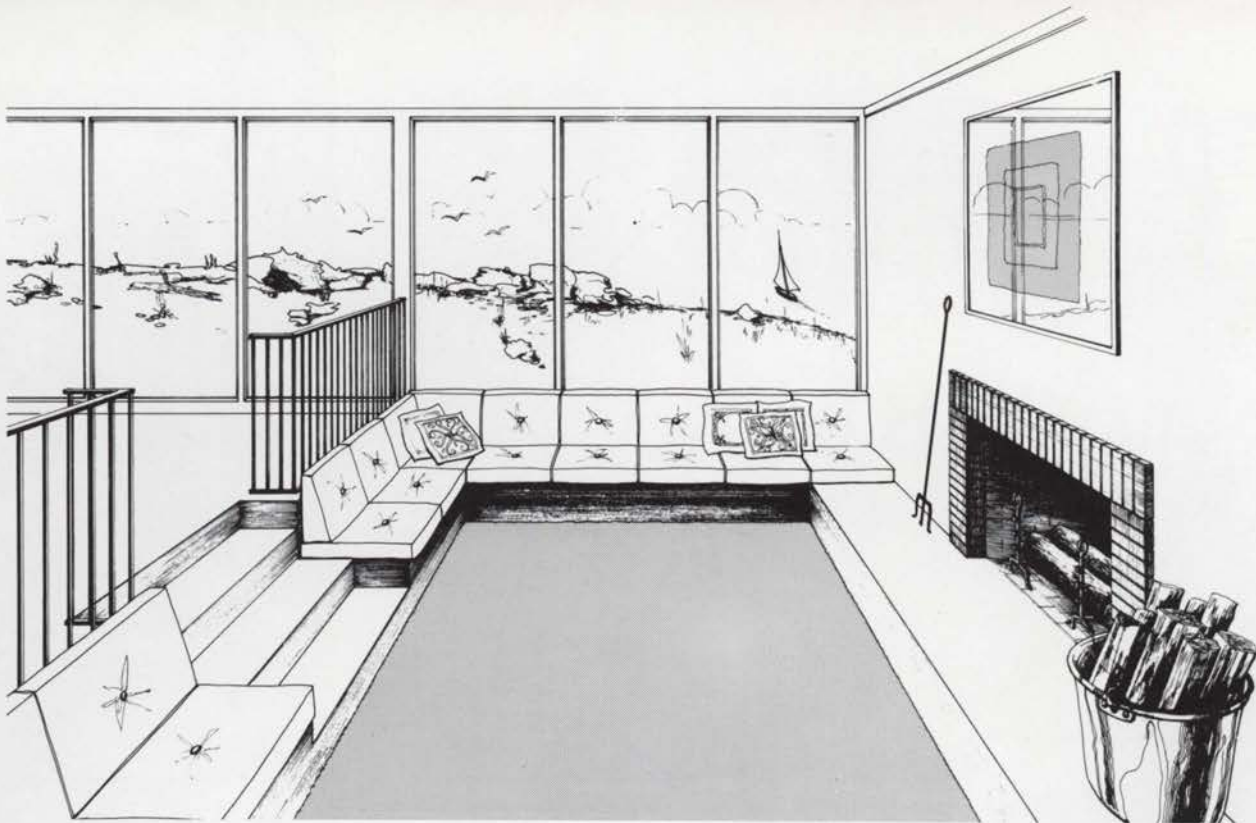
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This circular is one of a series on small homes. Other circulars are available for 15¢ each. For information, write to Small Homes Council-Building Research Council, University of Illinois at Urbana-Champaign, One East Saint Mary's Road, Champaign, Illinois 61820.

MATERIAL IN THIS CIRCULAR BY WAYNE L. SHICK AND SEICHI KONZO



FUNCTION

A fireplace can serve as a supplemental source of heat, and, while the fire is burning, it exhausts odors and fumes from the room. However, the conversion of fuel to useful heat is inefficient, and the chores of supplying wood, tending the fire, and removing ashes may not appeal to the busy homeowner. Heating efficiency can be increased through the use of a prefabricated metal fireplace form containing air circulation passages.

A fireplace does have aesthetic appeal for many people. It can be a pleasant center where the family and guests can enjoy light and warmth.

DESIGN

The location and design of the fireplace should enhance the view of the fire and the arrangement of furniture.

These pages show several fireplace types and construction materials from which the home builder may make a selection. The traditional fireplace on the cover has a structural design proven by long experience. A mantel may be selected from millwork catalogs or may be designed by the contractor or architect. Manufactured fireplaces of several designs, one of which is shown on the cover, are sold ready to install, including the flue.

MATERIALS AND FINISHES

Incombustible materials at least 6 inches wide must surround the fireplace opening at sides and top, and form a front hearth at least 20 in-

ches deep. Innumerable colors, textures, and finishes may be used on the fireplace exterior. A number of possibilities are listed below.

Concrete

standard
adobe
exposed aggregate
quartz chips
terrazo
troweled
floated
brushed
fluted
precast
hammered
ground
polished

Stone

marble
granite
limestone
slate
soapstone
boulders
field stone
split face
ground face
polished
carved
carved and polished
random
coursed

Brick

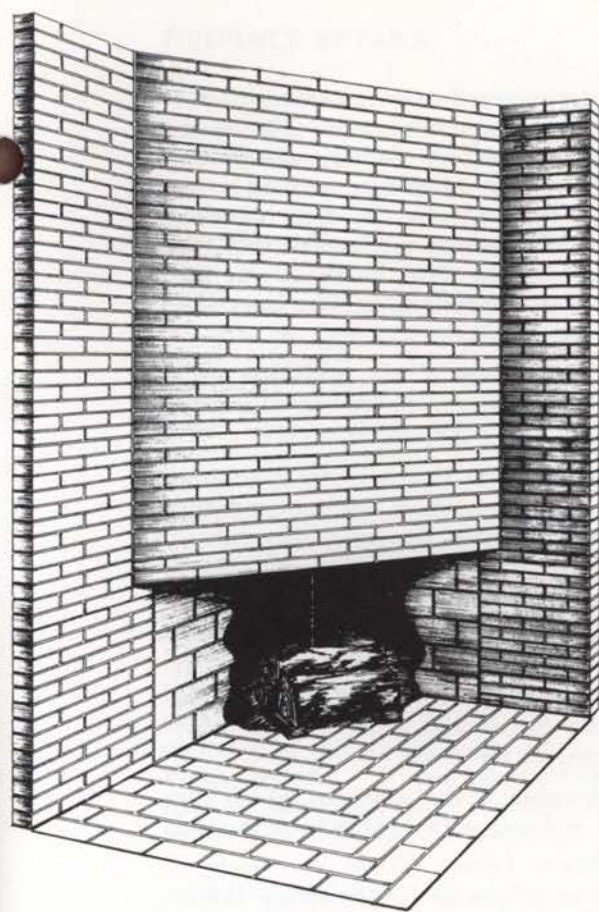
sizes
colors
textures
glazed
used
patterns
bonds
joints
mortar

Metals

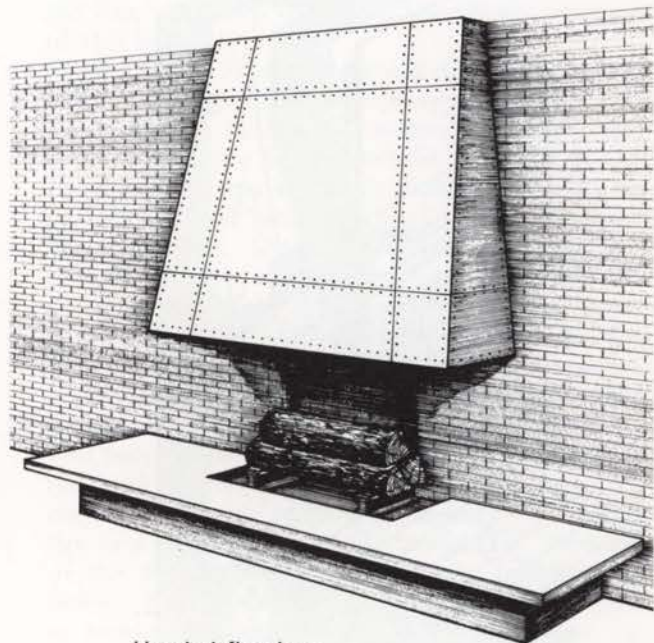
iron
steel
stainless
aluminum
copper
brass
bronze
hammered
polished
embossed
cast
brushed
anodized
figured

Ceramics

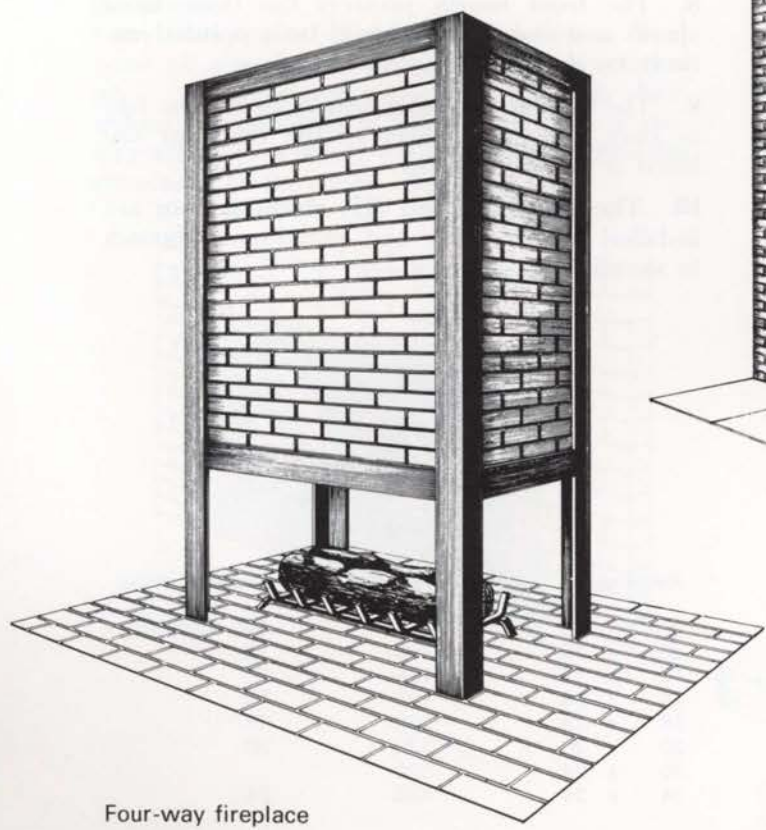
quarry tile
terra cotta
glazed tile
mosaic tile
glass
decorated
metallic
variegated
colors
sizes
shapes
textures
patterns



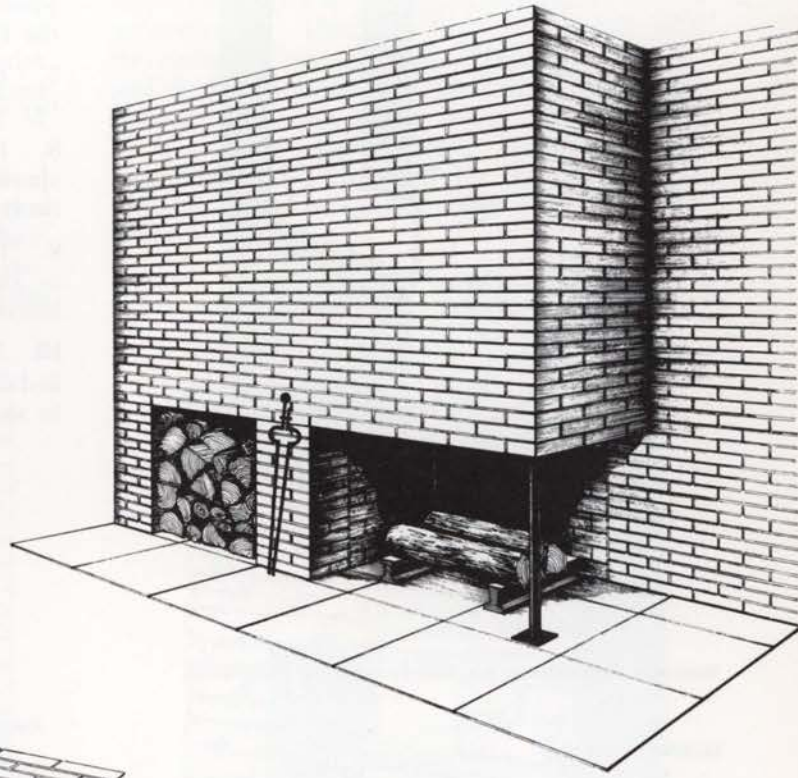
Corner fireplace



Hooded fireplace

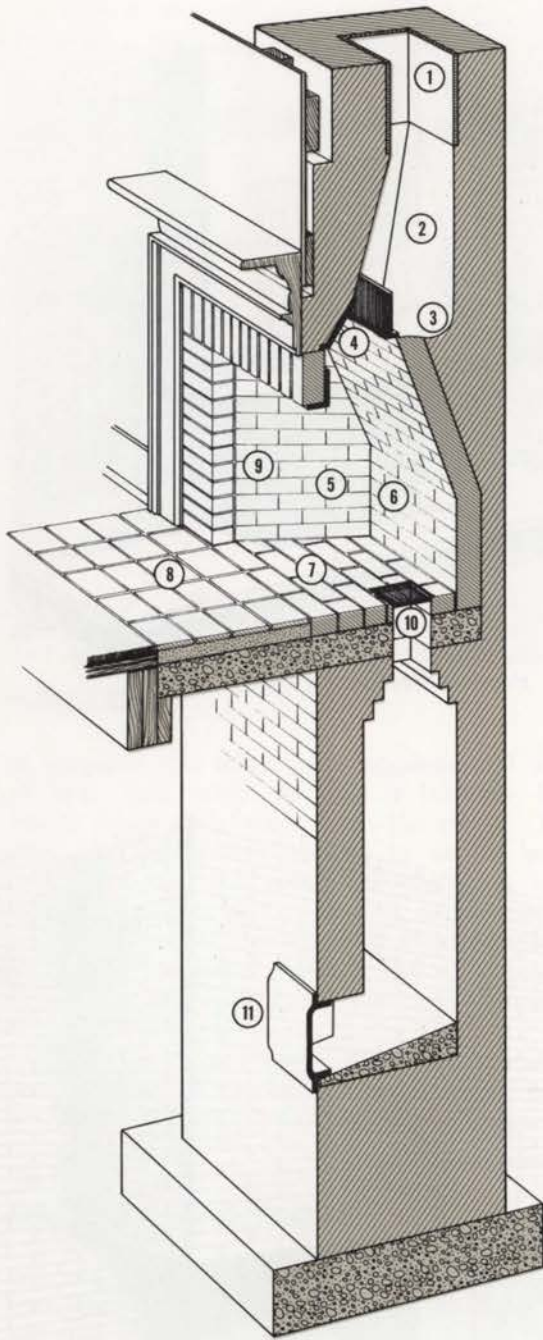


Four-way fireplace



Two-sided fireplace

PARTS OF A TRADITIONAL FIREPLACE



1. The **flue** carries combustion gases out of the house. A flue liner should be used. The minimum flue area is 70 square inches, and should be about 1/10 of the fireplace opening area. For example, a 48" wide by 29" high opening has an area of 1392 square inches, for which a 13" x 18" rectangular flue lining is recommended. See the table below for flue liner size recommendations.

2. The **smoke chamber** is the transition area which connects the damper with the flue and eases the flow of gases into the chimney.

3. The **smoke shelf** is the horizontal surface just behind the damper which helps to prevent downdrafts from reaching the fire. The smoke shelf and damper plate help to turn any down draft back up the chimney.

4. The **damper** is used to close the flue when the fireplace is not in use, and is located at the throat above the fireplace opening. It should cover the entire throat and consist of a movable plate hinged at the back.

5. The **fire chamber** is the space in which the fire burns. It is lined with firebrick or a steel fireplace form.

6. **Fire brick** is a special heat-resistant brick. Fire clay is used for setting the fire brick and the flue lining.

7. The **back hearth** is the surface on which the fire is built.

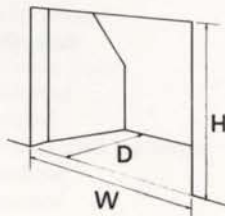
8. The **front hearth** protects the floor from sparks and embers. It should be supported entirely by the fireplace structure.

9. The **fireplace opening** admits air for the fire to burn. Common sizes of the openings are listed in the table below.

10. The **ash dump** and (11) **cleanout door** are installed in basement and crawl-space houses to simplify ash removal.

Average Proportions for Single-opening Fireplaces

Width	Height	Minimum Depth
24"	20"	18"
30	21	18
36	24	20
42	24	20
48	25	21
54	28	24
60	30	26
72	33	28



Flue Lining Sizes

Rectangular	Area (sq. in.)	Equivalent round
8½" x 13"	079	10" diameter
8½ x 18	108	12
13 x 13	125	
13 x 18	169	15
18 x 18	232	18
20 x 20	279	20
20 x 24	338	
24 x 24	420	24

FIREPLACE DETAILS

Metal screens. A metal screen prevents sparks and burning embers from falling beyond the limits of the hearth. It should be made from fine-gauge wire mesh and be large enough to cover the entire fireplace opening. One-piece and folding portable screens are available for average-sized fireplaces. Sliding curtain screens are usually custom made to be attached to the sides or top of the fireplace opening or mounted on the facing material. A fender at the bottom keeps ashes from spilling onto the front hearth.

Glass front. Heat-resisting glass fronts are commercially available, which provide a view of the fire, serve as a fire screen, and as a damper when the fireplace is not in use.

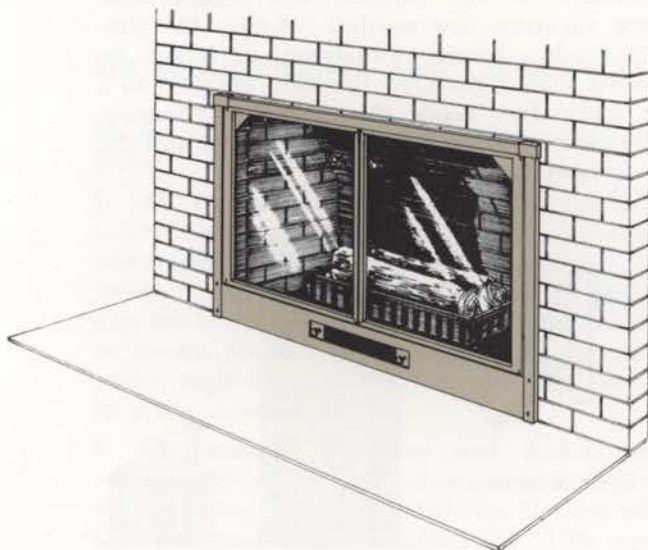
One or more glass panels can be used with a fireplace having more than one opening. A glass front enables one to leave a smoldering fire at night without fear of sparks leaving the fireplace.

The tempered glass should not be suddenly exposed to a roaring fire, but should be allowed to heat gradually. This avoids too rapid expansion of the glass and possible cracking.

Front hearth. A non-combustible hearth in front of the fireplace is required for protection from flying sparks. Except for the smallest fireplaces, the hearth should extend at least 12 inches beyond each side of the opening and extend at least 20 inches in front of the opening.

Raised hearths. Any differences in elevation of floor levels can be a hazard, especially under subdued light. A raised hearth is more obvious if made of contrasting color from the rest of the floor.

Conversation pit. A fireplace is often a focal point of a sunken living area or "conversation pit." A step-down area is particularly hazardous. A guardrail or divider element is recommended to separate the sunken area from the remainder of the room. See page 2.



Glass fire screen

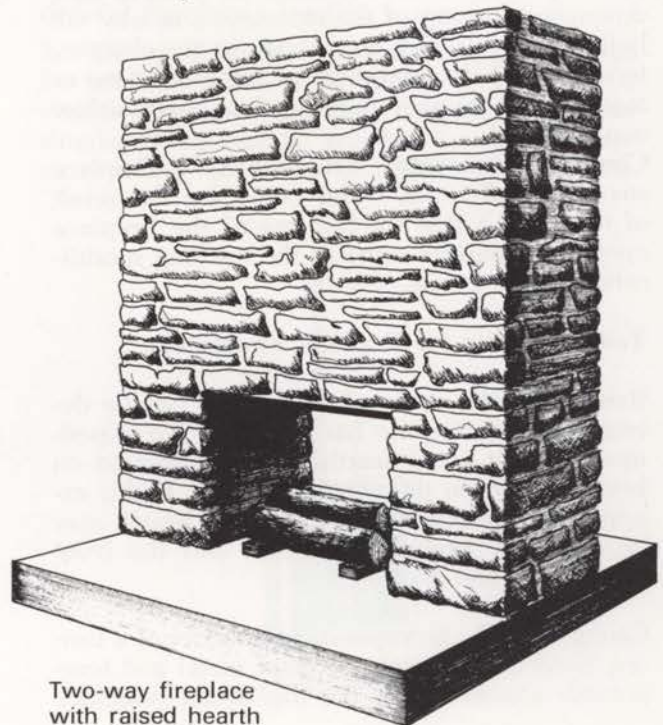
FIREPLACE HAZARDS

Hot surfaces. Hoods and canopies, as well as screens and glass fronts, can become hot from the fire. Children should be specifically warned of this hazard.

Flash fire. Do not burn old Christmas trees, holly wreaths, cardboard boxes, excelsior, or other highly flammable materials which can make a flash fire far beyond the capacity of the fireplace. Charcoal lighter fluids, kerosene, or gasoline, should never be used in the fireplace.

Wood ignition. Dry wood has an ignition temperature as low as 250 degrees Fahrenheit. At no point should the wood structure of the house come in contact with the hot surfaces of the chimney or fireplace. (Prefabricated fireplaces are available which can be installed with zero clearance.) Usually a 2-inch air space is specified between the chimney and wood framing. At the back of the fireplace, a 4-inch air space is required. Under prolonged operation of a hot fire in a fireplace, the brick surface at the back of the fireplace may exceed safe temperature limits. Combustible material, such as furniture or fabrics, should not be permitted to come into contact with the rear wall of a fireplace.

Chimney fire. When soft or cannel coal is burned in a fireplace for a long period, soot will accumulate inside the chimney. Occasionally, under prolonged heat, the soot may ignite and an intensely hot "chimney fire" will result until the carbon is burned away. The roar of the fire and the flames which belch out of the top of the chimney will cause alarm, but are not hazardous to chimneys in good condition. However, nearby roofs should be inspected for live sparks, and the attic should be inspected for any overheating immediately.



Two-way fireplace with raised hearth

WHAT TO DO ABOUT A FIREPLACE THAT SMOKES

There are several reasons why a fireplace smokes. Simple corrective measures should be tried before more drastic solutions are considered.

Air. It takes a lot of air to make a good draft in a chimney, as much as 500 cubic feet of air per minute. In tightly-built homes, it may be necessary to open a window an inch or so to supply air for the fireplace.

The operation of an exhaust fan in a kitchen or bathroom tends to induce a downdraft in a chimney. During fan operation it may be necessary to open a nearby window.

Occasionally, birds or squirrels build obstructions at the top of a chimney which block the flow of flue gases.

Cold Chimneys. A chimney, especially on an outside wall, may be so cold prior to the start of a fire that a downdraft exists. Before starting the fire, crumpled newspapers placed at the fireplace damper level should be ignited to warm the chimney and induce an updraft.

Excess Fire. The air and gases from a fireplace fire must converge toward the fireplace damper. If the fire is laid too far forward, or if the gases are released too rapidly, some of the gas may spill into the room. The fire should be started with a small amount of dry tinder at the back of the hearth until the chimney is well heated. The amount of combustible material in the fireplace should not be too great at any time.

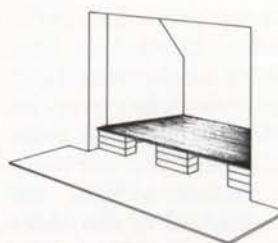
Occasional Smoking. Fireplaces may operate well most of the time, but smoke on occasions. This may occur when the wind is from a particular direction or when the wind is gusty. The cause may lie in wind action at the top of the chimney. High trees may cause the wind to flow downwards on top of the chimney; a nearby tall building may cause a downdraft; or the chimney top may be below the ridge of the roof. One or more of the chimney modifications listed below may be tried.

Continuous Smoking. Occasionally a fireplace smokes at all times. This could be the result of too small a flue for the size of the fireplace opening. Consider some of the opening modifications listed below.

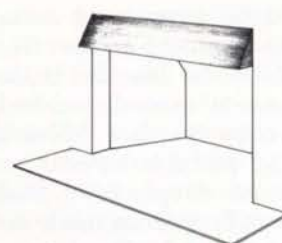
Trial Remedies for Smoking Fireplaces.

Raised Hearth. A fireplace opening can be decreased by raising the back hearth. To experiment, a sheet metal hearth can be supported on bricks placed on the existing hearth. If this experiment improves the fire, the back hearth may be raised by firebrick masonry, and the front hearth may also be built up.

Canopy Hood. An experimental model of a canopy hood can be made of sheet metal and temporarily attached over the top of the fireplace



Raised hearth



Canopy hood

opening. Try various designs and sizes. If the hood works well, a heavy metal hood can then be built in by a sheet metal contractor.

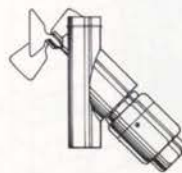
Extend Chimney. A good draft is usually provided by a chimney which is 20 feet high from hearth to top of chimney. If the existing flue is short (less than 15 feet) the draft may be poor. A trial piece of chimney liner or metal cylinder can be securely fastened on top of an existing chimney to test whether the draft is improved.

Chimney Top. If a downdraft impinges on top of the chimney, as from nearby tall structures or trees, a chimney top of metal or stone may be tried to deflect the downdraft.

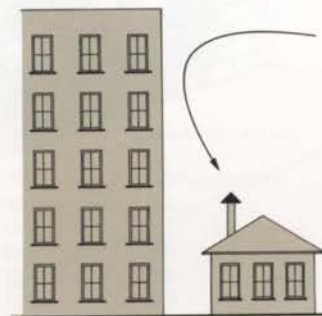
Trim Trees. Smoke patterns above the chimney may indicate that tall trees are causing downdraft, and that trees should be trimmed.

Draft Inducer. When no other remedies work, consideration may be given to a fan that forces air up the chimney. Such draft inducing equipment is specifically designed for the purpose and must be Underwriters listed. Periodic inspection and maintenance are required.

Rebuilding or Replacement. If the fireplace deficiencies are gross, the damper has become inoperative, or the chimney has deteriorated, drastic measures are needed. Either the fireplace needs extensive rebuilding, or it can be replaced with a gas-fired fireplace coupled to a new metal flue inside the defective chimney. Or an electric fireplace can be installed and the old chimney sealed off.



Draft inducer



Chimney top

CHIMNEYS AND VENTS

Vents and chimneys are available that do not require masonry construction. Such manufactured products are made in a variety of forms, including the following:

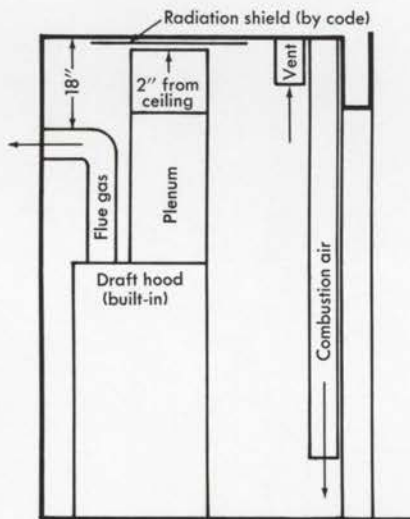
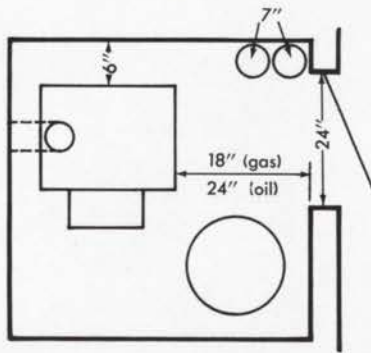
1. double wall, sheet metal (aluminum or stainless steel) with air space between the walls
2. double wall, sheet metal with insulation between walls
3. triple wall, sheet metal with insulation between the inner and middle walls
4. cement-asbestos pipe
5. porcelain enamel pipe

Some of the vents and chimneys are restricted to gas fuels, while others are usable with any fuel. Materials should be listed for the fuel used by the Underwriter's Laboratories. The vent pipes and chimneys should be installed in accordance with manufacturer's instructions.

MANUFACTURED FIREPLACES

Three types of manufactured fireplaces are commonly available:

1. **Prefabricated fireplace.** Several designs and shapes are available for burning conventional solid fuels. These units are sold complete with flues, and some are constructed to permit installation directly against combustible materials. Because of their light weight, many do not require a separate foundation.
2. **Gas fireplace.** These are sold as either total units, including firebox, hearth, and flue, or as partial units for installation inside a traditional fireplace. Venting is required.
3. **Electric fireplace.** The electric log unit can be installed within a traditional fireplace, or a complete package, including firebox, hearth, and simulated log, can be attached to existing construction. No vents or flues are required.



Standard Clearances for Furnaces and Boilers*

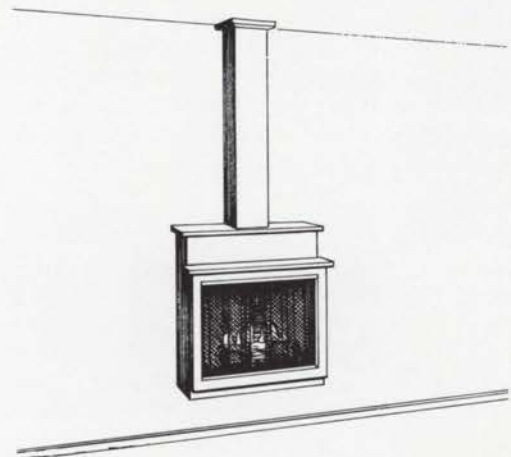
*For use when room volume is at least 12 times furnace volume or 16 times boiler volume.

AIR REQUIREMENTS AND CLEARANCES

Safety provisions for combustion equipment include:

1. **Air for combustion.** Sufficient air is required for complete burning of fuels. Furnaces and boilers located in open basements and open utility rooms depend upon normal air leakage into the house. For closed furnace rooms, such as shown above, special provisions for an air supply must be made. A duct to a ventilated attic space is common.

2. **Clearances.** Furnaces and boilers have been designed for less clearances than those shown above and are listed by Underwriters' Laboratories for such installations. This equipment must be installed in accordance with the manufacturer's specifications.

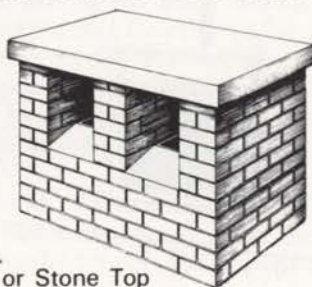


BUILD A SAFE AND EFFICIENT CHIMNEY

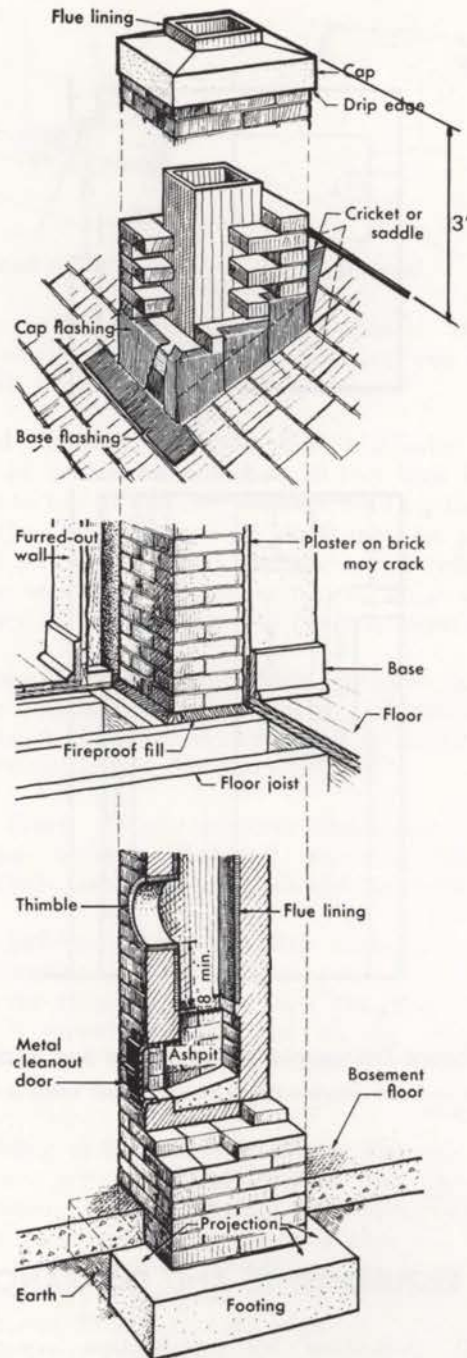
1. Masonry chimneys must be free-standing—giving no support to, and receiving none from, the house.
2. A cap of stone or concrete at the top of the chimney will shed water, and thereby preserve the masonry below. All masonry chimneys should have a flue liner, which should extend through the cap and project above it.
3. Chimneys should extend above roofs and ridges so that air currents will not be deflected down into the flue.
4. Water leakage around chimneys can be prevented by proper **flashing** and **counter flashing**. Corrosion-resistant metal is required. The flashing is built into the roofing material, and extends up onto the masonry. The counter flashing is bonded into the mortar joints and is lapped down over the flashing.
5. A **cricket** (or saddle) on the high side of a sloping roof will shed water around the chimney.
6. The chimney should be supported by a spread **footing**, located below the frost line.

WHEN THERE IS MORE THAN ONE FLUE IN A CHIMNEY BE SURE THAT:

1. Each flue is entirely separate from the other flues with no cross connections between them.
2. Brick spacers or **wythes** separate the flue linings in one chimney.
3. Flue linings are built **ahead** of the construction of the chimney, and the brickwork is laid up around the lining. Joints in the flue lining must be bedded in fire clay.
4. Each fireplace and furnace must have a separate flue all the way to the top of the chimney.
5. **Chimney tops** will help to protect the masonry by keeping out the rain and snow, especially in buildings such as summer cottages, where the chimney may not be used for a large portion of the year. When downdrafts from surrounding trees or tall buildings hit the top of the chimney and prevent proper draft, a hood or cover may be helpful in deflecting these air currents. The total area of the side openings should be at least four times the area of the chimney flue. Tops should be periodically inspected and cleared of bird nests.



Concrete or Stone Top



6. **Spark arresters** are often placed at the tops of chimneys when one is firing fuels which may emit sparks, or when using incineration in which paper is burned. Arresters are not recommended for use with soft coal because they may become plugged with soot.

7. A straight flue is preferable. However when a change in direction cannot be avoided in the fireplace flue, the **offsets** should be gradual. (The slope should be no more than 30 degrees from vertical).