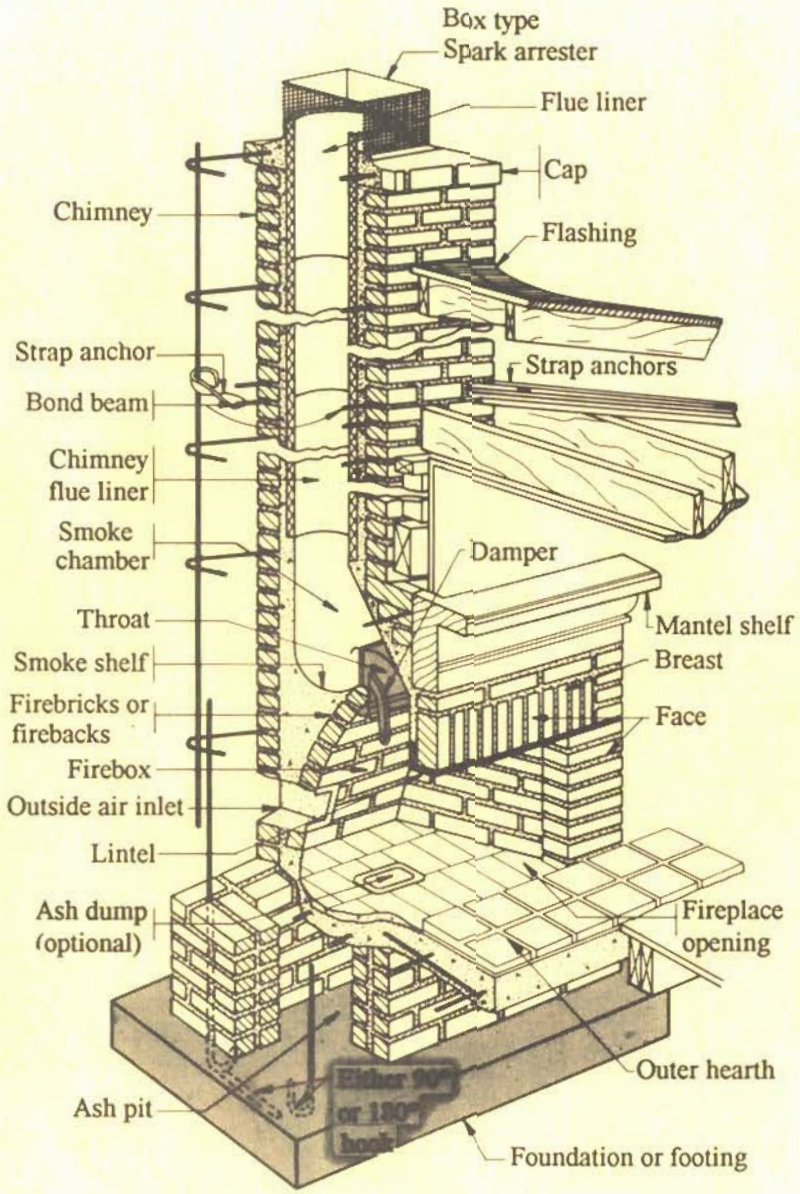



PARTS OF A FIREPLACE AND CHIMNEY

# RESIDENTIAL MASONRY FIREPLACE AND CHIMNEY CONSTRUCTION DETAILS AND SPECIFICATIONS

## BASED ON THE 1997 U.B.C.

Date_____

Location_____

_____

Name & Address-Owner_____

_____

Name & Address-Contractor_____

_____

DIMENSIONS

Dimensions shall be not less than listed in table of General Code Requirements unless special approval is obtained.

Width of Opening_____ Height of Opening_____

Depth of Firebox_____ Size of Flue_____

Width of Jambs Each Side of Opening_____

Height: Top of Foundation to Top of Chimney_____

Ash Dump & Clean-out Fittings Required: Yes____ No____

Special Items & modifications applying to this job:

_____

_____

_____

MIA

**Masonry Institute of America**

386 Beech Ave., Suite #4
Torrance, CA 90501-6202
(310) 328-4400 – Fax (310) 328-4320

## SPECIFICATIONS

**Scope:**

The following specifications, including special items and modifications, shall govern the construction of the fireplace and chimney.

**Work Not Included:**

Any concrete work or reinforcement embedded in concrete including vertical dowels.

**Work Included:**

All labor, materials, equipment, appliances, anchors, bolts, miscellaneous iron work and all other reinforcing steel, including setting of vertical steel as indicated on the plans and as herein specified.

**Materials:**

Materials shall be as follows: Water shall be clean and potable.

Sand conforming to "Aggregate for Masonry Mortar" ASTM C 144. Portland cement conforming to ASTM C 150 Type I or 11.

Hydrated lime conforming to "Hydrated Lime for Masonry Purposes" ASTM C 207 Type S.

Steel Reinforcing conforming to "Deformed Billet Steel Bars Concrete Reinforcement", ASTM A 615 - Grade 40 or 60.

Brick, meeting the requirements for "Building Brick" ASTM C 62 or for "Facing Brick" ASTM C 216 or for "Hollow Brick" ASTM C 652.

Block meeting the requirements for "Hollow Load Bearing Concrete Masonry Units" ASTM C 90.

Clay flue liners conforming to "Clay Flue Linings" ASTM C 315 or "Concrete Flue Liners" conforming to ICBO E.R. No. 2602.

**Mortar Proportions:**

Mortar shall be proportioned by volume as follows: One part Portland cement, one-half part hydrated lime and four-and-a-half parts dry, loose sand.

**Mixing of Mortar:**

All cementitious materials and aggregates shall be mixed for a minimum period of three minutes, with the amount of water required to produce the desired workability.

**Re-tempering:**

Permitted once only by adding water within a basin formed of mortar and the mortar reworked into the water. Mortar which has become harsh and non-plastic shall not be re-tempered or used. Mortar that has set for more than 2 ½ hours shall not be used.

**Grout:**

Grout may be 1 part Portland cement, 3 parts sand, 2 parts pea gravel of pouring consistency or may be composed of retempered mortar.

**Joints:**

All joints exposed to the weather shall be tooled. Joints in firebrick shall not exceed ¼".

**Construction:**

When the bricks are being laid, they shall be sufficiently damp, and the mortar sufficiently soft, so that the mortar will remain plastic to permit the units to be leveled and plumbed immediately after being laid without losing bond. All masonry work shall be accurately executed and in conformity with the plans.

No brick less than ½ length shall be used in exposed work. Head and bed joints shall be solidly filled with mortar and brick shall be shoved into place.

Fireplaces are generally of two types. One type is constructed on concrete slab floors and the other type is constructed in a frame floor using a cantilevered hearth.

The generally accepted method of construction of a fireplace from the hearth up is as follows: The fireplace is laid out; the back of the fireplace is constructed to a scaffold height approximately five feet; and then the firebox is constructed and back-filled with tempered mortar. Slush untempered mortar or grout loosely behind firebox wall to allow for expansion of firebox.

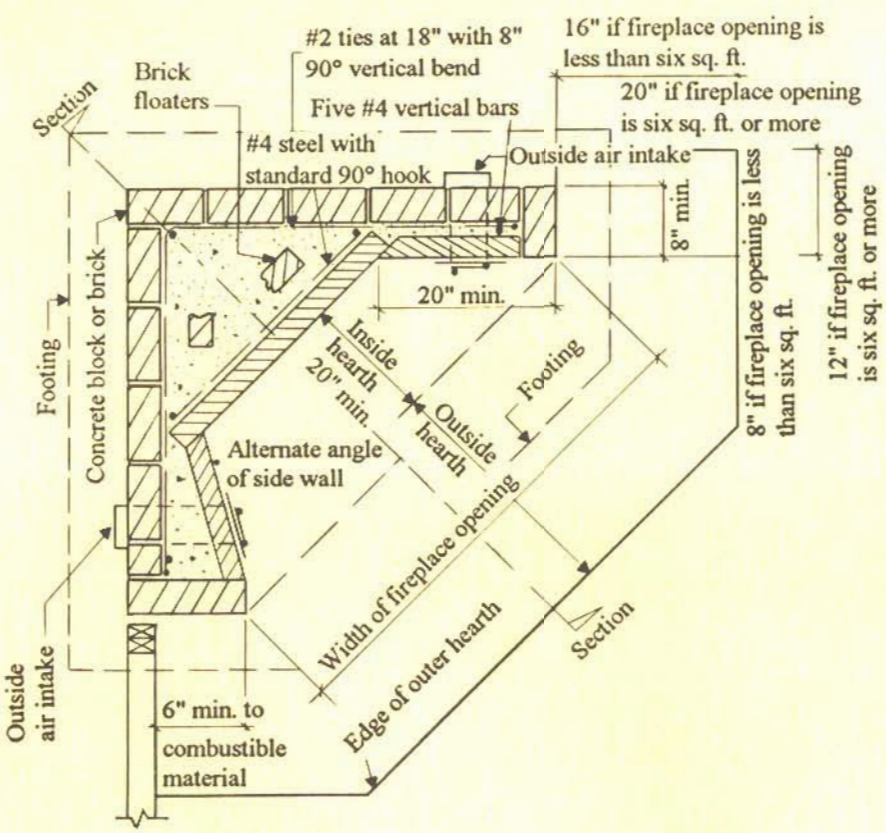
The horizontal steel may be placed either in the mortar bed joint or in the grouted area.

Some fireboxes are constructed without the face, leaving ties so the face may be added at a later date, while other fireboxes are constructed simultaneously with the face. Either way is an approved method of construction.

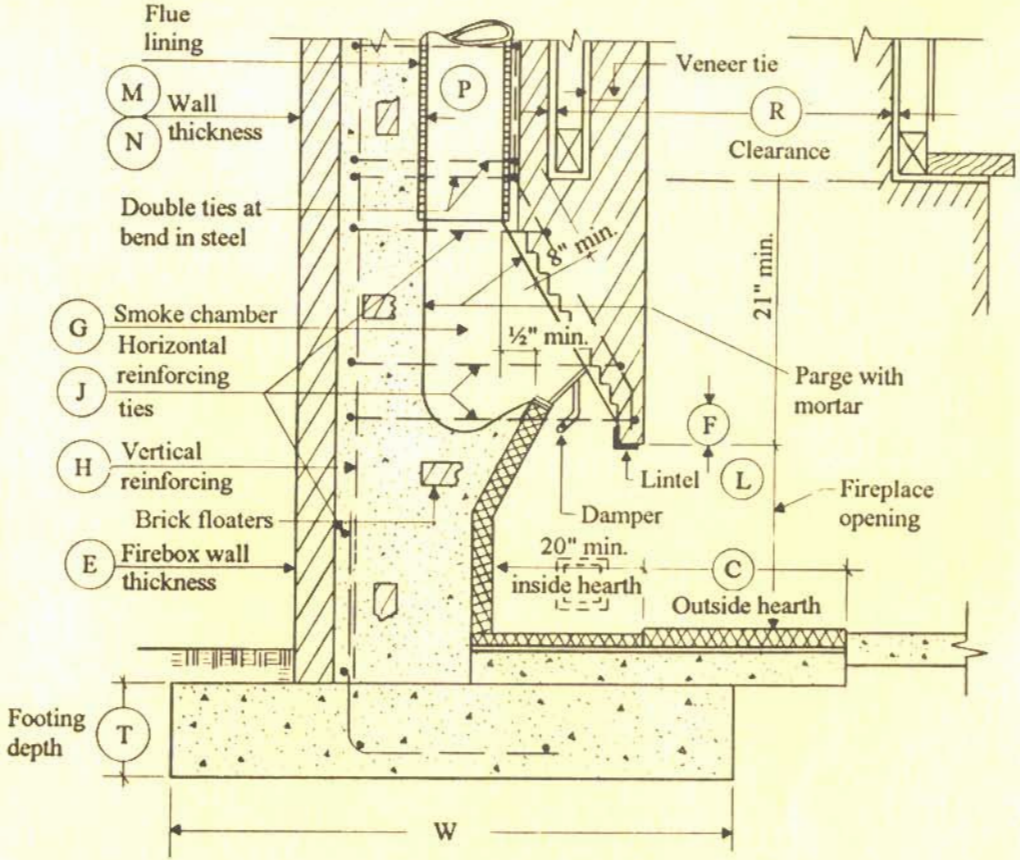
Tempered mortar grout shall fill the void between the flue lining and the masonry wall.

Note: These residential masonry construction details do not include Rumford fireplaces.

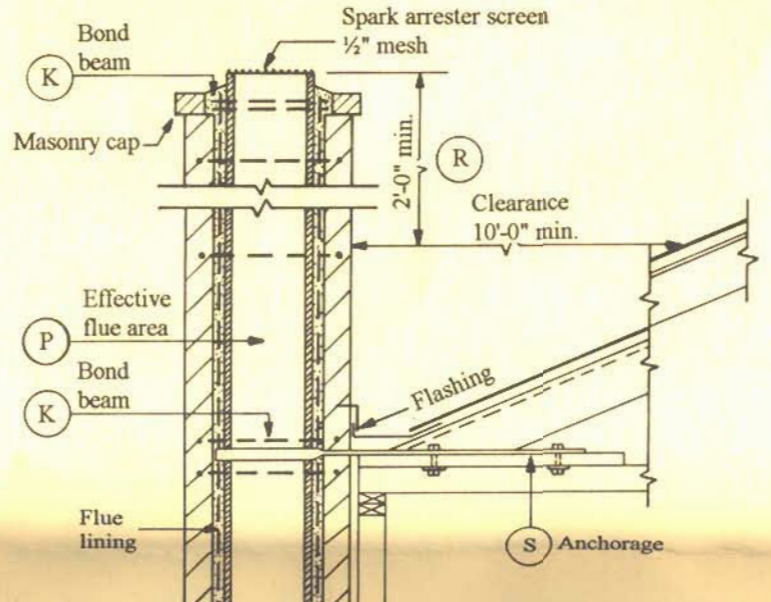
# MASONRY CHIMNEY SECTIONS

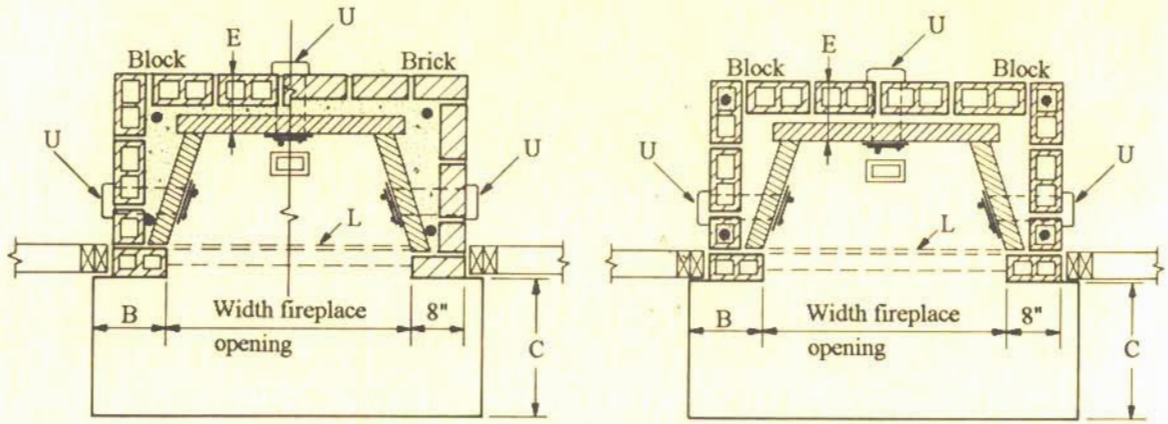



PLAN AT TOP OF HEARTH FOR CORNER FIREPLACE

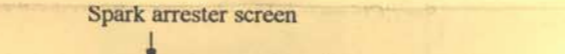


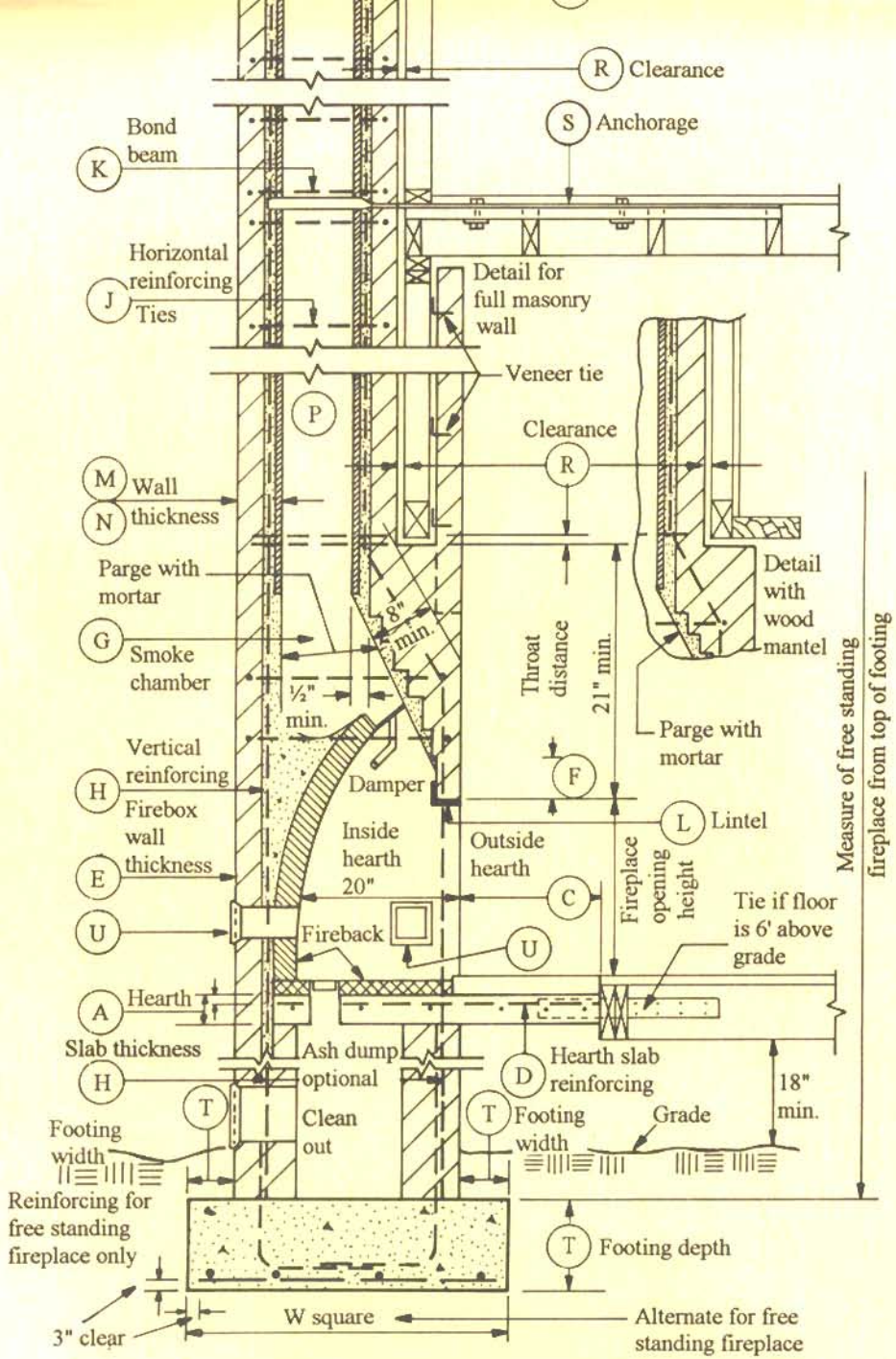

SECTION—THRU FIREBOX OF A CORNER FIREPLACE



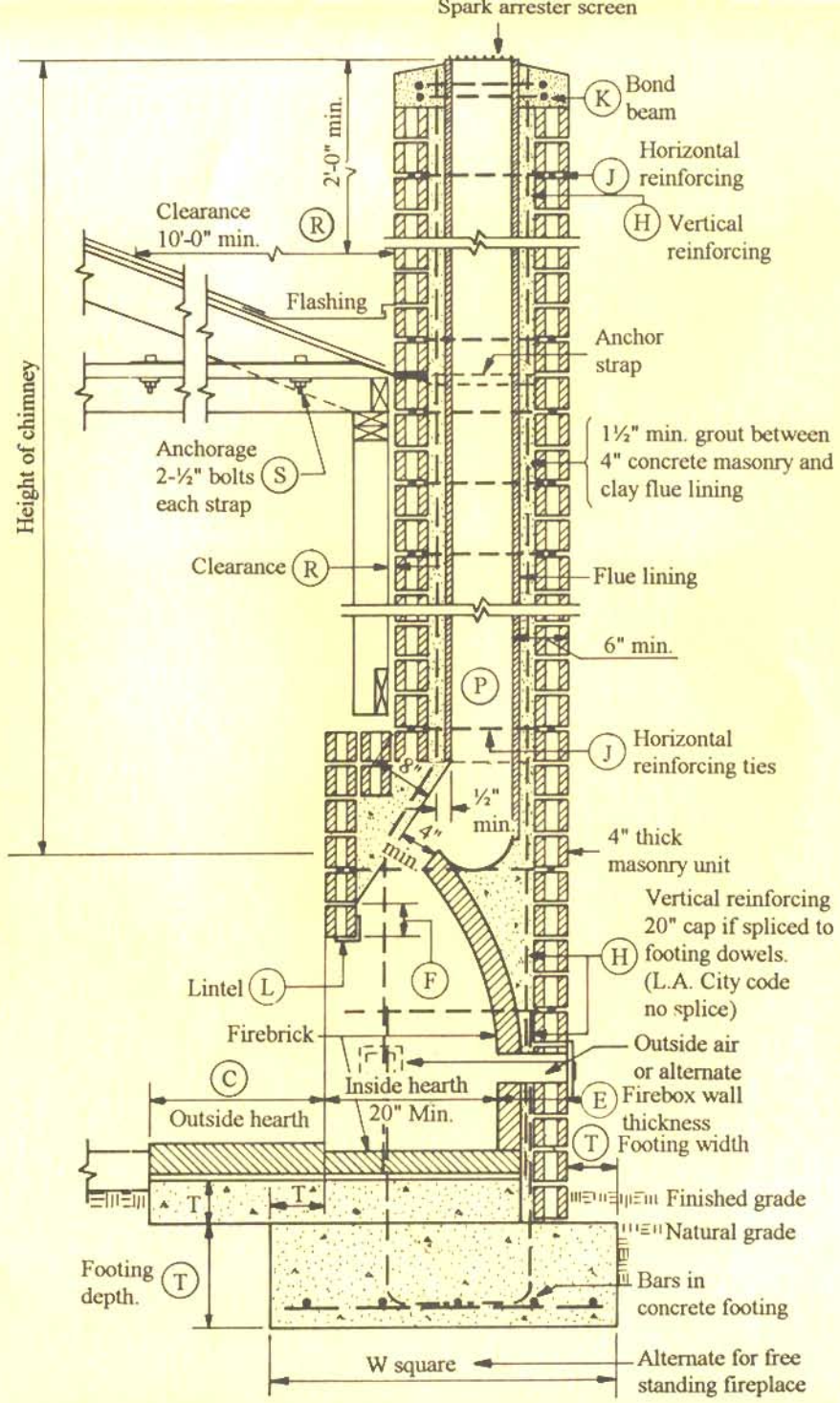




PLAN AT TOP OF HEARTH






BRICK FIREBOX AND CHIMNEY WOOD FLOOR



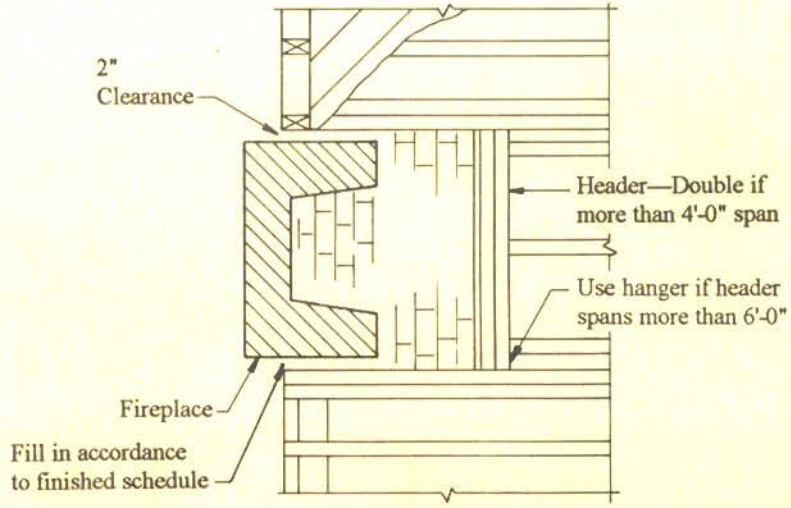

HOLLOW UNIT MASONRY FIREBOX AND CHIMNEY ON CONCRETE SLAB

# GENERAL CODE REQUIREMENTS

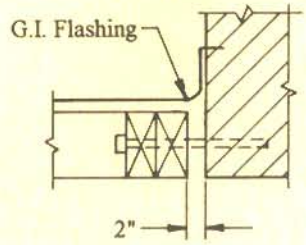
### U.B.C. REQUIREMENTS FOR MASONRY FIREPLACES

| ITEM | LETTER* | UNIFORM BUILDING CODE REQUIREMENTS |
|---|---|---|
| Hearth slab thickness | A | 4″ (102 mm) |
| Hearth extension (each side of opening) | B | 8″ (203 mm) fireplace opening < 6 sq. ft. (0.56 $m^2$)<br>12″ (305 mm) fireplace opening ≥ 6 sq. ft. (0.56 $m^2$) |
| Hearth extension (front of opening) | C | 16″ (406 mm) fireplace opening < 6 sq. ft. (0.56 $m^2$)<br>20″ (508 mm) fireplace opening ≥ 6 sq. ft. (0.56 $m^2$) |
| Hearth slab reinforcing | D | Reinforced to carry its own weight and all imposed loads. |
| Thickness of wall of firebox | E | 10″ (254 mm) common brick or 8″ (203 mm) where a firebrick lining is used. Joints in firebrick $^1/_4$″ (6 mm) max. |
| Distance from top of opening to throat | F | 6″ (152 mm) |
| Smoke chamber edge of shelf<br>Rear wall—thickness<br>Front and sidewall—thickness | G | <br>6″ (152 mm)<br>8″ (203 mm) |
| Chimney<br>Vertical reinforcing | H | Four No. 4 full-length bars for chimney up to 40″ (1016 mm) wide. Add two No. 4 bars for each additional 40″ (1016 mm) or fraction of width or each additional flue. (Seismic Zones 2, 3 and 4.) |
| Horizontal reinforcing | J | $^1/_4$″ (6.4 mm) ties at 18″ (457 mm) and two ties at each bend in vertical steel. |
| Bond beams | K | No specified requirements. |
| Fireplace lintel | L | Noncombustible material. |
| Walls with flue lining | M | Brick with grout around lining. 4″ (102 mm) min. from flue lining to outside face of chimney. |
| Walls with unlined flue | N | 8″ (203 mm) solid masonry. |
| Distances between adjacent flues | | 4″ (102 mm) |
| Minimum effective flue area (based on area of fireplace opening) | P | Round lining—$^1/_{12}$ or 50 sq. in. (32 258 $mm^2$) min.<br>Rectangular lining—$^1/_{10}$ or 64 sq. in. (41 290 $mm^2$) min.<br>Unlined or lined with firebrick—$^1/_8$ or 100 sq. in. (64 516 $mm^2$) min. |
| Clearances<br>Wood frame<br>Combustible material<br><br><br>Above roof | R | 2″ (51 mm) (See floor construction detail)<br><br>6″ (152 mm) min. to fireplace opening.<br>12″ (305 mm) from opening when material projecting more than $^1/_8$ for each 1″ (25 mm).<br>2′ (610 mm) at 10′ (3048 mm) |
| Anchorage<br>Strap<br>Number<br>Embedment into chimney<br>Fasten to<br>Bolts | S | <br>$^3/_{16}$″ × 1″ (4.8 mm by 25 mm)<br>2<br>12″ (305 mm) hooked around outer bar w/6″ (152 mm) ext.<br>2″ × 4″ (51 mm by 102 mm) ties crossing a min. of 4 joists<br>Two $^1/_2$″ (13 mm) diameter |
| Footing<br>Thickness<br>Width | T | <br>12″ (305 mm) min.<br>6″ (152 mm) each side of fireplace wall |
| Outside air intake | U | + Optional - Alternate locations |

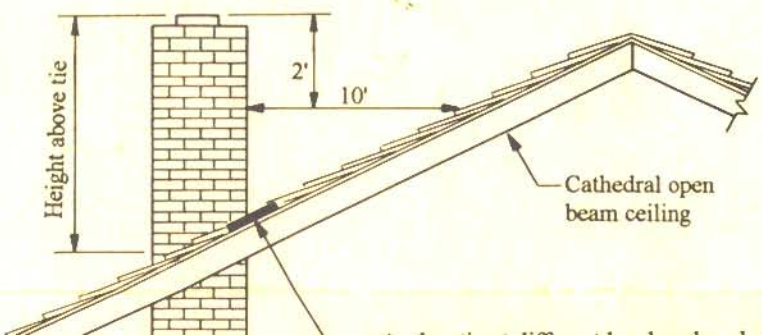
NOTE: *See Figure 5 for letter references.
Steel reinforcement shown is required in Seismic Zones 2, 3 and 4.
See "Chimneys, Fireplaces and Barbecues" for additional information.
+When outside air intake vents are required, provide either one in




FLOOR CONSTRUCTION DETAIL

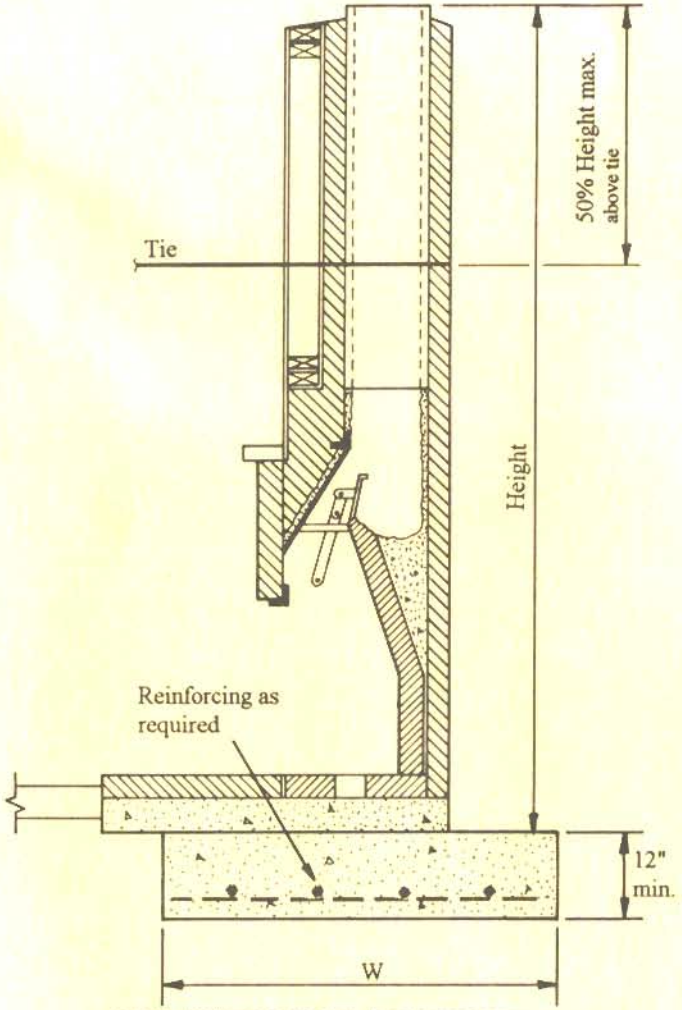



VERTICAL FLASHING



See "Chimneys, Fireplaces and Barbecues" for additional information.

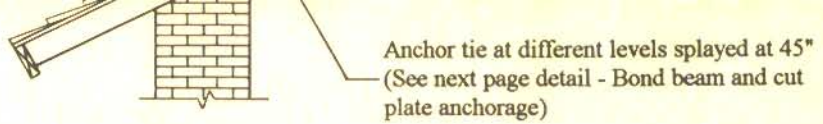
+When outside air intake vents are required, provide either one in rear of firebox or one on each side of firebox.



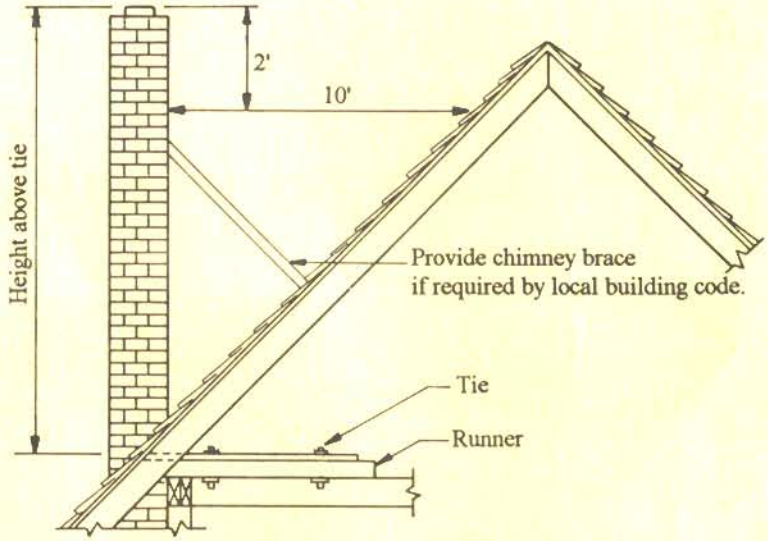

ALTERNATE FOUNDATION SCHEDULE FOR A ONE STORY FREE STANDING FIREPLACE
(Soil Bearing 1000 psf max.)

| FREE STANDING HEIGHT-FT. | SQUARE FOOTING "W" (min.) | BOTTOM REINF. EACH WAY |
|---|---|---|
| 11' | 4'-0" | 4-#4 |
| 13' | 4'-6" | 4-#4 |
| 15' | 5'-0" | 5-#4 |
| 17' | 5'-6" | 5-#4 |

Fireplace and chimney reinforcing and details same as "minimum requirements" this sheet except no anchor tie connections at roof or ceiling are required, but are recommended in seismic areas.




GABLE END OPEN BEAM




ANCHOR TIE CONNECTION REQUIREMENTS FOR TALL CHIMNEYS

The above reinforcement requirement will be adequate for chimneys to ten feet (2.54 m) above anchor tie. (Check local building code requirements).

Chimneys of excessive height, weight, width or other special or unusual features should be designed in accordance with sound engineering principles to withstand the forces imposed by wind or earthquake.

Many times, when a chimney extends considerably above the roof level, an intermediate lateral support or tie may be placed between the roof line and the top of the chimney and tied back to the roof.

| HEIGHT OF CHIMNEY ABOVE TIE | SMALL CHIMNEY APPROX. 22" x 30" | | WIDE STRAIGHT UP CHIMNEY APPROX. 22" x 55" | |
|---|---|---|---|---|
| | Bolt tie to 2" x 4" runner | Nail 2" x 4" runner to rafters or joists | Bolt tie to 2" x 4" runner | Nail 2" x 4" runner to rafters or joists |
| 8' | 2-½ " bolts | 8-16d nails | 2-½ " bolts | 12-16d nails |
| 10' | 2-½ " bolts | 10-16d nails | 2-½ " bolts or 3-½" bolts | 14-16d nails |

## EFFECTIVE AREA AND FLUE SIZES

| Effective Area of Flue Lining | Nominal Flue Size | Actual Outside Dimensions | Inside Dimensions |
|---|---|---|---|
| Sq. In. | Inches | Inches | Inches |
| 74 | *8 x 13 SQ. | 9 1/8 x 13½ | 7½ x 11½ |
| 79 | *11½ x 11½ SQ | 11 5/8 x 11 5/8 | 10 x 10 |
| 83 | **+13 x 13 RC** | **13 x 13** | **10½ x 10½** |
| 85 | **+8½ x 17 RC** | **8½ x 17** | **6¼ x 14 7/8** |
| 85 | **+10 x 14 RC** | **10½ x 14¾** | **8 x 12 3/8** |
| 91 | *8 x 13 OV | 8¼ x 12¾ | 6½ x 11½ |
| 92 | *8 x 17 SQ | 8¾ x 17 5/8 | 6½ x 15½ |
| 92 | **+8 x 19½OV** | **8 x 19½** | **5¾ x 17¼** |
| 95 | *8 x 17 OV | 8¾ x 17¼ | 6¾ x 15½ |
| 95 | *11 RD | 13 | 11 |
| 95 | **+10 x 17½ RC** | **9 5/8 x 17¾** | **7 x 15 1/8** |
| 99 | **+13 x 13 SQ** | **13¼ x 13¼** | **11¼ x 11¼** |
| 104 | *8 x 19 OV | 8½ x 19½ | 6½ x 17 3/8 |
| 106 | *8 x 20 SQ | 8 3/8 x 20¼ | 6¼ x 18¼ |
| 113 | *12 RD | 13½ | 12 |
| 114 | **+12 x 16 SQ** | **12 x 16** | **9¾ x 13¾** |
| 118 | *10 x 17 OV | 10¼ x 18¼ | 8 x 16 3/8 |
| 119 | *12 x 16 SQ | 12 x 16 | 10½ x 10½ |
| 126 | **+13 x 17 RC** | **13 x 17** | **10½ x 14¼** |
| 131 | *13 x 17 OV | 13 x 17 | 10½ x 14 ¾ |
| 136 | *13 x 17 SQ | 12 7/8 x 17½ | 10½ x 15¼ |
| 150 | *13 x 18 OV | 13 x 18 | 10¼ x 17¼ |
| 154 | **+13 x 20 RC** | **13 x 20** | **10½ x 16½** |
| 154 | *16 x 16 SQ | 16 x 16 | 14 x 14 |
| 160 | **+17 x 17 RC** | **17 x 17** | **14¼x 14¼** |
| 171 | *17 x 17 OV | 17¼ x 17¼ | 14¾ x 14¾ |
| 177 | *15 RD | 17 | 15 |
| 184 | *13 x 21 OV | 13¼ x 22¼ | 10½ x 19¾ |
| 201 | **+17 x 20 RC** | **17 x 19¾** | **14½ x 17** |
| 201 | *18 x18 SQ | 18 x 18 | 16 x 16 |
| 210 | *16 x 20 SQ | 16 x 20 | 14 x 18 |
| 246 | *17 x 21 OV | 17 5/8 x 22 | 15 x 18 5/8 |
| 254 | **+21 x 20 RC** | **21 x 20** | **18½ x 17 1/8** |
| 255 | * 16 RD | 18 | 16 |
| 255 | *20 x 20 SQ | 20 x 20 | 18 x 18 |
| 284 | *21 x 21 OV | 2 x 22 | 19 x 19 |
| 327 | *20 x 24 OV | 20 x 24 | 18 x 22 |
| 346 | *19 RD | 21 | 19 |

NOTE: By industry convention, rectangular flues are designated by exterior dimension, round flues by interior diameter.

NOTE: For dimensions in mm, multiply inches by 25.4
For area in sq. mm., multiply sq in. by 645.2

### CHIMNEY REINFORCEMENT

Every chimney in Seismic Zones 2, 3 and 4 and in areas of high winds such as hurricanes and tornadoes shall be reinforced with at least four ½ inch (13 mm) diameter vertical reinforcing bars. The bars shall extend the full height of the chimney.

The vertical bars shall have a minimum cover of ½ inch (13 mm) of grout or mortar tempered to a pouring consistency.

Vertical bars may be spliced with a 24 inch (609 mm) or 48 bar diam. lap if permitted by local building department. The bars shall be tied horizontally at 18 inches (457 mm) maximum intervals with not less than ¼ inch (6 mm) diameter steel ties at each interval.

Two ties shall also be provided at the bend in a bar where it changes from a sloped position to a vertical position. Maximum slope of vertical steel should be six inches (152 mm) horizontal to twelve inches (305 mm) vertical.

Where the width of the chimney exceeds 40 inches (1016 mm), two additional ½ inch (13 mm) diameter vertical bars shall be provided for each additional flue incorporated into the chimney or for each additional 40 inches (1016 mm) in width or fraction thereof.

### ANCHORAGE OF CHIMNEY TO BUILDING

It is required by all codes to provide anchor straps from the chimney to the building when the chimney is outside the building and against the exterior wall.

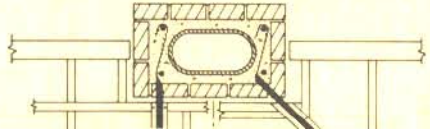
For a standard size chimney with one flue, steel straps approximately 3/16 inch by 1 inch (5 mm x 25 mm), or standard FHA anchors, are embedded in the grout and around the reinforcing steel. They are attached with two 1/2 inch (13 mm) bolts or four 3/8 inch (10 mm) diameter by three inch (76 mm) lag screws to framing members. Bolts or lag screws used in all anchors must each be in separate holes. Blocking between rafters is recommended to provide diaphragm resistance.

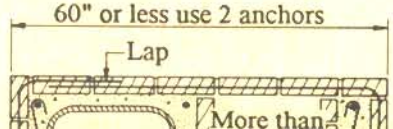
Where the joists do not head into the chimney, the anchor straps are connected to two inch by four inch (51 mm x 102 mm) ties crossing a minimum of four joists. The ties shall be connected to each joist with two 16d nails. *As an alternative to the two inch by four inch (51 mm x 102 mm) ties, the straps shall be connected to the structural framework by two ½ inch (13 mm) bolts in an approved manner.* Where the two inch by four inch (51 mm x 102 mm) tie is installed at the floor line, it is necessary to notch the floor joists. This is undesirable. This allows an unspecified alternative connection, but requires the connections to be made by bolts.

When plates are cut, anchor the chimney with 3/16 inch by one inch (5 mm x 25 mm) steel straps hooked into the chimney and attached to plates by two 1/2 inch by four inch (13 mm x 102 mm) lag screws or two 1/2 inch (13 mm) bolts.

When the chimney is two stories high, it should be anchored at both the second floor and at the ceiling or roof level.

If a chimney is inside a house, passes through the roof and is completely surrounded by roof diaphragm, generally no special anchors need be provided. The chimney would be supported by the roof diaphragm in the event it is subjected to lateral forces; however, some codes may require steel anchors even for chimneys completely surrounded by the roof or floor diaphragm. Check local codes for this requirement.



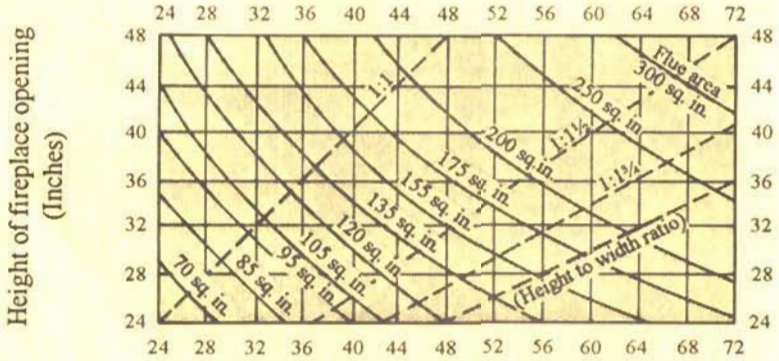


NOTE: For dimensions in mm, multiply inches by 25.4
For area in sq. mm., multiply sq.in. by 645.2

OV = OVAL; SQ = SQUARE; RC = ROUND CORNER; RD = ROUND.

* CLAY FLUE LININGS, $^{7}/_{8}$ inch thick. These meet or exceed requirements of ASTM C 315.
+ CONCRETE FLUE LININGS. These meet or exceed requirements of FHA, MPS 4900.1 Sec. 604-6.7; ICBO Research Recommendation No. 2602; City of Los Angles Research Report No. 23878. Approximate wall thickness $1\text{-}^{1}/_{8}\pm$ (29 mm ±).
Check with local supplier for availability of flue liner sizes. It would be recommended to use a larger flue rather than a smaller flue if the proper size is not available.

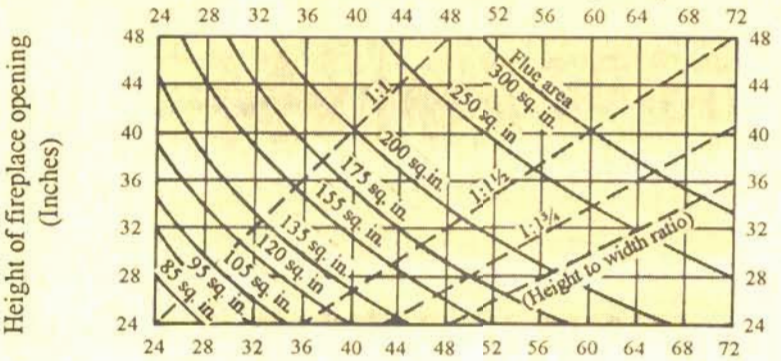
Area of Flue for 1/10 Fireplace Opening




Width of fireplace opening (Inches)

Graph to determine proper flue size for single face fireplace which requires 1/10 of fireplace opening or when the chimney is 15 feet high* or more.
*Chimney height is measured from the smoke shelf to the top of the chimney.

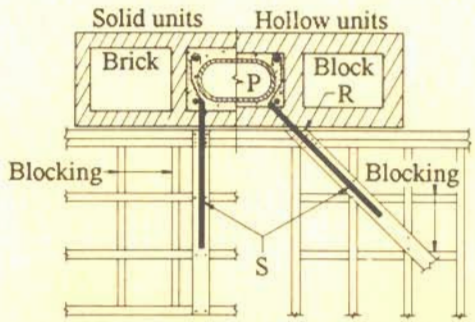
Area of Flue for 1/8 Fireplace Opening



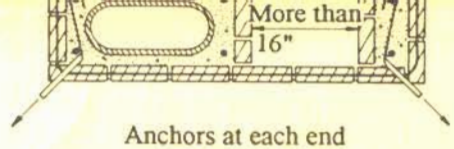

Width of fireplace opening (Inches)

Graph to determine proper flue size for single face fireplace which requires 1/8 of fireplace opening or when the chimney is 15 feet high*.
*Chimney height is measured from the smoke shelf to the top of the chimney.

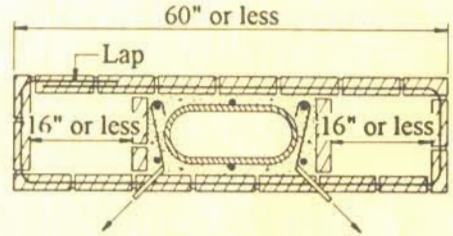

Bond beam and cut plate anchorage

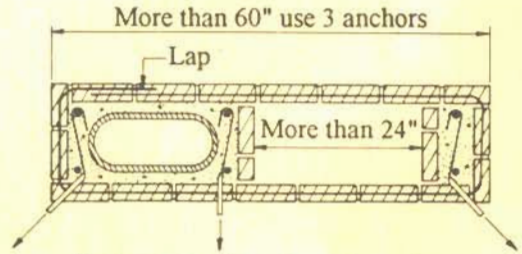



Anchorage of small chimney




Anchors at each end




Anchors at each end and in center

Anchorage of wide chimneys

## ENERGY CONSERVATION REQUIREMENTS

as per 1992 California Energy Conservation Standards for Residential and Non-Residential Buildings - Subchapter 7 (Section 150)

Masonry and factory-built fireplaces shall meet the following requirements.

1. The entire opening of the firebox must be covered with a tight-fitting, closeable, metal or glass door. This requirement may be omitted if such doors would interfere with devices permanently installed in the fireplace which are designed to increase the circulation of heat.
2. For fireplaces located on an outside wall the firebox must have an outside air intake which has a minimum area of six square inches. This air intake must have a tight-fitting damper (not the same as the flue damper) which is operable and readily accessible.
3. The flue damper must be tight-fitting with an accessible control.
4. Continuous burning gas pilot lights are prohibited.
5. The use of indoor air to cool the firebox when that indoor air is vented to the outside of the building is prohibited.

## GAS LOG LIGHTER

Installation of a gas log lighter should comply with local regulations for gas appliances.

The gas shut off valve should be an approved A.G.A. appliance and must be outside the masonry fireplace and not embedded in the outside hearth. A swing joint consisting of at least three elbows should be installed between the gas shut off valve and the log lighter pipe. This is to prevent breaks in the joints in the event of movement or settlement of the fireplace.

It is recommended that the gas log lighter be 1" above the ash bed and definitely not buried in the ashes or in sand.