



# tek spec #3.5

## RECOMMENDED PRACTICES FOR MASONRY FIREPLACE AND CHIMNEY CONSTRUCTION

### INTRODUCTION

A well constructed masonry fireplace adds several elements of interest to the home. Providing for not only a source of warmth, masonry fireplaces add character, charm and value. As a result, housing industry studies have shown that masonry fireplaces are among the top preferences of potential home buyers. The concrete masonry industry offers this Recommended Practice to clarify the design and construction of masonry fireplaces in an effort to assure quality, and safe construction that meets or exceeds the requirements of local and national building codes. Following the guidelines contained in this publication will assure quality, safety, practicality, ease of construction and code compliance. These guidelines are a compilation of information from manufacturers, engineers, contractors, technical agencies and building code officials. Always check with your local code enforcement official prior to construction of your fireplace.

### SIZE OF FIREPLACE

Careful consideration should be given to the size of the fireplace best suited to the room in which it is located. This is important not only from the fireplace's appearance, but from its operation as well. If it is too small it will not produce a sufficient amount of heat, even though it functions properly. Follow Chart No. 1 as a guide in selection of the size best suited for your application.

After selecting the appropriate size of the fireplace, consideration in planning is necessary for several



other important areas such as the foundation, hearth, firebox, and smoke chamber. Some of these important items are expanded upon below. Also see the enclosed drawing details for further clarification.

Please read the entire tek spec 3.5 before proceeding with design and construction.

**CHART NO. 1**

Fireplace Opening Width in Inches	Size of Room in Feet
24 to 32	10 x 14
32 to 36	12 x 16
36 to 40	12 x 20
40 to 48	14 x 28
48 to 60	16 x 30
48 to 72	20 x 26

## BEFORE WE START

Masonry fireplaces are site built and offer the unique ability for infinite variability and individual expression. Two specific designs are detailed in this guide, the Standard Fireplace and the Rumford Fireplace. The Standard fireplace (see p. 4-5) has a short firebox with the back wall leaning forward. The Rumford Fireplace (see p. 6-7) is tall with widely splayed sidewalls and an aerodynamic curved throat that improves draft and reduces emissions. The heating ability of the Rumford is legendary. The ease of construction, and the visual appeal of the tall opening makes the Rumford a very popular feature with architects and home builders.

Although there are many design variations that are quite acceptable for masonry fireplaces, the same principles of construction apply to all designs as outlined in this specification. Of particular importance are minimum clearance to combustibles, building codes and specifications of materials.

Again please read this entire specification for help to assure a quality fireplace installation.

## FOUNDATION

The foundation consists of concrete footings and masonry walls. Minimum code requirements must be met with respect to foundation and wall design. Unless specifically designed for additional loads, no other part of the structure or adjoining structure should be supported by the chimney.

Immediately above the foundation wall, support for the combustion chamber and the extended hearth is provided by a cast in place or precast concrete slab. The forming of the concrete slab requires that openings be included for outside combustion air vents and ash dumps. If a permanent form is used it must be non-combustible, (i.e. steel, slate, or corrugated metal). The concrete slab must not support the floor system.

## FIREBOX AND HEARTH

All materials used to construct the firebox, hearth, and extension must be completely non-combustible masonry materials. Brick or stone are most popular. In no instance may

combustible elements offer support to the hearth or fireplace.

For fireplaces up to 6 sq. ft. (or an opening of approximately 3' x 2') the hearth extension must project 16 inches in front of the fireplace and 8 inches beyond each side of the fireplace opening. For larger sized openings these dimensions increase to 20 inches in front and 12 inches on the sides. The fireplace hearth and sidewalls are constructed of a minimum of 2 inches of firebrick laid in refractory mortar. Note the firebox is surrounded by 4 inch solid block for structural stability and thermal heat storage (refer to drawings for minimum total wall thickness). Firebrick made to the specifications listed will provide minimal expansion and contraction throughout the operating temperature of residential fireplaces and chimneys. Therefore, no allowance to accommodate movement of firebrick is included.

All firebrick must be installed in refractory mortar. The back side of the firebox shall be parged with mortar adding to its strength. Regular masonry mortar may be used here. The fill behind the firebox shall be non-combustible rubble or solid masonry.

## PLACEMENT OF THE DAMPER AND LINTELS

Metal parts have a greater coefficient of expansion than masonry units. Room for expansion or movement must therefore be provided. The damper should be laid on top of the firebox in a bed of refractory mortar only thick enough to assure a level damper installation. A 1/8" to 1/4" space should be left at the ends of the damper flanges. The damper shall not support any masonry. Any fireplace lintel shall be installed in a similar manner on a bed of mortar (for leveling purposes) with a 1/8" to 1/4" space on sides and ends. This space may be filled with non-combustible soft material such as fiberglass insulation or refractory blanket. Any masonry corbeled from the firebox shall not bear on the damper assembly. To prevent this, a second lintel may be installed with the same provisions for thermal expansion and the lintel installed above the fireplace opening.

## SMOKE CHAMBER

The smoke chamber located directly above the firebox shall be constructed of minimum 2" thick firebrick, a manufactured vitrified clay smoke chamber, or 4" solid masonry. A 1/2" to 3/4" thick parged refractory may be required over corbeled firebrick to form a smooth surface to easily transition smoke and gases up through the smoke chamber. (Refer to drawings for minimum total wall thickness).

The smoke chamber, for Standard Fireplace Design, shall be constructed so the sidewalls and front wall taper inward to form the support of the fireplace chimney. The chimney shall be positioned so that it is centered on the width of the fireplace and the back of the flue liner is aligned flush with the vertical rear surface of the smoke chamber. This configuration provides for smooth uninterrupted exiting of smoke and gases from the fireplace into the chimney. NOTE: The Rumford throat and Smoke Chamber are usually made of preformed parts. (See p. 6-7). Follow the manufacturers instructions.

## CHIMNEY

The chimney is constructed directly on the smoke chamber. The chimney consists of a flue liner and chimney wall. The chimney wall shall be constructed so there is at least a 4 inch nominal thickness of solid masonry between the flue liner and any exterior surface. Solid masonry products for the chimney wall construction are those (brick, block, or stone) which are either 100% solid or those which have cores or holes of any configuration which do not exceed 25% of the gross cross sectional area of any load bearing surface. The chimney shall be separated from the flue liners by an air space no greater than the thickness of the clay flue liner. This will assist the clay flue to stay in alignment as well as permit the clay flue to expand or contract freely.

All spaces between chimneys and floors and ceilings through which the chimneys pass shall be firestopped with non-combustible material. The firestopping of spaces between chimneys and wood joists, beams, or header shall be galvanized steel not less than 26 gauge or non-combustible material not thinner than 1/2 inch. Clay flue liners shall be installed bedding

one on the other in refractory mortar with close fitting joints left smooth on the inside and outside face of the flue liner. Depending on the size and design of the chimney the mason may choose to install an additional wythe or by other accepted methods (i.e. corbel header construction, etc.) to insure the structural integrity of the clay flue lining. The flue lining and surrounding masonry shall touch only in spot locations (not to exceed two inches square each) to assure proper alignment and support. In no case will the clay flue liner be encased completely around its circumference at one location. Clay flue liners made to the listed specifications may expand or contract during the operating temperatures of residential fireplaces and chimneys. This publication allows for such movement.

When more than one flue is contained in a chimney, a separation shall be provided between adjacent flues. The separation shall be constructed of solid masonry wythes (walls) not less than 4 inches, nominal, in thickness and the wythes shall be bonded to the chimney wall with either ties or masonry mortar.

The chimney must extend at least 2 feet above the highest point where it passes through the roof. In addition, the top of the chimney should be at least 2 feet above any portion of the building that is within 10 feet of the chimney. Good draft is normally achieved if the chimney height is such that the vertical distance from the top of the fireplace opening to the top of the chimney is at least 15 feet. If the chimney is less than 15 feet, a larger clay flue size should be considered than what is required for a chimney of 15 feet or more.

### CHIMNEY CAP

Every masonry chimney should have a chimney cap to terminate the masonry and protect the chimney. This cap can be precast concrete or cast in place concrete.

The chimney cap shall extend beyond the exterior face of the masonry and incorporate a drip slot or other characteristic, to prevent moisture penetration from the top of the masonry wall to the chimney.

The cap shall never be cast tightly against the flue liner. A gap should be left to accommodate expansion and contraction of the flue lining. The gap at the top between the cap and flue liner should be sealed with caulk to prevent entrance of water into the chimney. This is a maintenance joint that should be checked on a regular basis to insure water tightness and replaced when necessary.

The use of quality polysulfide, butyle, or silicone rubber caulking compound is recommended. Oil based sealants do not perform well here. Backer rod also is suggested to support caulk around flue.

### FLASHING

Base flashing and counter flashing are installed at the chimney/roof interface. The base flashing is installed first on the faces of the chimney perpendicular to the ridge line with tabs at each corner. The flashing shall extend a minimum of 4 inches up the roof. Counter flashing is then installed over the base flashing. It is inserted into the mortar joint for 3/4 to 1 inch and mortared solidly into the joint. The counter flashing shall lap the base flashing by at least 3 inches. If the flashing is installed in sections, the flashing higher up the roof line shall lap over the lower flashing a minimum of 2 inches. All joints in the same base flashing and counter flashing shall be thoroughly sealed. The unexposed side of any bends in the flashing shall also be sealed.

### MATERIAL SPECIFICATIONS

Use only those materials conforming to the following specifications.

- A. Concrete Block - conforming to ASTM C-90 Grade N, ASTM C-129
- B. Mortar Mix - ASTM C-270 Type N
- C. Concrete Mix - for hearth slab and chimney cap should conform to ASTM C-39
- D. Brick - ASTM C-55 (or 216 Grade-SW)
- E. Caulking - Polysulfide, Butyl or Silicone Rubber
- F. Flashing - Corrosion resistant metal. No aluminum

G. Clay Flue Liners - Clay Flue Lining Institute and ASTM C-315, C-1283

H. Firebrick - ASTM C-27 or C-1261 low duty 2" thick minimum.

I. Refractory mortar - Non water soluble refractory mortar is best for installing both firebrick and clay flues. Homemade mixes combining fireclay and mortar simply do not meet the code. Refractory parge for smoke chamber must also be non-water soluble. See manufacturers instructions. All above must meet the high temperature requirements of ASTM C-199 medium duty.

J. Dampers - should be certified to have air infiltration losses not to exceed 20 cubic feet per minute when in the closed position.

K. Steel Angle - meeting ASTM A-36 with minimum dimensions as specified in chart 11.

### CLEARANCE TO COMBUSTIBLES

One of the most important fire safety requirements is the air space that separates the chimney from combustible materials such as framing. For interior chimneys this space must be 2 inches minimum. For an exterior chimney this space must be 1 inch minimum. This space insulates the chimney from transferring heat to the combustible materials and must not be filled except for required firestopping. When masonry fireplaces and chimneys are part of a masonry wall combustible materials shall not be in contact with the masonry less than 12 inches from the outside surface of the flue lining or firebox.

Exposed combustible trim and the edges of sheathing materials such as wood siding, flooring and drywall shall be permitted to abut fireplace and chimney walls provided they are at least 12 inches from the inside surface of the fireplace or flue lining.

Woodwork or other combustible materials shall not be placed within 6 inches of the fireplace opening. Combustible material within 12 inches of the fireplace opening shall not project more than 1/8 inch for each 1 inch distance from such opening.

## BALANCING THE VENTILATION

In order for a fireplace, which utilizes natural draft to function properly, a supply of makeup air must be available to replace the air exhausted up the chimney. In older homes there is often enough leakage around doors and windows to provide this air. In newer, tighter homes another source of air may need to be provided. Before lighting the fire, use incense or a candle to determine if there is an updraft or a down draft in the chimney. If there is no updraft try cracking open a window or door to provide a source of air to the room. If any problem persists you may need to locate other sources of air entering or being exhausted from the home. Exhaust fans and opening the attic or upstairs rooms may be a source of air flowing out of the building. Warm air tends to flow out from the upper floors and cold air flows in down lower in the house. If you determine that you need a permanent source of makeup air, contact a heating and ventilating specialist and discuss the various options. Fireplaces will exhaust 400cfm to 1000cfm depending on size and intensity of the fire.

## REDUCING CREOSOTE BUILDUP

One method for reducing creosote buildup is to gradually stoke a medium hot fire for 15 to 30 minutes at least once a day, which tends to burn off the creosote in small amounts. Seasoned or dry wood will form less creosote deposits than unseasoned or wet wood. In mild weather, frequent slow burning of the fireplace will severely aggravate the creosote problem.

Frequent inspection of the chimney flues is important, especially during the first season. Any problems that may be occurring can be corrected before they become hazards. Inspect chimneys from the roof using a flashlight, or use a mirror to look up through the chimney flue. Any time an inspection shows soot or creosote buildup the chimney should be cleaned.

**CAUTION:** The use of chemicals which are supposed to clean the chimney when they are placed on a fire could produce heat intense enough to cause damage to the concrete masonry and clay flue liners which contribute to the deterioration of these elements.

## TIPS OF SAFE FIREPLACE OPERATIONS

A fireplace fire, properly laid and fed is easy to tend to and trouble free. Here is a good method for building a fire.

Be sure the damper is open before lighting the fire!

Use a small amount of paper and a moderate number of kindling wood pieces to lay down the base. Place three small split logs directly on top. Space the logs to allow air to flow freely.

Use wadded paper wand to light the fire. Hold the burning wand at damper level to start the draft, then lower it to the paper/kindling stack.

As the kindling burns, add two or three pieces of wood - small logs are best at first. Stack the logs so that the flames can get between them. Use larger logs when the fire is well established.

The use of glass doors and screens is recommended for the safe and thermally efficient use of the fireplace.

Keep screen closed when fire is burning. Slow burning hard woods make the best fuel. Green wood gives off less heat and can cause excess creosote to build up in the chimney. When ashes build up under the grate, all but a base layer about 1 inch thick should be removed. Never use a fireplace as an incinerator.

For commercial or industrial appliance applications please consult the local code. The recommendations, suggestions, statements, and technical data in this tech sheet are based on our best knowledge at the time of printing. They are given for informational purposes only and without any responsibilities for their use.

## CODE ENFORCEMENT NOTIFICATION

The code enforcement official shall be notified by the purchaser of any purchase or acquisition of any solid fuel burning heating appliance, or chimney construction materials.

All businesses selling or installing solid fuel burning heating appliances, and or chimney construction materials shall notify the purchaser(s) in writing at the time of sale or acquisition that they are legally required to notify their local code enforcement official before installation or erection commences.

Please accept this Tek Spec 3.5 as and official written notification of the above.

## REFERENCES

New York State Fire Prevention and Building Code

National Fire Protection Association, Quincy, MA

### International Code Council

International Building Code

International Residential Code  
Country Club Hills, Illinois

USA - Clay Flue Lining Institute

National Concrete Masonry Association, Herndon, VA

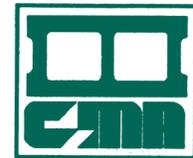
Brick Industry Association of America, Reston, VA

Illinois Masonry Institute,  
Park Ridge, IL

Minnesota Masonry Institute  
Minneapolis, MN

Masonry Institute of America,  
Los Angeles, CA

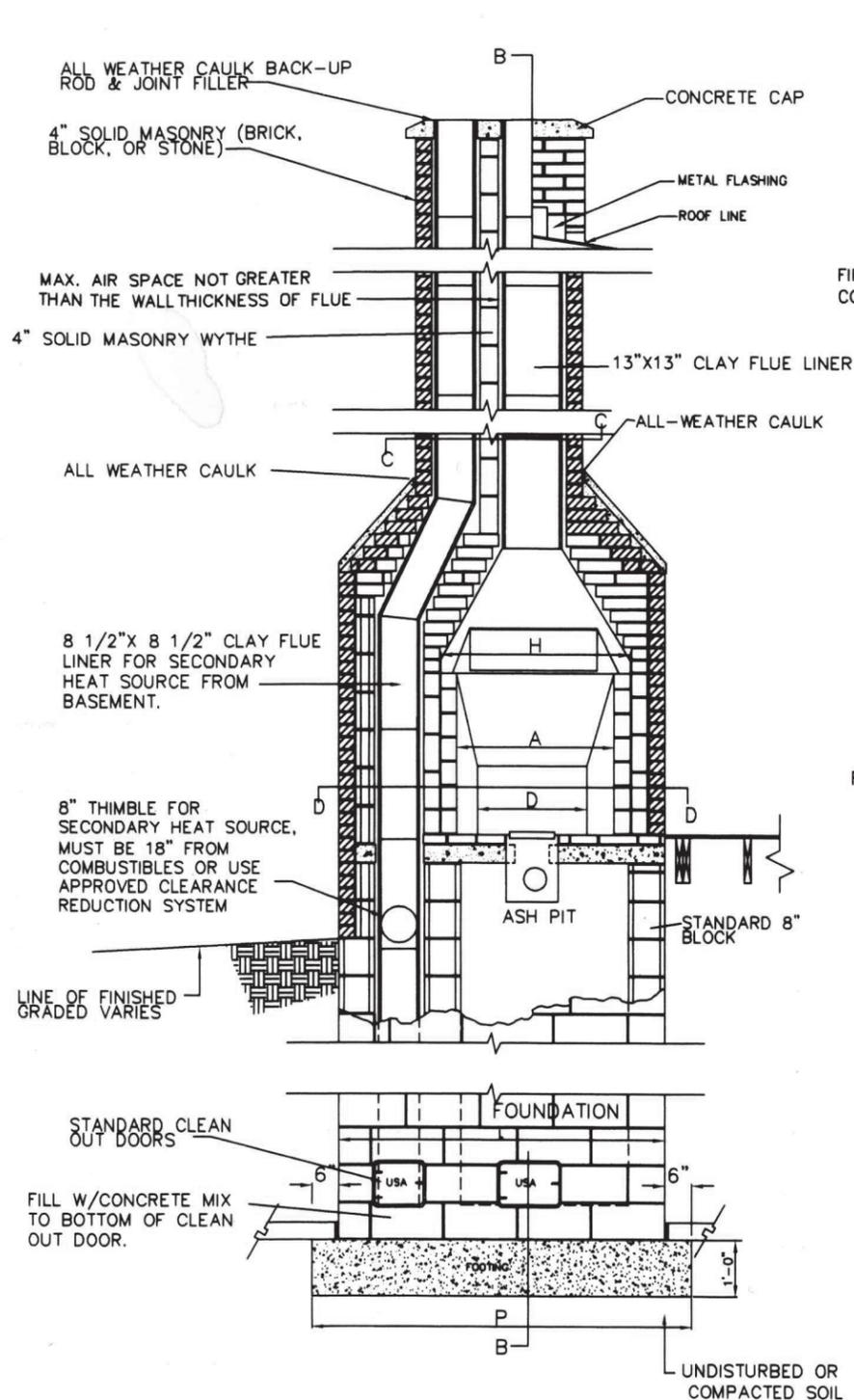
## NEW YORK STATE CONCRETE MASONRY ASSOCIATION



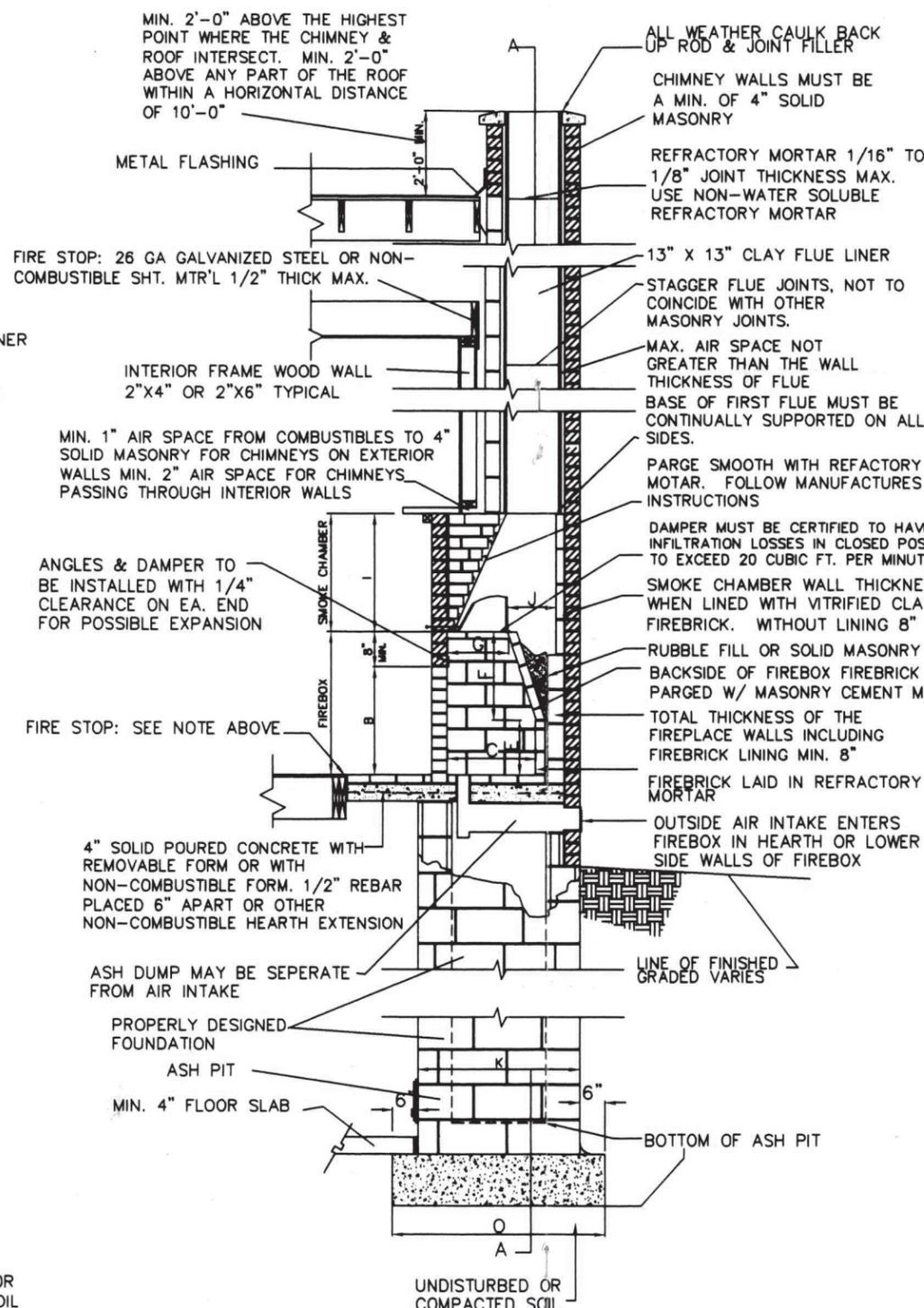
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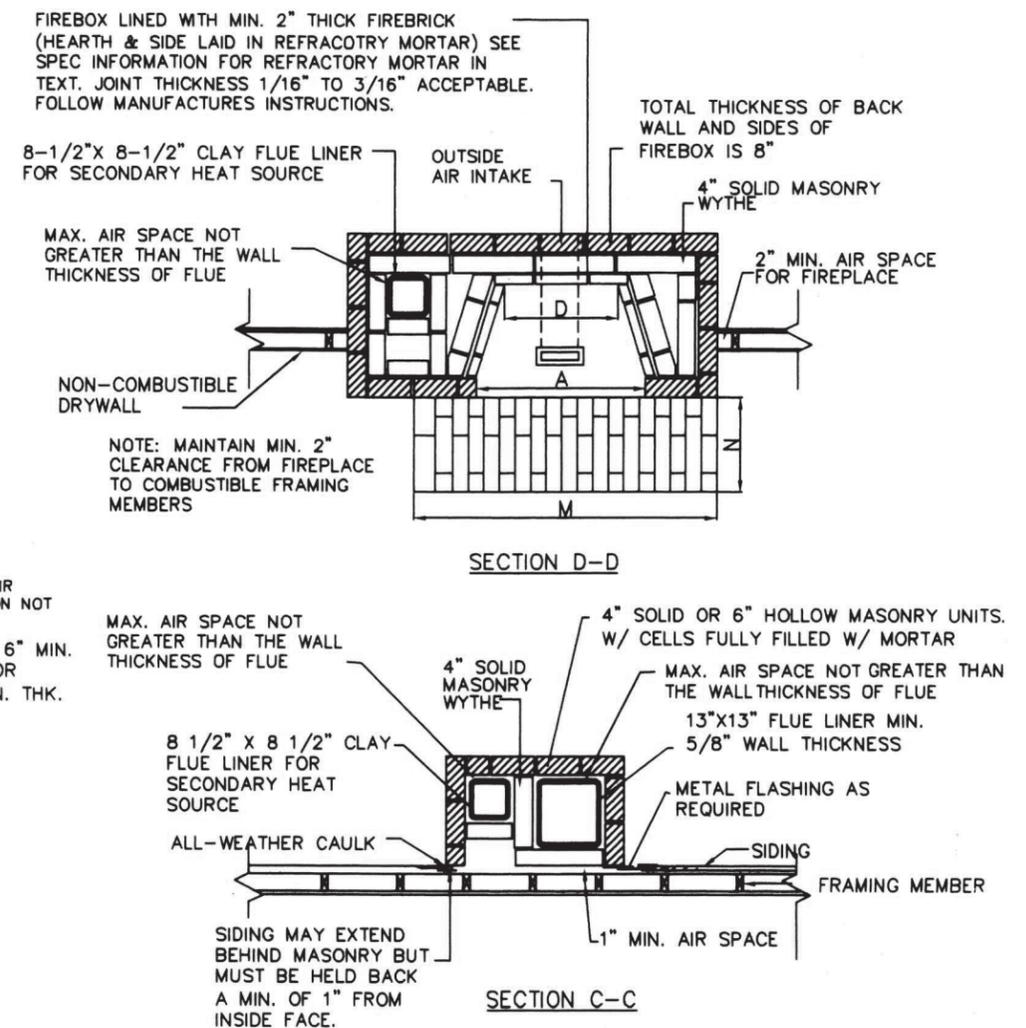
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SECTION A-A



SECTION B-B



SECTION D-D

SECTION C-C

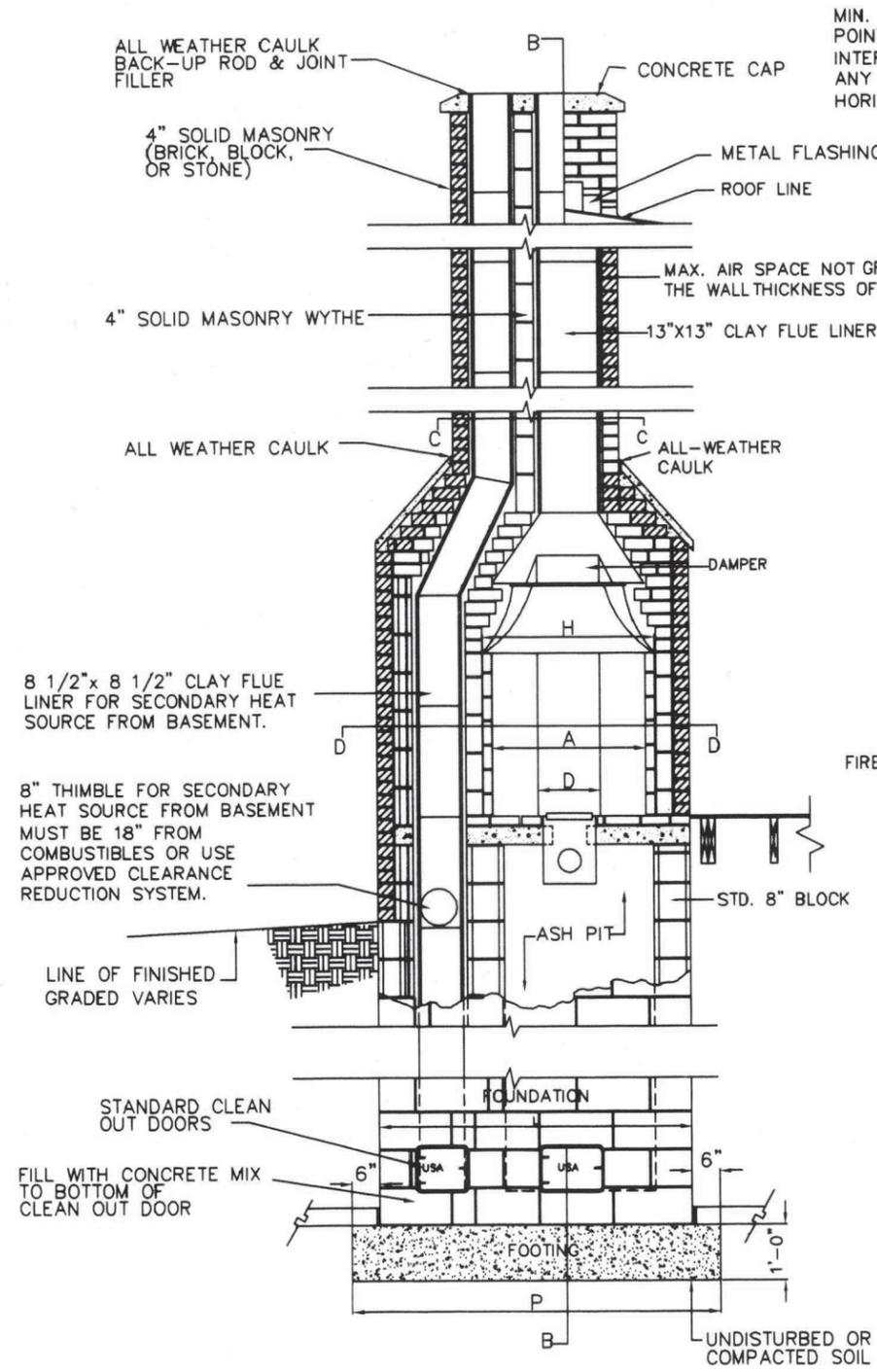
**CHART II**

CONSTRUCTION DIMENSIONS, INCHES (APPROX.)

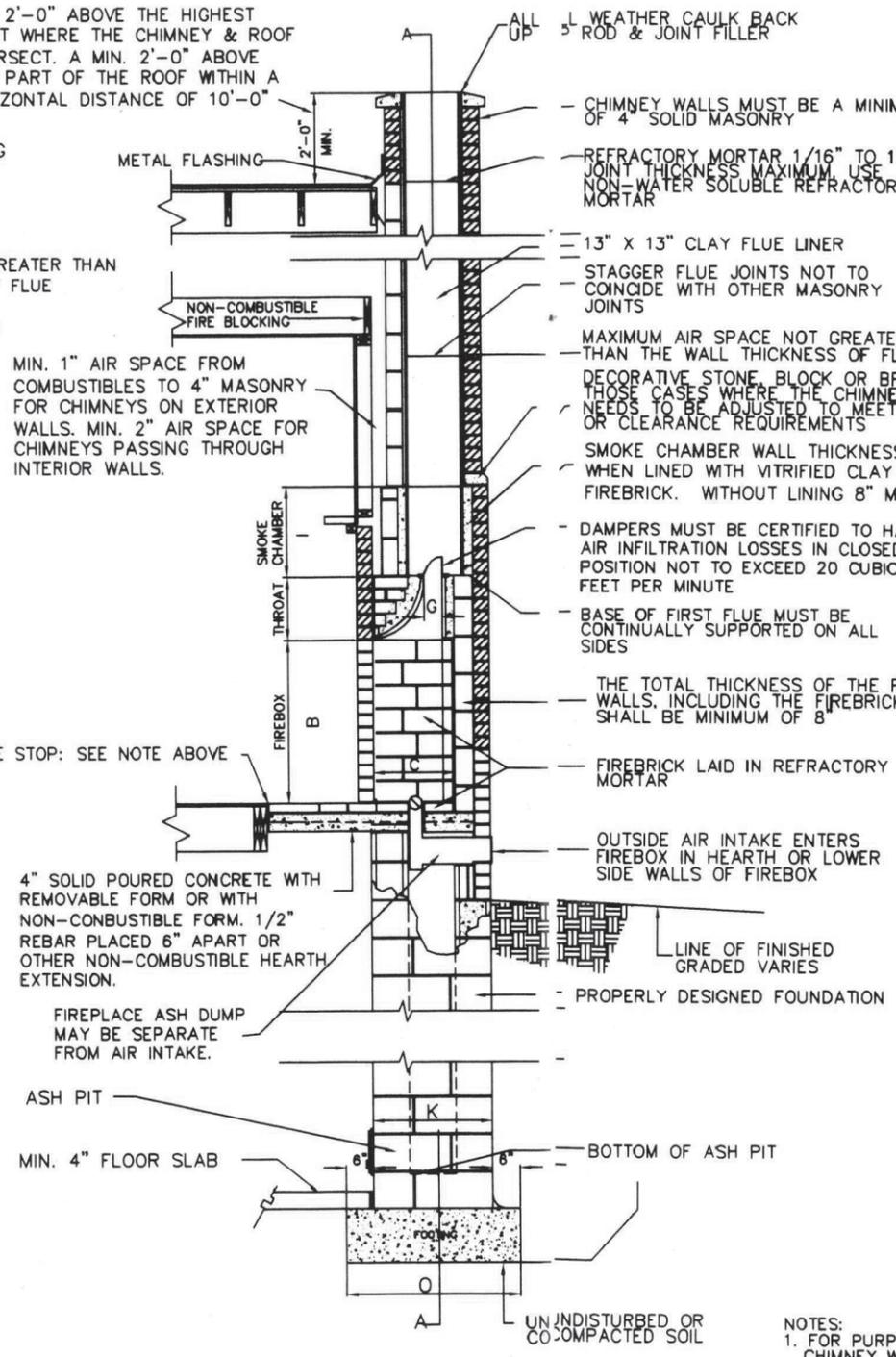
FIREPLACE OPENING						THROAT DEPTH	SMOKE CHAMBER				FOUNDATION SIZE		HEARTH EXTENSION		STEEL ANGLE	FIREPLACE FLUE SIZE	FTG SIZE	
A	B	C	D	E	F	G	H	I	J	K	L	M	N	INCHES	INCHES	O	P	
24	24	16	12	14	18	9	32	18	12	32	60	48	16	36x3x3x3/16	8.5X13	44	72	
30	26	16	18	14	20	9	38	24	12	32	66	54	16	36x3x3x3/16	8.5X13	44	78	
36	26	20	24	14	20	9	44	28	12	40	72	60	20	42x3x3x3/16	13X13	52	84	
42	32	20	30	14	26	9	50	32	12	40	78	66	20	48x3x3x3/16	13X13	52	90	
48	32	20	34	14	26	9	56	36	14	40	84	72	20	54x3x3x1/4	16X16	52	96	
54	36	20	38	16	28	11.5	68	44	14	40	90	78	20	60x3x3x1/4	16X20	52	102	
60	38	22	42	16	30	11.5	72	44	14	40	96	84	20	66x3x3x1/4	16X20	52	108	
72	40	22	54	18	30	11.5	84	56	14	40	108	96	20	84x3x3x1/4	20X20	52	120	

- NOTES:
- FOR PURPOSE OF ILLUSTRATION IN THIS SPECIFICATION WE HAVE CHOSEN A STANDARD 36" (DIM.A) FIREPLACE AND CHIMNEY WITH A SECOND FLUE FROM THE BASEMENT ELEVATION FOR A SECONDARY HEAT SOURCE.
  - THE DRAWING HAS BEEN REDUCED FROM AN ORIGINAL. DO NOT SCALE OR PROPORTION DIMENSIONS FROM THIS DRAWING.
  - BOTH THE INSIDE TEXT AND THE DRAWING DETAILS MUST BE REFERRED TO PRIOR TO CONSTRUCTIONS. READ ALL OF TEK SPEC 3 BEFORE PROCEEDING.
  - FOR MATERIAL SPECIFICATIONS REFER TO PAGE 3 IN THE TEK SPECIFICATION.
  - INTERIOR MASONRY FIREPLACES 4" AIRSPACE FROM BACK FACE OF FIREPLACE TO COMBUSTIBLE FRAMING MEMBERS.
  - FOR FIREPLACE OPENINGS OF 6 SQUARE FEET OR LARGER: A HEARTH EXTENSION OF 20" MINIMUM IS REQUIRED. HEARTH EXTENSION MUST ALSO EXTEND AT LEAST 12" BEYOND EACH SIDE OF OPENING. FOR FIREPLACE OPENINGS LESS THAN 6 SQUARE FEET: A HEARTH EXTENSION OF 16" MINIMUM IS REQUIRED - HEARTH EXTENSION MUST ALSO EXTEND AT LEAST 8" BEYOND EACH SIDE OF OPENING.
  - A SOLID MASONRY UNIT IS DEFINED AS A MASONRY UNIT WHOSE NET CROSS SECTIONAL AREA IN EVERY PLANE PARALLEL TO THE BEARING SURFACE IS 75% OR MORE OR IT'S GROSS CROSS-SECTIONAL AREA IN THE SAME PLANE.

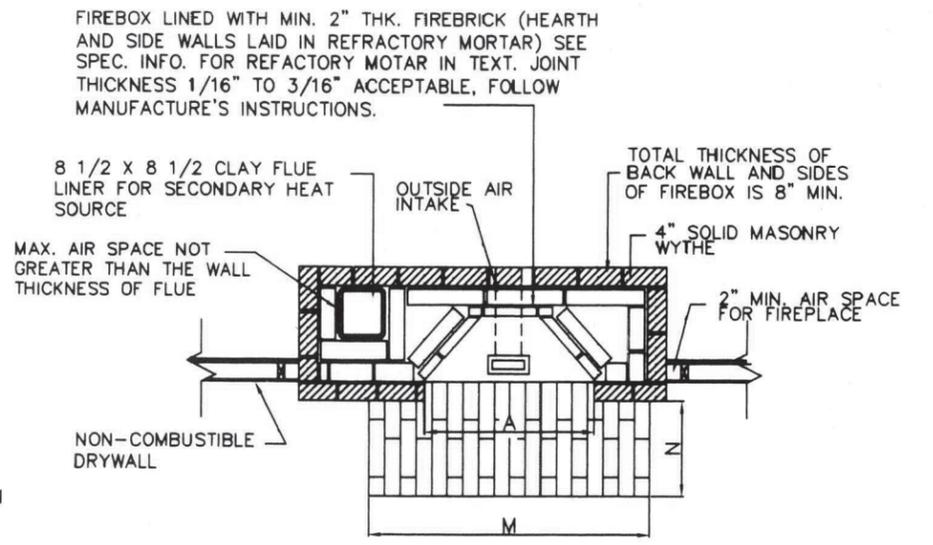
# STANDARD FIREPLACE



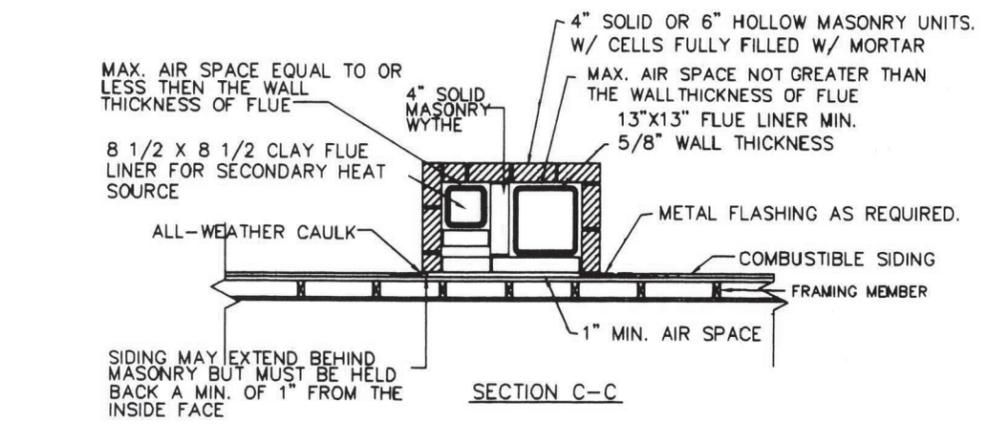
SECTION A-A



SECTION B-B



SECTION D-D



SECTION C-C

**CHART II**  
CONSTRUCTION DIMENSIONS, INCHES (APPROX.)

FIREPLACE OPENING		THROAT DEPTH	SMOKE CHAMBER SIZE			FOUNDATION SIZE		HEARTH EXTENSION		STEEL ANGLE	FIREPLACE FLUE SIZE	FTG SIZE	
A	B	C	D	G	H	I	K	L	M	N	INCHES	O	P
24	24-28	12	13.5	3	24	19	24	60	48	16	36x3x3x3/16	8.5x13	36 72
30	28-32	12	13.5	3.5	34	18	24	66	54	16	36x3x3x3/16	13x13	36 78
36	32-38	14	13.5	4	34	18	24	72	60	20	42x3x3x3/16	13x13	36 84
42	38-42	15	15	4.25	34	18	24	78	66	20	48x3x3x3/16	13x18	36 90
48	42-48	16	18	5.25	34	18	24	84	72	20	54x3x3x1/4	16x20	36 96
60	45-54	20	22.5	10	50	30	28	96	84	20	60x3x3x1/4	20x20	40 108
72	45-60	24	27	10	57	30	32	108	96	20	66x3x3x1/4	24x24	44 120

- NOTES:
- FOR PURPOSE OF ILLUSTRATION IN THIS SPECIFICATION WE HAVE CHOSEN A STANDARD 36" RUMFORD (DIM. A) FIREPLACE AND CHIMNEY WITH A SECOND FLUE FROM THE BASEMENT ELEVATION FOR A SECONDARY HEAT SOURCE.
  - THE DRAWING HAS BEEN REDUCED FROM AN ORIGINAL. DO NOT SCALE OR PROPORTION DIMENSIONS FROM THIS DRAWING.
  - BOTH THE INSIDE TEXT AND THE DRAWING DETAILS MUST BE REFERRED TO PRIOR TO CONSTRUCTIONS. READ ALL OF TEK SPEC 3 BEFORE PROCEEDING.
  - FOR MATERIAL SPECIFICATIONS REFER TO PAGE 3 IN THE TEK SPECIFICATION.
  - INTERIOR MASONRY FIREPLACES REQUIRE 4" AIRSPACE FROM BACK FACE OF FIREPLACE TO COMBUSTIBLE FRAMING MEMBERS.
  - FOR FIREPLACE OPENINGS OF 6 SQUARE FEET OR LARGER: A HEARTH EXTENSION OF 20" MINIMUM IS REQUIRED. HEARTH EXTENSION MUST ALSO EXTEND AT LEAST 12" BEYOND EACH SIDE OF OPENING. FOR FIREPLACE OPENINGS LESS THAN 6 SQUARE FEET: A HEARTH EXTENSION OF 16" MINIMUM IS REQUIRED - HEARTH EXTENSION MUST ALSO EXTEND AT LEAST 8" BEYOND EACH SIDE OF OPENING.
  - A SOLID MASONRY UNIT IS DEFINED AS A MASONRY UNIT WHOSE NET CROSS SECTIONAL AREA IN EVERY PLANE PARALLEL TO THE BEARING SURFACE IS 75% OR MORE OF IT'S GROSS CROSS-SECTIONAL AREA IN THE SAME PLANE.
  - FOR SPECIFIC DIMENSIONS REGARDING RUMFORD DESIGN FOR OTHER THAN 36" RUMFORD ILLUSTRATED HERE REFER TO MANUFACTURERS ILLUSTRATIONS.

# RUMFORD FIREPLACE

# Masonry Bake Oven ■ Tek Spec 3.5



**Wood fired ovens constructed of masonry materials have been used for cooking and baking for many centuries.** In the last decade we see increased interest in a variety of masonry oven designs for commercial and residential applications for both indoors and outside. We offer this sketch (as an addendum to Tek Spec 3.5) as a possible design or a place to start for your installation. Many designs are available of varying sizes and shapes. Some are built from individual masonry construction throughout and some are built from pre-engineered and manufactured component parts.

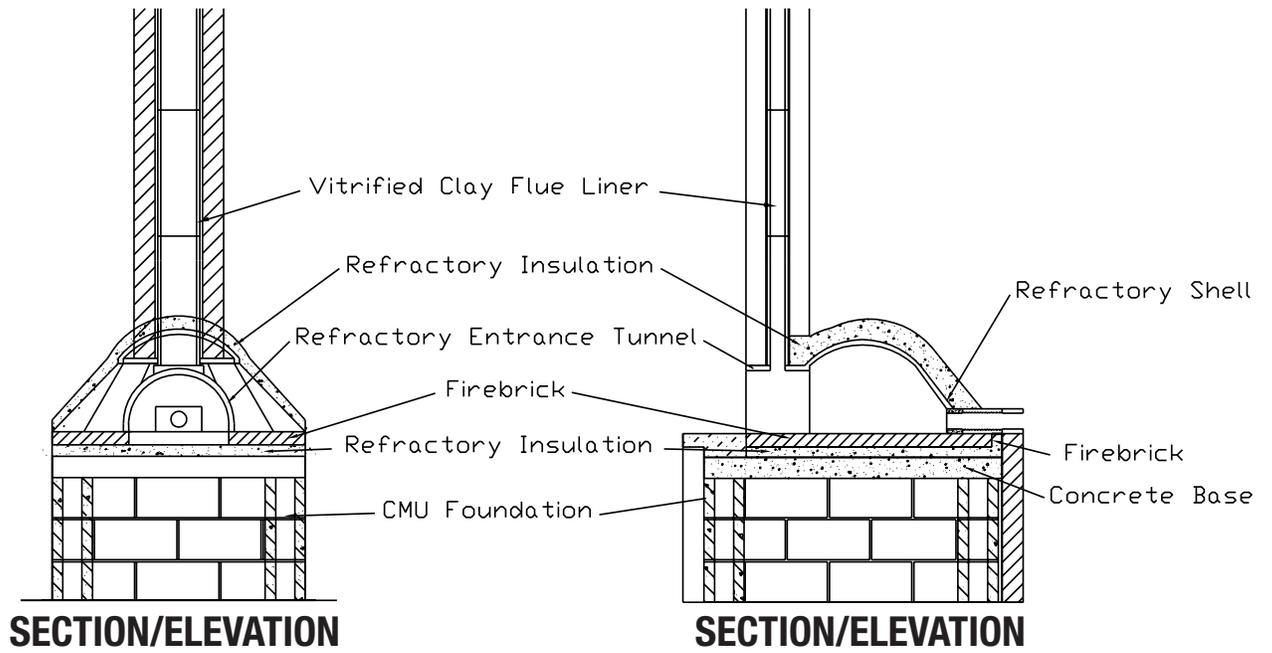
No matter the design, masonry products for foundation, internal components, and veneers (ie brick, block, firebrick, mortar, refractory components, stucco, stone, terra cotta and etc.) are available from your local masonry supplier. Seek their advice. Seek further information from the internet.

*As with all masonry construction we encourage fire safety and code compliance.*



Vitriified Clay Flue Liner

## PLAN VIEW @ CHIMNEY



## MASONRY BAKE OVEN

