



Standard Practice for Installing Clay Flue Lining¹

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1. Scope

1.1 This practice covers the minimum requirements for installing clay flue lining for residential concrete or masonry chimneys.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values stated in parentheses are for informational purposes only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- C 24 Test Method for Pyrometric Cone Equivalent (PCE) of Fireclay and High Alumina Refractory Materials
- C 27 Classification of Fireclay and High-Alumina Refractory Brick
- C 55 Specification for Concrete Building Brick
- C 90 Specification for Loadbearing Concrete Masonry Units
- C 99 Test Method for Modulus of Rupture of Dimension Stone
- C 129 Specification for Nonloadbearing Concrete Masonry Units
- C 170 Test Method for Compressive Strength of Dimension Stone
- C 199 Test Method for Pier Test for Refractory Mortars
- C 216 Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
- C 270 Specification for Mortar for Unit Masonry
- C 315 Specification for Clay Flue Liners and Chimney Pots

- C 652 Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
- C 896 Terminology Relating to Clay Products
- C 1184 Specification for Structural Silicone Sealants

3. Terminology

3.1 *General*—Terminology C 896 should be used for clarification of definitions in this practice.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *chimney connector*—tubular unit or pipe used to convey products of combustion from a heating or cooking appliance to the chimney.

3.2.2 *flue*—passageway within a chimney through which products of combustion are conveyed.

3.2.3 *flue liner*—manufactured tubular nonloadbearing fired clay unit, normally used for conveying hot gases in chimneys.

3.2.4 *masonry chimney*—vertical structure constructed of brick, concrete, concrete masonry units, or stone, which contains one or more flues, and conveys products of combustion from a heat source or cooking appliance.

3.2.5 *smoke chamber*—section of a fireplace above the throat and below the flue, which is an area of transition from the shape of the throat to the shape of the flue.

3.2.6 *thimble*—manufactured tubular nonloadbearing fired clay unit normally used to connect the chimney connector from an appliance through the wall of the chimney to the flue.

4. Footings and Foundations

4.1 Footings for masonry chimneys shall be constructed of concrete or solid masonry at least 12 in. (305 mm) thick, and it shall extend at least 6 in. (150 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded below frost depth on natural undisturbed earth or engineered fill. In areas not subjected to freezing, footings shall be founded at least 12 in. (305 mm) below finished grade.

4.2 The foundation shall be placed, with respect to adjacent structures existing or anticipated, to minimize the possibility of damage by construction operations or by transmission of additional loads to the supporting soils.

4.3 Concrete footings and foundations shall conform to local building codes.

¹ This practice is under the jurisdiction of ASTM Committee C04 on Vitrified Clay Pipe and is the direct responsibility of Subcommittee C04.20 on Methods of Test and Specifications.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4.3.1 In the absence of a local building code, concrete with a minimum 28 day compressive strength of 3000 psi (21 MPa) shall be used.

4.4 Where a chimney or fireplace is added to the outside of the exterior wall of an existing structure, the following shall apply:

4.4.1 The new footing shall be installed at the same level or below the existing footing, provided the level is below the frost line and the new footing is placed on soil with adequate bearing capability.

4.4.2 The existing drainage provision shall not be obstructed.

5. Chimney Construction

5.1 Materials:

5.1.1 *Flue Linings*— Specification C 315.

5.1.2 *Refractory Mortar*—Test Method C 24 (cone 10) and Test Method C 199 (medium duty).

5.1.3 *Concrete Block*— Specification C 90 or Specification C 129.

5.1.4 *Brick*—Specification C 55 or Specification C 216, Grade SW.

5.1.5 *Mortar*—Specification C 270.

5.1.6 *Firebrick*—Classification C 27.

5.1.7 *Natural Stone*— Test Method C 170 or Test Method C 99.

5.2 The chimney consists of a flue liner and the chimney wall. When used to vent a fireplace, the chimney is constructed directly on the smoke chamber.

5.3 The flue lining shall start from a point not less than 8 in. (205 mm) below the entrance of the lowest chimney connector.

5.4 Flue liners shall be installed, each flue liner carefully bedded on the previous one, using refractory mortar. All joints of flue liners shall be $\frac{1}{16}$ in. (1.6 mm) to $\frac{1}{8}$ in. (3.2 mm) thick, and struck flush so as to produce a straight, smooth, fully aligned flue. Liners shall be placed in such a manner as to minimize ledges or steps within the flue passageway.

5.5 Flue liners shall be surrounded by masonry on all sides but shall not be bonded to the surrounding masonry. The flue liner shall contact the chimney wall only as necessary for support and alignment in order to permit the flue liner to expand and contract freely. The separation of the flue liner from the surrounding concrete or masonry shall not exceed the wall thickness of the flue liner. Where seismic reinforcing requires the space between the flue liner and the chimney wall to be grouted solid, the flue shall be wrapped with ceramic fiber paper capable of withstanding temperatures of 2100°F to prevent the flue liner from bonding to the chimney walls.

5.6 The flue lining shall extend the entire height of the chimney. The lining shall be carried up as vertically as possible. When offsets are necessary, their slopes shall be no flatter than 30° from vertical.

5.7 When more than one flue is contained in a chimney, a separation shall be provided between adjacent flues. The separation shall be solid masonry wythes (partitions) not less than 4 in. (100 mm) nominal thickness and bonded into the chimney walls.

5.8 Adjustments to the liner size or shape shall be made with a masonry saw.

5.8.1 When fabricating custom size flue liners, the aspect ratio shall not exceed 2:1 and the vertical joint shall be sealed with refractory mortar as required in 5.4.

5.9 Openings in the flue liner for chimney connectors shall be manufactured or machine cut.

5.10 Chimney walls shall be constructed of concrete or solid masonry units at least 4 in. (100 mm) nominal thickness.

5.10.1 Products for chimney wall masonry construction are those (concrete, concrete masonry units, brick or stone) that are at least 75 % solid or grouted solid and which meet the requirements of Specification C 55, Specification C 90, Specification C 216 Grade SW, or Specification C 652.

5.10.2 Cast in place concrete chimneys must be designed by an engineer.

5.11 The chimney shall be adequately anchored to the building to provide stability against wind and seismic loads. In seismic design categories, building codes may require additional anchoring or reinforcements.

5.12 The mortar in all joints exposed to weather shall be compacted and well tooled.

5.13 Masonry chimneys shall extend 3 ft (0.92 m) above the highest point of the structure where chimneys pass through a roof of a building and at least 2 ft (0.61 m) above any location of any structure within 10 ft (3.1 m) (measured horizontally from the vertical centerline chimney line).

6. Clearances

6.1 The minimum air space clearance between interior masonry chimneys and combustible materials shall be 2 in. (51 mm). Any chimney with at least one interior wall shall be treated as interior.

6.2 The minimum air space clearance between exterior masonry chimneys and combustible materials shall be 1 in. (25 mm).

6.3 Combustible material shall be permitted to abut the masonry chimney sidewalls, provided they are a minimum of 12 in. (305 mm) from the inside surface of the flue liner.

6.4 All spaces between chimneys and floors or ceilings through which chimneys pass shall be fire stopped with noncombustible material. The fire stopping of spaces between chimneys and wood joists, beams, or headers shall be galvanized steel not thinner than 26 gage or noncombustible sheet material not thicker than $\frac{1}{2}$ in. (13 mm).

7. Openings For Chimney Connections

7.1 The chimney connection shall be made by either a metal or clay thimble. The thimble shall be installed on a $\frac{1}{4}$ in. (6.4 mm) per foot slope toward the appliance. This is to allow any liquid creosote to drain back into the appliance for reburning.

7.2 A minimum of 12 in. (305 mm) of solid masonry, or a combination of 4 in. (100 mm) solid masonry and 2 in. (51 mm) air space shall be provided between clay thimbles and combustible materials.

7.3 The thimble shall pass through the flue lining and be flush with the inside of the flue lining or butted to the outside of the flue liner. The joint between the thimble and the flue lining shall be sealed with a refractory mortar.

7.4 The opening for a flue pipe connection shall be positioned to maintain the clearances from combustible construction, as specified in Section 6.

7.5 The stovepipe shall be positioned so that horizontal movement will not cause it to back out of the thimble or protrude into the flue.

8. Chimney Caps

8.1 All masonry chimneys shall have a chimney cap that slopes a minimum of 10° downward from the flue liner to the edge of the chimney cap (see Fig. 1).

8.4 Chimney caps shall be separated from the flue lining by a bond break, and this separation shall be sealed with a noncombustible resilient sealant to prevent water entering the chimney. This is a maintenance joint and should be checked and renewed as needed (see Fig. 1).

8.5 Clay flue linings shall extend above the chimney cap by not more than 4 in. (100 mm).

8.6 Where a clay chimney pot is installed on a masonry chimney, the chimney pot shall comply with the requirements of Specification C 315.

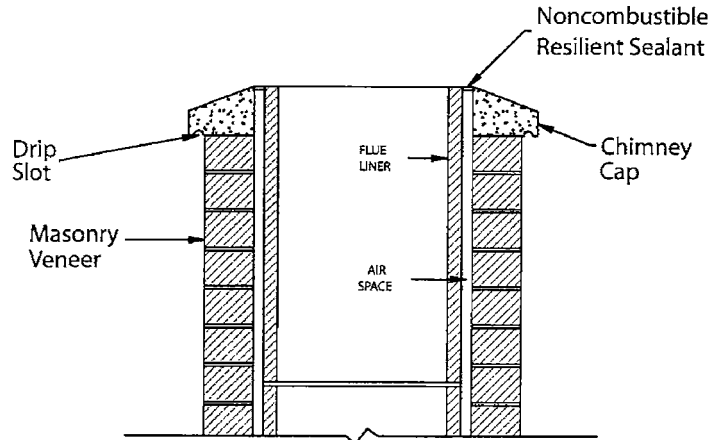


FIG. 1 Chimney Cap

8.2 Chimney caps shall overhang the chimney wall by a minimum of 2 in. (51 mm).

8.3 Chimney caps are of the following types and construction:

8.3.1 Precast or cast-in-place concrete caps shall be a minimum of 2 in. (51 mm) in thickness, shall have a drip slot on the underside at least 1 1/2 in. (38 mm) away from the chimney wall, and shall be reinforced with a minimum of 1/2 in. (13 mm) mesh galvanized hardware cloth located halfway into the filled form.

8.3.2 Metal chimney caps must lap down the chimney wall at least 4 in. (100 mm) and a noncombustible resilient sealant shall be used between the metal cap and the flue liner and between the base of the metal cap and the chimney.

8.3.3 Stone caps shall be a minimum of 2 in. (51 mm) in thickness and shall have a drip slot on the underside at least 1 1/2 in. (38 mm) away from the chimney wall.

9. Special Conditions

9.1 Special features to mitigate any problem relating to condensation shall be permitted in the construction of chimneys.

9.1.1 Flue liners with joints that prevent leakage of condensation shall be permitted. Socketed and overlapping joints manufactured as an integral part of the flue liner are acceptable.

9.1.2 A condensate drain installed at the base of the chimney shall be permitted.

10. Keywords

10.1 chimney; chimney caps; clay; fireplace; flue liner; flue lining; masonry; venting

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