



Tek Spec 4.0

Reference Guide

RECOMMENDED
PRACTICES FOR
FIREPLACE, CHIMNEY
AND BAKE OVEN
CONSTRUCTION

A well-constructed masonry fireplace or bake oven adds several elements of interest to the home, providing not only a source for warmth, but also character, charm and value. Housing industry studies have shown that masonry fireplaces are among the top preferences of potential home buyers. To make sure your installation is done properly, the concrete masonry industry offers this easy-to-follow Construction Guide.

These instructions have been compiled after careful consultation with manufacturers, engineers, contractors, technical agencies and building code officials. Following these recommended practices can help you to achieve a safe, quality outcome that is compliant with local and national building codes. Always check with your local code enforcement officials prior to construction of your fireplace.

PLEASE READ THIS ENTIRE GUIDE FOR SPECIFICATIONS TO ENSURE A QUALITY INSTALLATION.



STANDARD VS. RUMFORD DESIGNS

Masonry fireplaces are built on site, and offer many variations to suit each individual's preferences in terms of design and appearance. Two specific types of designs are detailed in this guide: the **Standard Fireplace** and the very popular **Rumford Fireplace**. The Standard Fireplace has a short firebox with the back wall leaning forward. The Rumford design is taller with widely splayed sidewalls and an aerodynamic curved throat that improves draft and reduces emissions. The heating capacity of the Rumford design is legendary. The ease of construction and the visual appeal of the tall opening of the Rumford design makes this a very popular choice among architects, masons and home builders.

Although there are many different design options and variations that are acceptable for masonry fireplaces, the same construction principles specified in this Guide apply to all designs. Of particular importance are maintaining minimum clearance to combustible surfaces, ensuring compliance to all building codes, and selecting the proper materials.

SIZE OF THE FIREPLACE

Once the design option has been determined for your fireplace, careful consideration should be given to the size best suited to the room in which it is located. This is important not only from an appearance standpoint, but also for it to operate efficiently. If it is too small for the room, for example, it may not produce a sufficient amount of heat – even if it functions properly. (Follow Chart I as a guide to the selection of the size best suited to your application.) Once the proper size has been determined, careful consideration should be given to other important areas, such as construction of the foundation, as well as the hearth, firebox, and smoke chamber.

CHART I

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
60 to 72	20 x 26

FOUNDATION

The foundation of the fireplace 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 should be provided by a cast-in-place or precast concrete slab. The slab should include openings 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 made of non-combustible masonry materials. Brick or stone are the most popular. In no instance should combustible elements be used to provide support to the hearth of the fireplace.

For fireplaces up to 6 sq. ft. (or an opening approximately 3 foot x 2 foot) 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 should be constructed of a minimum of 2 inches of firebricks laid in refractory mortar. The firebox should be surrounded on three walls (front and two sides) by 4 inch thick solid block for structural stability and thermal heat storage (refer to the drawings for minimum total wall thickness). Firebrick made to these specifications 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 conforming to



our national building codes (ASTM C-199 medium duty). The back side of the firebox should be parged with mortar to provide added strength and insulation. Regular masonry mortar may be used here, but you may want to consider the specialty refractory products available which are designed for parging. The fill behind the firebox should be non-combustible rubble or solid masonry.

PLACEMENT OF THE DAMPER AND LINTELS

Metal parts have a greater coefficient of expansion than masonry units. Since damper and lintels are metal, 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 ensure a level installation. A 1/8 inch to 1/4 inch space should be left at the ends of the damper flanges. The damper should not support any masonry. Any fireplace lintel should be installed in a similar manner on a bed of mortar (for leveling purposes) with a 1/8 inch to 1/4 inch space on the sides and ends. This space may be filled with non-combustible soft material such as fiberglass insulation or a ceramic blanket. Any masonry corbeled from the firebox should not bear weight on the damper assembly. To prevent this, a second lintel may be installed with the same provisions for thermal expansion as the lintel installed above the fireplace opening.

SMOKE CHAMBER

The smoke chamber located directly above the firebox should be constructed using a choice of firebrick laid in with refractory mortar (ASTM C-199 medium duty) at a minimum thickness of 2 inches, a manufactured vitrified clay smoke chamber, or 4 inches of solid masonry. As required by code, an insulating refractory parging product (also ASTM C-199 medium duty) must be applied 1/2 to 3/4 inch thick over the corbeled firebrick to form a smooth surface, allowing for an easy transfer of visible smoke and other gases through the chamber. (Refer to drawings for the minimum total wall thickness.) The smoke chamber in the standard fireplace design should be constructed so that the sidewalls and front wall taper inward to form the support of the fireplace chimney. In this design, the chimney should 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. Follow the manufacturer's directions when building a Rumford fireplace.*

CHIMNEY

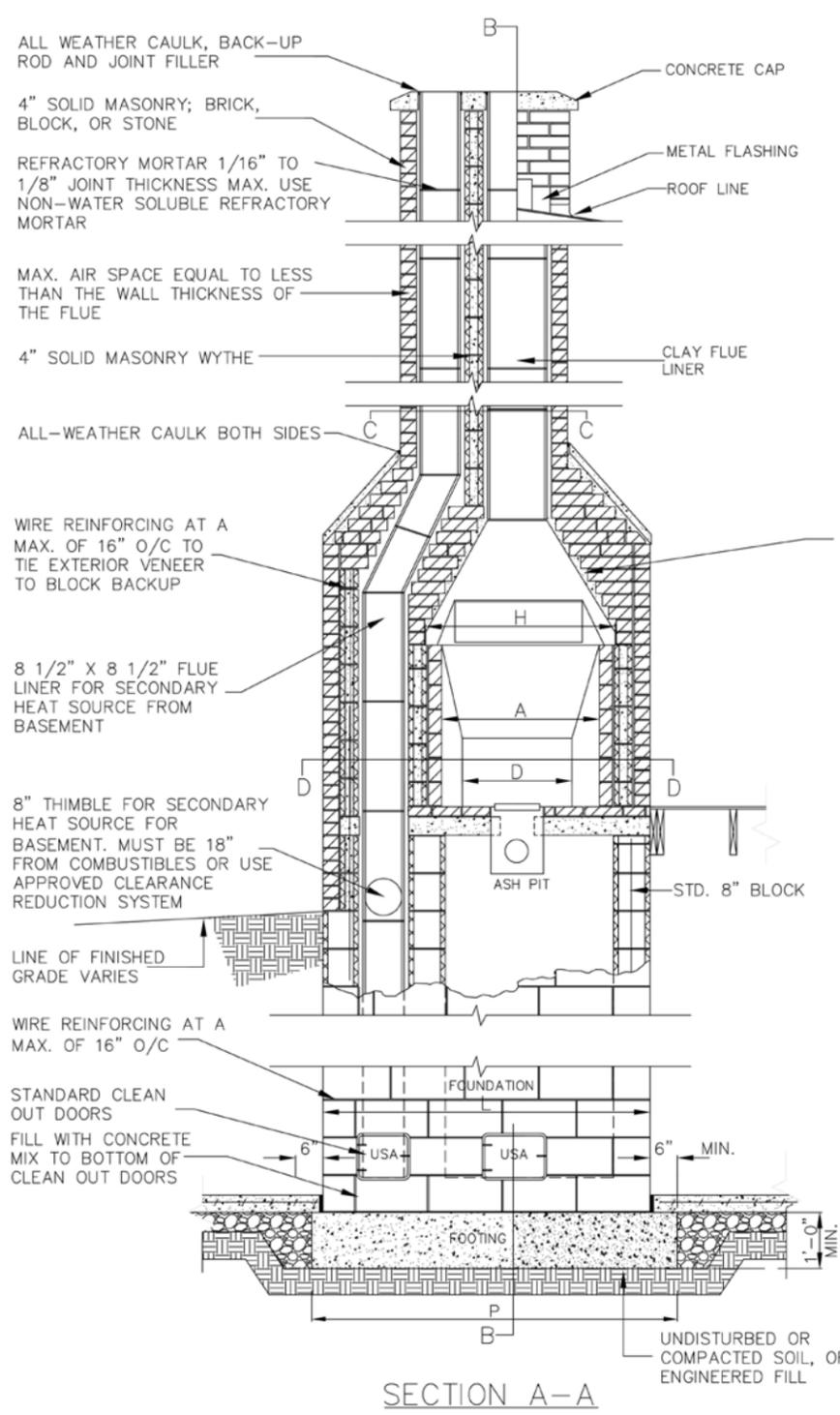
The chimney is constructed directly on the smoke chamber. It consists of a flue liner and chimney wall. The chimney wall should have at least a 4 inch thickness of solid masonry between the flue liner and any exterior surface. Solid masonry products used in the chimney wall construction are those which are either 100 percent solid (brick, block or stone) or those which have cores or holes which do not exceed 25 percent of the gross cross sectional area of any load bearing surface. The chimney should be separated from the flue liner by an air space that is not greater than the thickness of the clay



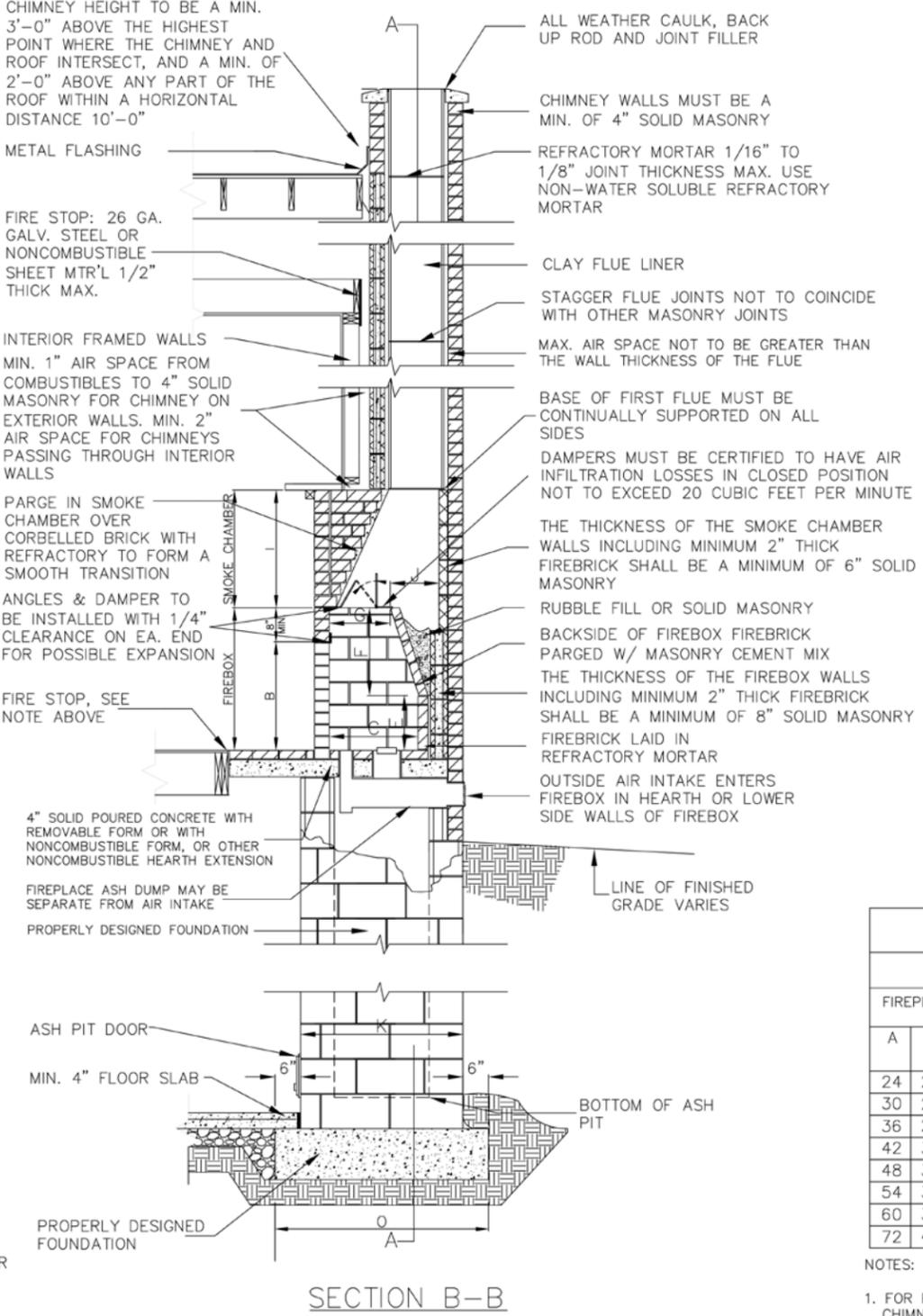
flue liner. This will enable the flue liner to stay in alignment and permit expansion and contraction.

All spaces between the chimney and the floor and ceilings should be insulated with non-combustible, fire-proof material. The fire proofing material of choice for use between the chimney and nearby wood joists, beams or headers should be galvanized steel that is at least 26 gauge and no thinner than 1/2 inch. Clay flue liners should be installed with non-water soluble refractory mortar bedding with close fitting joints left smooth on the inside and outside facing of the flue liner. Depending on the size and design of the chimney, the mason may choose to install an additional vertical section of masonry one unit wide (wythe) or support the structure by other accepted methods

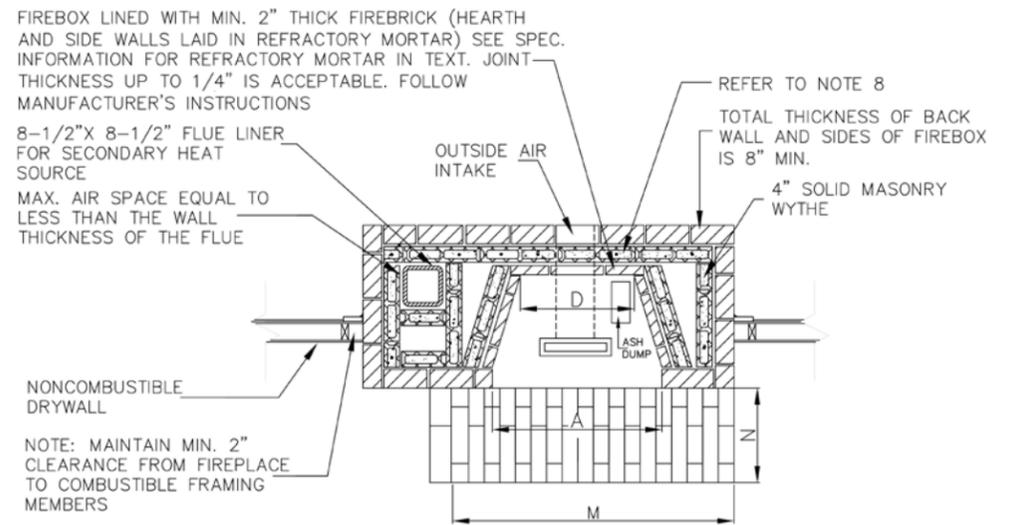
(e.g., by using a corbel header) to ensure structural integrity of the clay flue lining. The flue lining and surrounding masonry should touch each other only in spot locations (not to exceed 2 inches square each) to ensure proper alignment and support. In no circumstances should the clay flue liner be encased completely around its circumference in one location. Clay flue liners installed as such will have sufficient room for expansion and contraction during normal operating temperatures of residential fireplaces and chimneys. When more than one flue is contained within the chimney, a solid masonry wall (wythe) separation of at least 4 inches should be maintained between adjacent flues. The walls should be bonded to the chimney wall with either ties or masonry mortar.



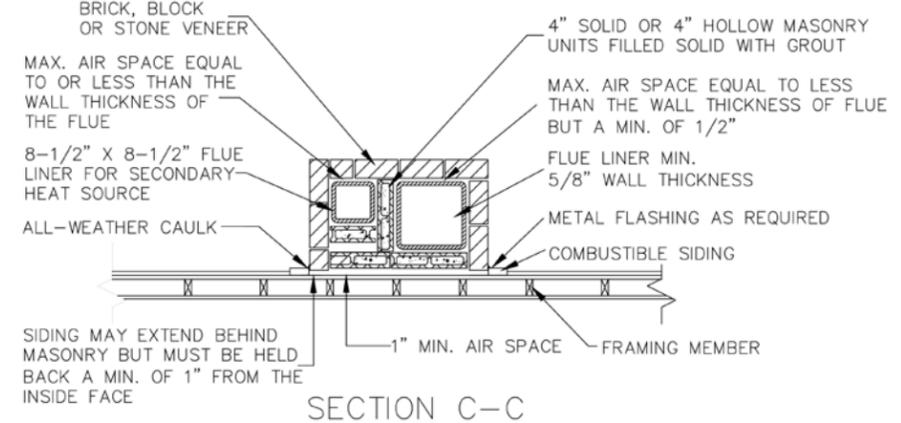
SECTION A-A



SECTION B-B



SECTION D-D



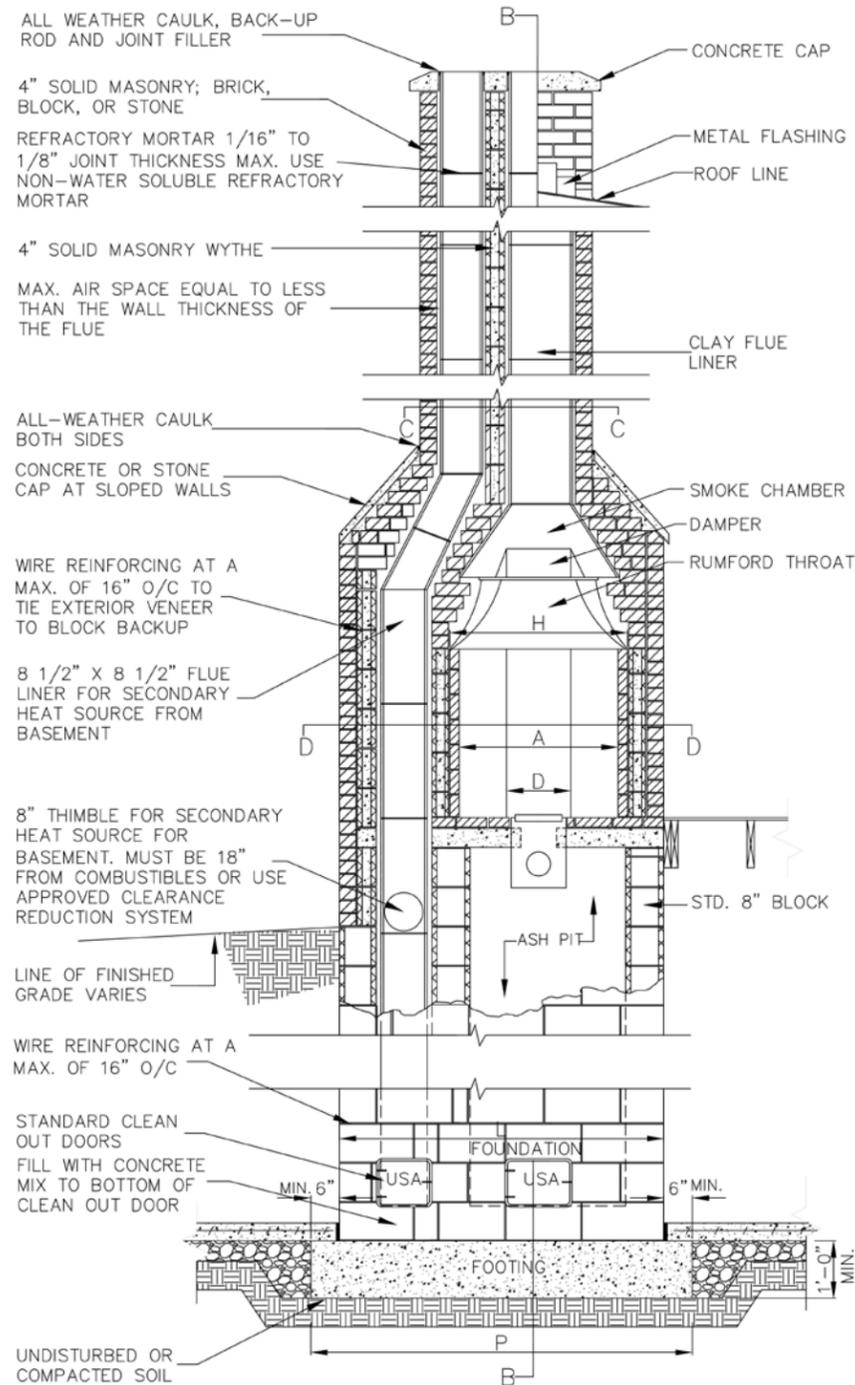
SECTION C-C

CHART II
CONSTRUCTION DIMENSIONS, INCHES (APPROX.)

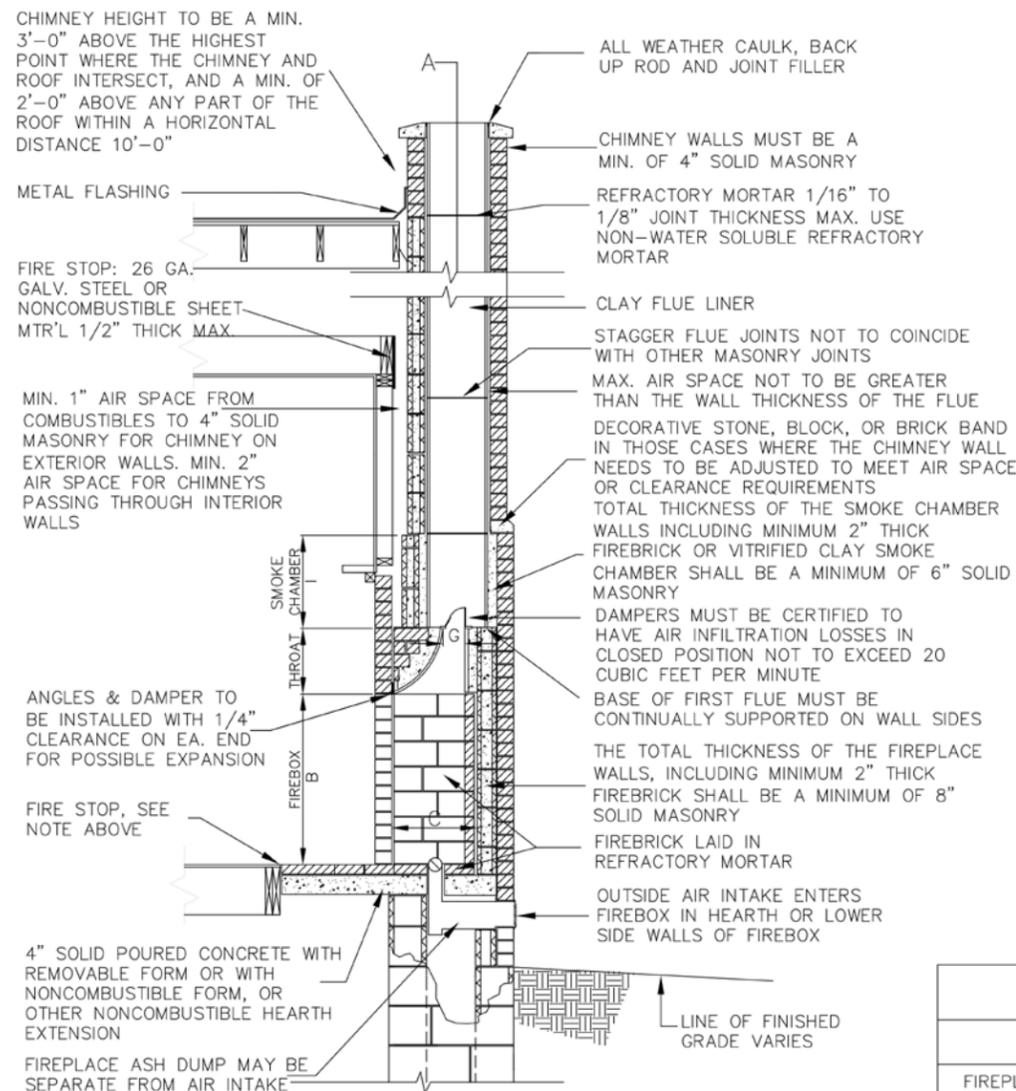
FIREPLACE OPENING		THROAT DEPTH	SMOKE CHAMBER		FOUNDATION SIZE		HEARTH EXTENSION		STEEL ANGLE	FIREPLACE FLUE SIZE	FTG SIZE						
A	B	C	D	E	F	G	H	I	J	K	L	M	N	INCHES	INCHES	O	P
24	24	16	12	14	18	9	32	18	12	32	60	48	16	36x3x3x3/16	8.5X13	44	72
30	26	16	18	14	20	9	38	24	12	32	66	54	16	36x3x3x3/16	8.5X13	44	78
36	29	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 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 THE ORIGINAL. DO NOT SCALE OR PROPORTION DIMENSIONS FROM THIS DRAWING.
 - BOTH THE INSIDE TEXT AND THE DRAWING DETAILS MUST BE REFERRED TO PRIOR TO CONSTRUCTION. READ ALL OF TEK SPEC. 4 BEFORE PROCEEDING.
 - FOR MATERIAL SPECIFICATIONS REFER TO PAGE 9 IN THE TEK SECTION.
 - INTERIOR MASONRY FIREPLACES REQUIRE A 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" MIN. 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" MIN. IS REQUIRED - HEARTH EXTENSION ALSO MUST EXTEND AT LEAST 8" BEYOND EACH SIDE OF OPENING.
 - A SOLID MASONRY UNIT IS DEFINED AS A MASONRY UNIT WHOSE CROSS SECTIONAL AREA IN EVERY PLANE PARALLEL TO THE BEARING SURFACE IS 75% SOLID OR MORE OF IT'S GROSS CROSS-SECTIONAL AREA IN THE SAME PLANE.
 - FOR REINFORCING AND OR SEISMIC AREA DESIGN CONSULT WITH THE LOCAL CODE AUTHORITY.

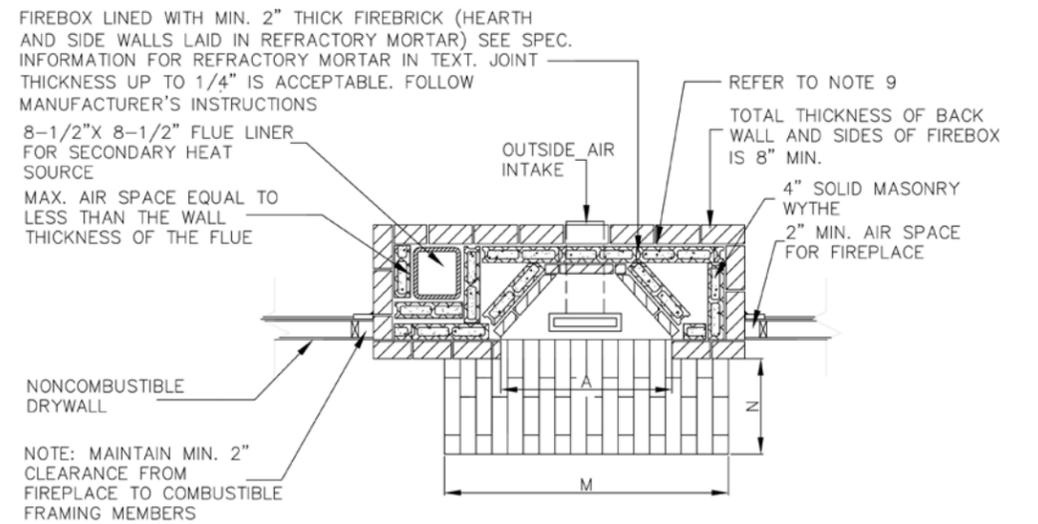
STANDARD FIREPLACE



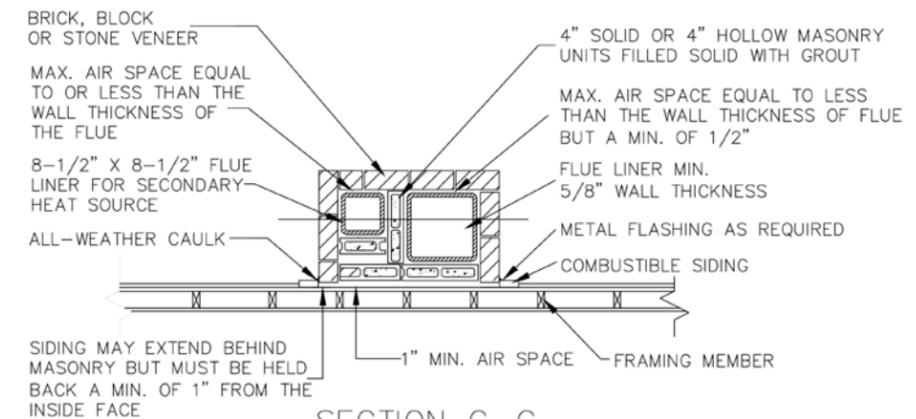
SECTION A-A



SECTION B-B



SECTION D-D



SECTION C-C

CHART II

CONSTRUCTION DIMENSIONS, INCHES (APPROX.)

FIREPLACE OPENING		THROAT DEPTH	SMOKE CHAMBER	FOUNDATION SIZE	HEARTH EXTENSION		STEEL ANGLE INCHES	FIREPLACE FLUE SIZE INCHES	FTG SIZE					
A	B				M	N			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	48-54	20	22.5	10	50	30	28	96	84	20	60x3x3x1/4	20X20	40	108
72	48-60	24	27	10	57	30	32	108	96	20	66x3x3x1/4	24X24	44	120

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- FOR FIREPLACE OPENINGS OF 6 SQUARE FEET OR LARGER A HEARTH EXTENSION OF 20" MIN. IS REQUIRED. THE HEARTH EXTENSION MUST ALSO EXTEND AT LEAST 12" BEYOND EACH SIDE OF THE OPENING. FOR FIREPLACE OPENINGS LESS THAN 6 SQUARE FEET: A HEARTH 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% SOLID OR MORE OF IT'S GROSS CROSS SECTIONAL AREA IN THE SAME PLANE.
- FOR SPECIFIC DIMENSIONS REGARDING RUMFORD DESIGN FOR OTHER THAN THE 36" RUMFORD ILLUSTRATED HERE REFER TO MANUFACTURER'S ILLUSTRATION.
- FOR REINFORCING OR SEISMIC AREA DESIGN CONSULT WITH THE LOCAL CODE AUTHORITY.

RUMFORD FIREPLACE

Chimneys, con't.

The chimney must extend at least 3 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. The best draft is achieved if the top of the fireplace opening to the top of the chimney is at least 15 feet. If this distance is less than 15 feet, a larger flue size may be necessary.

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 should 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 interior of the chimney. The cap should 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 the flue liner should be sealed with caulk to prevent water or moisture from entering the chimney. This is a maintenance joint that should be inspected on a regular basis to ensure water tightness. It should be replaced when necessary.

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

FLASHING

Base and counter flashing should be installed at the chimney / roof surface. The base flashing should be installed first, on the faces of the chimney perpendicular to the ridge line with tabs at each corner. The flashing should extend a minimum of 4 inches along the roof surface. Counter flashing should then be installed over the base flashing, inserted into the mortar joint 3/4 to 1 inch wide, and mortared solidly into place. The counter flashing should lap the base flashing by at least 3 inches. If the flashing is installed in sections, the flashing higher up the roof line should lap over the lower flashing a minimum of 2 inches. All joints in the same base and counter flashing should be sealed thoroughly, with any exposed side of the bends in the flashing also 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** – ASTM C-39 (for the hearth slab and chimney cap).
- 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 inches 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 the smoke chamber must also be non-water soluble. All of the above must meet the high temperature requirements of the ASTM C-199 medium duty code.
- J. Dampers** – Should be certified to have air filtration losses not to exceed 20 cubic feet per minute when in the closed position.
- K. Steel Angle** – Must meet ASTM A-36 with minimum dimensions as specified in Chart II in each fireplace drawing.



CLEARANCE TO COMBUSTIBLES

One of the most important fire safety requirements is the air space that separates the chimney from the combustible materials such as the framing. For interior chimneys this space must be a minimum of 2 inches. For an exterior chimney this space must be a minimum of 1 inch. This space insulates the chimney and minimizes the transfer of heat to combustible materials. It must not be filled except for required fire stopping. When masonry fireplaces and chimneys are part of a masonry wall, combustible materials should reside 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 should be at least 8 inches from the inside surface of the fireplace or flue lining.

Woodwork or other combustible materials should not be placed within

6 inches of the fireplace opening. Combustible materials that are within 12 inches of the fireplace opening should not project more than 1/8 inch for each 1 inch distance from such an opening.

BALANCING THE VENTILATION

In order for a fireplace to function properly, a natural supply of makeup air must be available to replace the exhausted air from the chimney. In older homes there is often enough leakage around doors and windows to provide this air. In newer, tightly built homes another source of air must be provided. Before lighting the fire, use a match stick or 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 insufficient air is present, you may need to locate other sources of air entering or being exhausted from the room. The use of exhaust fans and opening an attic or upstairs rooms may be a source of air flowing out of

the building. Warm air tends to flow out from upper rooms, while cold air flows down to the lower rooms in the house. If you determine that you need a permanent source of makeup air, contact a heating and ventilation specialist and discuss the various options. Fireplaces will exhaust 100-cfm to 1,000-cfm depending on the size and intensity of the fire.

REDUCING CREOSOTE BUILDUP

Burning wood and fossil fuels in the absence of adequate airflow causes incomplete combustion of the oils in the wood, which are off-gassed as volatiles in the smoke. As the smoke rises through the chimney it cools, causing water, carbon and volatiles to condense on the interior surfaces of the chimney flue. The black oily residue that builds up is referred to as creosote. Creosote deposits reduce the draft (airflow through the chimney) which increases the probability that the wood fire is not getting enough air for complete combustion. Since creosote is highly combustible, a thick

accumulation creates a fire hazard, making its reduction or removal imperative.

One method of reducing creosote buildup is to gradually stoke a medium hot fire for 15-30 minutes at least once per day. This tends to burn off the creosote in small amounts. Seasoned or dry woods tend to 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 chimney flues is important, especially during the first season of use. Any problems with creosote buildup can be corrected before it becomes a hazard. Inspect the chimney regularly from the roof using a flashlight, or alternatively by using a mirror to look up through the flue. If an inspection indicates soot or creosote buildup, the chimney should be cleaned.

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

MASONRY BAKE OVEN

Wood-fired ovens constructed of masonry materials have been used for cooking and baking for centuries. In the past two decades we have seen a significant increase in the construction of masonry ovens designed for commercial and residential applications, for both inside and outside use.

The architectural sketch that follows offers some design suggestions. Many additional designs are feasible, with varying materials in different shapes and sizes. Some are built traditionally using masonry materials from scratch.



NOTIFICATION

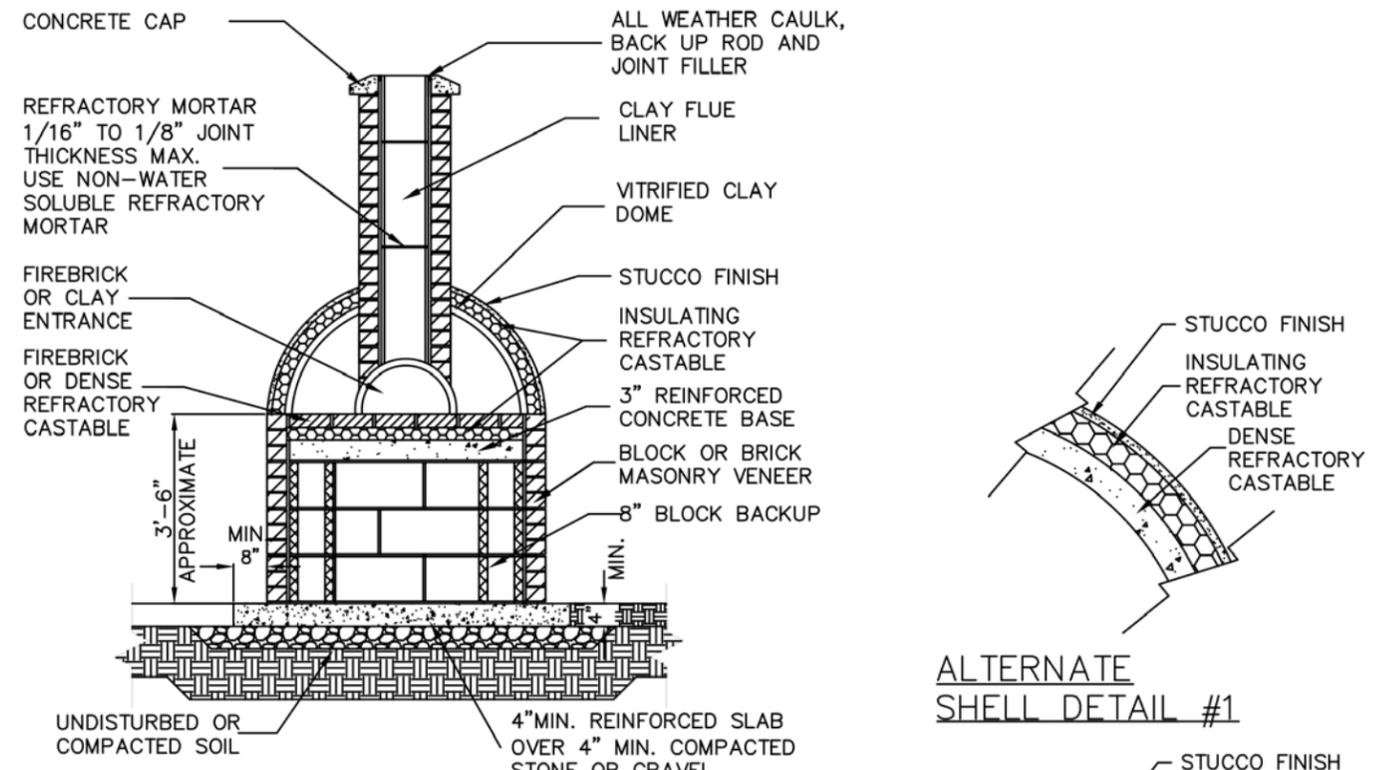
Code enforcement authorities must be notified when solid-burning fuel heating appliances or chimney construction materials are purchased or acquired.

All businesses selling or installing solid fuel burning heating appliances and / or chimney construction materials must 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 commences. Please accept this Tek Spec 4.0 document as official written notification of the above.

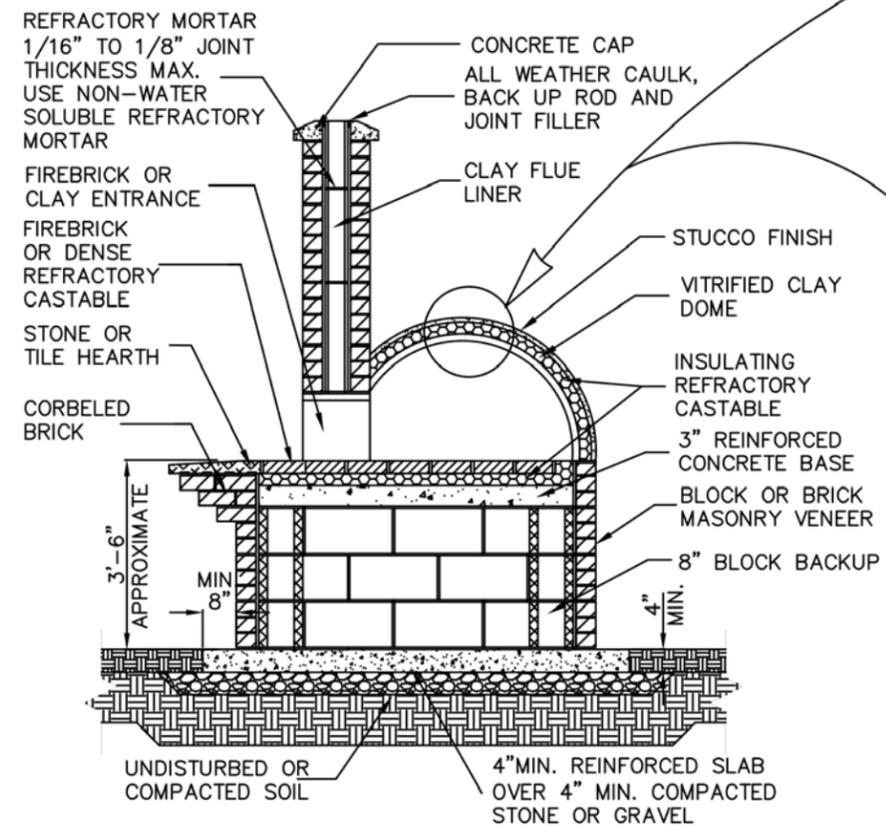
Others use pre-engineered component parts offering the latest technology, providing operational efficiency and ease of construction.

No matter your preference in oven design, all products used in masonry

oven construction (e.g., brick, block, firebrick, refractory components, stucco, stone, terra cotta, etc.) are widely available at your local masonry supply dealer. As with all masonry construction, carefully observe fire safety and code compliance.

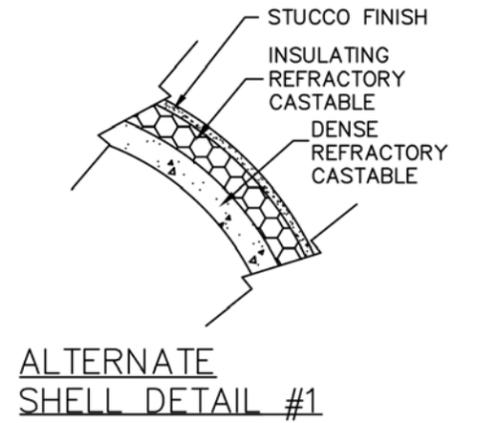


SECTION/ELEVATION

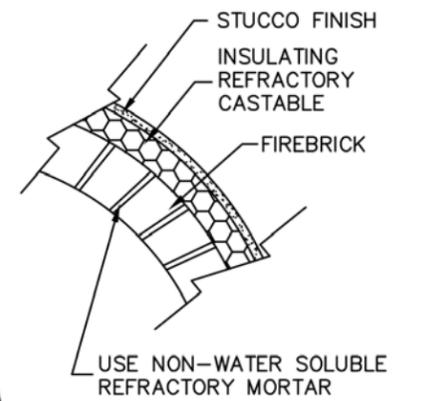


SECTION/ELEVATION

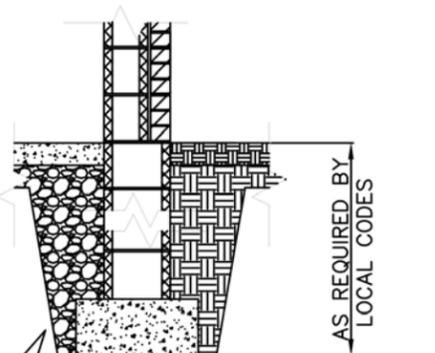
BRICK OVEN



ALTERNATE SHELL DETAIL #1



ALTERNATE SHELL DETAIL #2



ALTERNATE FOUNDATION DETAIL

IN SOME CLIMATES A FOUNDATION MAY BE REQUIRED

STEPS FOR SAFE FIREPLACE STARTING / OPERATION

A fireplace fire, properly laid and fed is easy to tend to and should provide years of trouble-free enjoyment. Here are some tips for building a fire:

- Be sure the damper is open before lighting the fire!
 - Use a small amount of paper and kindling wood 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 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 flames are well established.
 - The use of glass doors or screens is recommended for the safe and thermally efficient use of the fireplace. Keep the screen closed when the fire is burning.
 - Use slow burning hardwoods as these 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 of about 1 inch thick should be removed. Never use a fireplace as an incinerator.
- For commercial or industrial appliance applications please consult your local building inspector for the proper building code.

The recommendations, suggestions, statements and technical data in this document are based on our best knowledge at the time of publication. They are provided for informational purposes only and without any responsibility for their use.

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, IL)

USA – Clay Flue Lining Institute

National Concrete Masonry Association (Herndon, VA)

Brick Industry Association of America (Reston, VA)



NEW YORK STATE CONCRETE MASONRY ASSOCIATION

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