

**CRSC Proposal for IRC
Draft November 13, 2015**

Add new Appendix Chapter U as follows:

APPENDIX U

**SEISMIC REPAIR AND SEISMIC RETROFIT OF MASONRY CHIMNEYS IN
ONE- AND TWO-FAMILY DETACHED DWELLINGS**

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

**SECTION AU101
GENERAL**

AU101.1 Scope. This appendix provides prescriptive provisions for repair of earthquake-damaged masonry chimneys and fire boxes in one- and two-family detached dwellings. The provisions of this section are also permitted for pre-earthquake seismic retrofit of existing masonry chimneys, whether damaged or not. When used for seismic retrofit, the objective of these provisions is hazard reduction.

AU101.2 Repair and Retrofit Methods. Repair or seismic retrofit of masonry chimneys are fireboxes shall be permitted to be by one of the following methods:

1. Capping of Chimney at roof level in accordance with Section AU102,
2. Reconstruction from top of firebox up in accordance with Section AU103,
3. Reconstruction from the top of firebox using a fireplace insert in accordance with Section 104, or
4. Full reconstruction of firebox and chimney in accordance with Section 105.

**SECTION AU102
CAPPING OF CHIMNEY AT ROOF LEVEL**

AU102.1 Scope. This section provides prescriptive provisions for repair of earthquake-damaged masonry chimneys in single story dwellings where the chimney damage occurs only above the roof level.

AU102.2 Fireplace use. The provisions of this section shall only be used when the fireplace will not be used for any solid-fuel or gas burning device. Access to the interior of the fire box shall be completely closed off from the dwelling interior with gypsum board, wood structural panel or other sheathing material such that no fuel or device can be placed in the firebox.

AU102.3 Inspection prior to use. An inspection of the firebox and chimney shall be provided by _____ in order to verify that earthquake damage does not extend into masonry to be remain. Where earthquake damage does extend into existing masonry to remain, the provisions of this section shall not be used.

AU102.4 Chimney partial removal and capping. The chimney shall be removed to a distance of six inches above the highest adjacent roofing. This distance shall be permitted to be increased to a maximum o twelve inches where required to maintain existing roof flashing undisturbed.

A sheet metal cap of galvanized steel or stainless steel shall be provided for weather protection. The cap shall extend not less than three inches down each side of the chimney and shall lap not less than two inches with existing roof flashing. The cap shall be secured directly to the masonry with adhesive

anchors. Installation shall be in accordance with Figure AU101.1.



Figure 3: Dwelling with a chimney capped at the roof line.

SECTION AU103 RECONSTRUCTION FROM TOP OF FIREBOX UP

AU103.1 Scope. This section provides prescriptive provisions for repair of earthquake-damaged masonry chimneys in single story dwellings where the chimney damage occurs only above the transition from the firebox to the chimney.

AU103.2 Inspection prior to use. An inspection of the firebox and chimney shall be provided by _____ in order to verify that earthquake damage does not extend into masonry to be remain. Where earthquake damage does extend into existing masonry to remain, the provisions of this section shall not be used.

AU102.3 Chimney partial removal. The chimney shall be constructed using a lightweight metal flue contained in a cold-formed steel stud chimney enclosure, as shown in Figure 4. This lightweight, flexible construction is much more resistant to damage in future earthquakes. Although the remaining masonry firebox could be damaged in a future earthquake, the firebox is much less vulnerable to damage than the original masonry chimney. As a result, the risk of collapse and the associated risk to life safety are greatly reduced when this reconstruction alternative is implemented.

AU102.4 Chimney reconstruction.

The primary components of Alternative B construction are listed below, illustrated in Figure 5. Additional details of construction are provided in Figures 6 and 7.

1. **Masonry firebox.** *Inspect the firebox to verify that it is in good condition prior to start of repair work.*
2. **Existing framing.** *To remain as is except for roof blocking as detailed in Figure 7 and Item 7 below.*

3. **Masonry veneer.** Verify support and anchorage of existing veneer where it occurs above and surrounding the fireplace.
4. **Firebox to flue transition.** The transition from the masonry firebox to the metal flue, includes: anchorage to masonry, concrete bond beam, steel adapter cone, and UL listed anchor plate. This detail is critical to the safe performance of this reconstruction alternative. See Figure 6 for more information.
5. **Cold-formed steel track.** Anchor track to concrete beam per Figure 6.
6. **Cold-formed steel stud wall.** Provide full height studs sized for eight foot clear height.
7. **Chimney connection to dwelling.** Provide stud blocking and steel strap connection to existing dwelling framing at upper floor, ceiling, and roof framing.
8. **Insulation.** Provide insulation between studs at exterior walls of the chase, allowing for the proper clearances in accordance with the manufacturer's installation instructions.
9. **Metal flue.** Provide UL Standard 103 listed metal flue, installed in accordance with manufacturer's instructions. Provide as large a flue as can be installed in available space meeting minimum clear distances.
10. **Flue cap.** Install flue cap supplied by flue manufacturer.
11. **Fire blocking.** Provide fire blocking between chimney chase and attic as required by the Code.

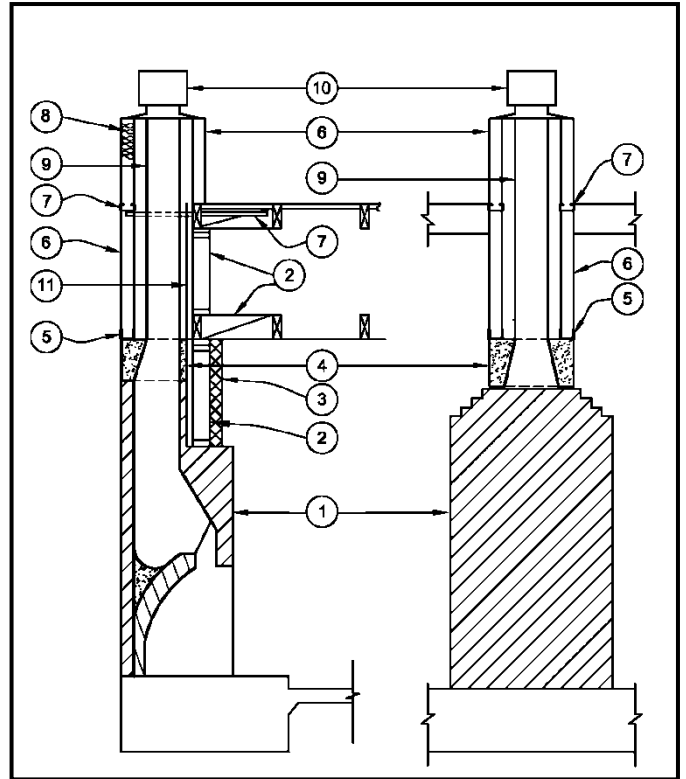


Figure 5: Components of a masonry firebox in combination with lightweight metal flue and chimney.

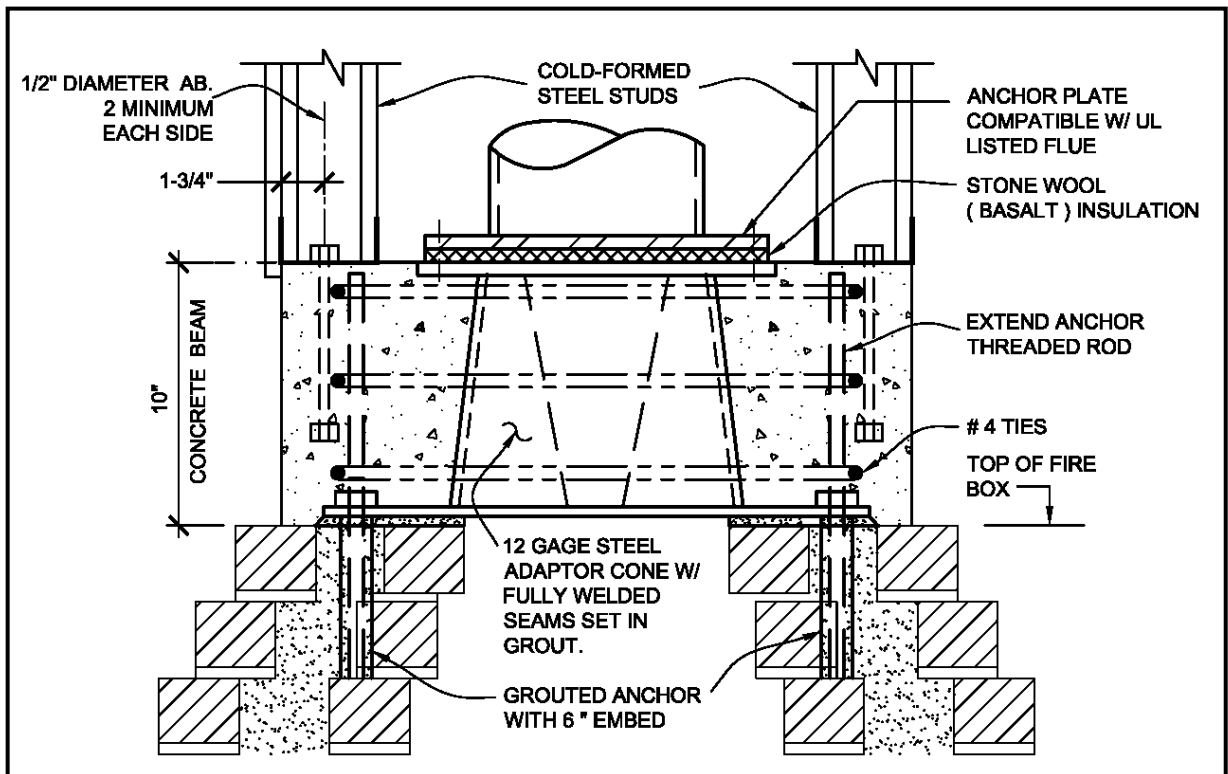


Figure 6: Detail at masonry firebox transition to metal flue and light-frame chimney.

Requirements for Flue Transitions and Components

Figure 6 provides details for the transition from the masonry firebox to the metal flue and stud wall chimney chase. The components of this transition include the following:

- Fabricate a 12 gage (97 mil) minimum sheet steel transition cone as shown in Figure 6. The transition cone is to have minimum 12 gage (97 mil) sheet steel top and bottom plates as shown. This will likely need to be custom fabricated by a sheet metal shop for each chimney. All seams are to be fully welded. The transition cone is intended to provide a smooth-surfaced transition between the flue opening at the top of the firebox and the anchor plate and metal flue. The base plate geometry is to match the opening geometry at the top of the firebox, and the top plate geometry is to be coordinated with the UL listed anchor plate. The transition cone will also serve to minimize movement of heated gas through cracks that might form in the surrounding concrete beam. The transition cone is to be set in cementitious grout.
- Provide not less than four 1/2-inch diameter threaded rod anchors anchoring the transition cone base plate to the firebox masonry, as shown in Figure 6. Extend the threaded rods to one inch below the top of the concrete beam. Where the existing masonry is fully grouted at anchor locations, drill one-inch diameter holes six inches deep and set in high-strength grout. Where the existing masonry is not fully grouted, place threaded rods in cavity and grout the entire cavity.
- Place reinforcing steel (rebar) and construct a concrete beam around the transition cone, using the cone as the inside form. Maintain a minimum 1-1/2 inch clear distance between rebar and outside face of concrete.
- Install stone wool (basalt) insulation board on top of the transition cone top plate as shown in Figure 6, and secure in place.
- Install fireplace adapter (chimney anchor plate) in accordance with the manufacturer's installation instructions. UL Standard 103a provides information on anchor plates that provide the transition from the fireplace to the metal flue, however UL does not currently certify (list) these adapters. The provider of the metal chimney should provide an adapter that is intended for use with the chimney, and should verify that it has been tested per UL103a.
- Enclose the new flue in a light frame chimney enclosure constructed of not less than 18 gage (43 mil) by 2-1/2 inch deep galvanized steel studs at not more than 12 inches on center. Install fire stops per code requirements. Fasten the steel studs to the existing residence exterior wall and tie the chimney framing into the existing roof framing with not less than 20 gage by 1-1/2 inch wide steel straps with not less than four #8 screws to the steel construction and four 8d common nails to existing wood construction.

Light-Frame Chimney Bracing to Roof

IRC and CRC requirements for the height of the chimney require that the top of the chimney box extend three feet above the roof and not less than two feet above the

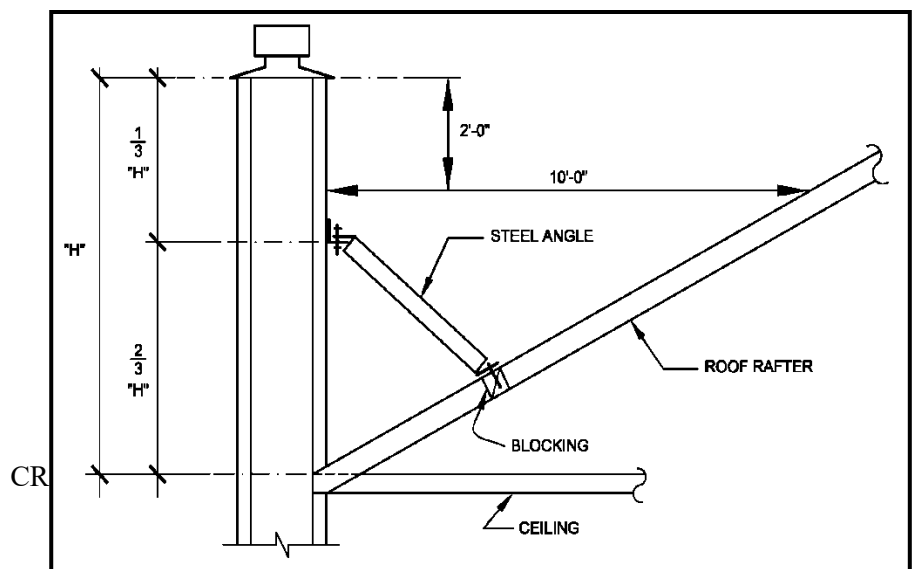


Figure 7: Bracing of light-frame chimney chase to roof.

elevation of the roof or other construction within a ten foot dimension, as illustrated in Figure 7. This often requires that the chimney extend a significant distance above the roof line at the location of the firebox. Where this occurs, it is necessary to provide bracing of the chimney down to the roof. Such bracing should be provided in the upper third of the chimney clear height above the roof (H), as shown in Figure 7. Chimney bracing may also be required in Alternative C.

SECTION AU104 RECONSTRUCTION FROM TOP OF FIREBOX USING A FIREPLACE INSERT

AU104.1 Scope. This appendix provides prescriptive provisions for repair of earthquake-damaged masonry

SECTION AU105 FULL RECONSTRUCTION OF FIREBOX AND CHIMNEY

AU105.1 Scope. This appendix provides prescriptive provisions for repair of earthquake-damaged masonry

Reason: In most recent moderate to major earthquakes, extensive damage has occurred to masonry chimneys and fire boxes. As a result, jurisdictions have needed to provide direction for repair of earthquake-damaged chimneys and fire boxes. Following the 2014 South Napa Earthquake, FEMA funded the writing of a recovery advisory addressing recommendations for repair of earthquake damaged chimneys and fire boxes, drawn in part from repair approaches that City of Napa and other jurisdictions had developed. This code change makes this guidance available to all jurisdictions to adopt on an as-need basis, and permits the same approaches developed for repair of damaged chimneys to be used for voluntary retrofit of chimneys prior to an earthquake.