PRE-CAST CONCRETE FIREPLACE DAMAGE AND REPAIR

Written by Dale W. Feb

There has been numerous pre-cast concrete fireplaces constructed and installed in the United States. Western, Sierra and Pro-Con were just a few. The most prominent pre-cast fireplace in California was the Rampart General. The Rampart General was produced in Santa Ana and installed throughout the greater part of Southern California.

It is important to fully understand the difference between the pre-cast concrete fireplace and the masonry fireplace. The masonry fireplace is assembled on site brick by brick with the use of mortar and hard labor. The pre-cast concrete fireplace is assembled in a factory and shipped to the site for installation. These concrete fireplaces are truly quite different from the masonry fireplaces.

The Rampart General pre-cast concrete fireplace was an engineered and designed system. What this means is that this fireplace was designed by a qualified engineer and was tested to determine the safe requirements for construction, installation, operation and repair. Approval for installation was granted based on this written design and specifications.

Fabrication commenced at the factory by pouring a firebox lining with a mix consisting of one part calcium aluminate cement to four parts of approved lightweight aggregate. This two-inch lining was cured and then set into the fireplace form. The reinforcing steel and flue liners were set in place and the firebox base, outer walls and chimney were poured using a lightweight aggregate concrete. This concrete was required to have a minimum compressive strength of 2000 pounds per square inch after curing for a minimum 28 days. The unitized fireplace structures were then transported to the job site for installation. At the job site the pre-cast concrete fireplaces were temporarily positioned on the edge of the footing and supported with a brace anchored to the slab.

The footing was then poured beneath the fireplace and left to cure. In some cases the fireplace was positioned and shored on a pre-poured footing and grouted into place. Also note that some of

the footings were post-tension. Please be aware that the post-tension cables found within this concrete footing should **never** be cut during the removal of a damaged pre-cast concrete fireplace. Injuries may occur and the repair cost is substantial. Once the footing had cured, the brace was removed and the wood framed dwelling was constructed.

The Cities and Counties allowed the installation of these fireplaces based on the Fireplace Manufacturers' Specifications and the ICBO Evaluation Services Report # 2076-P. As stated in the evaluation report "the Prefabricated Concrete Fireplaces comply with the Uniform Building Code, provided the fireplaces are constructed in conformance with this report and drawings". Based on the manufacturers' specifications, the ICBO evaluation report and the acceptance by the local building official of these two documents, **we are not allowed to deviate from the construction, installation or repair requirements stated within these written details.**

This means that if we decide to change or alter the existing pre-cast concrete fireplace outside the perimeters of the manufacturers' specifications then we invalidate the approval program required for the safe installation and operation of these fireplaces. The **incorrect type of repairs** that would fall into this category would be the replacement of the concrete chimney with a Class "A" chimney pipe, relining of the existing flue, the repair to a fractured "insulation plate" or the improper repair to exterior surface cracks. All of these incorrect repairs ultimately change the original structure, change the design or provide an unproven and/or potentially dangerous condition. Therefore any repair that varies from these pre-cast concrete fireplace specifications has not been accepted by the Fireplace Manufacturer or the Courts that have upheld these documents. Both believe that a dangerous condition may exist without strict adherence to these specifications.

When the concrete chimney is replaced with a Class "A" metal chimney the design is changed on the existing pre-cast concrete structure while the listing on the new metal Class "A" pipe is voided. The approval on the pre-cast concrete fireplace was based on that design (the manufacturer's specifications) as well as the proven ability of these fireplaces to safely operate. The Class "A" chimney pipe is approved for use with masonry fireplaces but has not been tested on pre-cast concrete fireplaces due to the lack of demand. When we place these two systems together it is unknown what we truly have. What we do know is that this is not the original system that was tested and approved for use.

Unlike masonry chimneys assembled on site with a high potential for human error, the liner joints on the pre-cast concrete chimney are not a concern. With a semi-hollow masonry chimney, (a chimney that is not fully grouted between the outer brick structure and the flue liners) heat

may travel through a breach in the flue liner joint and exit through the outer chimney wall. This condition could pose a real danger. However, with the solid pre-cast concrete chimney there is no possibility of the heated gases penetrating past the depth of the flue liner. Again, remember that this is a solid concrete structure. You will note that the rear wall of the pre-cast concrete chimney may have a collection of concrete while the other three sides may have voids or a lack of concrete at the liner joints. This is due to the horizontal assembly of this concrete chimney and the taping of the flue liner joints to prevent the passage of concrete through these joints during the assembly process. Voids on the liner joints are common with the solid concrete fireplace but there is no where for the gasses to travel. Therefore repair to these joints are not necessary or required. What is the actual intent of all flue liners? The flue liners are installed to reduce the transfer of heat through the chimney walls and provide a smooth surface to assist in the drafting process. The lack of concrete in the flue liner joints of these solid pre-cast concrete chimneys has little to no effect on the intent of these liners. Also take note that the use of a listed metal flue liner or a mortar lining system may reduce the flue volume, stall the draft and cause smoke to exit into the living area.

This pre-cast concrete fireplace historically does not indicate the same seismic failure as in the masonry fireplace. The masonry fireplace may show signs of cracking in combination with shifting and/or loss of material. The pre-cast concrete fireplace rarely has shifting and/or loss of material and usually only shows small to fine cracks. These cracks are often mistaken for minor damage and incorrectly repaired. If these cracks pass through the wall of this fireplace structure then repair is not allowed. A full evaluation by a qualified individual is required to determine the extent of this damage.

Although there are surface cracks in most concrete structures, the cracks of concern in the Pre-Cast Concrete Fireplace are addressed within the manufacturer's repair specifications. Cracks that do not pass through the walls into the interior areas may be repaired. However you must repair as per the manufacture's specifications. If the cracks are not repaired as per these specifications they have a higher tendency to return. These cracks are required to be cut out a minimum ½" wide by 2" in depth. Then a non-shrink grout with a minimum 2000 pound compression rating must be applied to replace the removed material. This repair method has proven to perform fairly well. The cracks found on the exterior of the fireplace structure are often caused by either the calcium chloride additive or seismic activity. The calcium chloride additive was placed in the concrete to speed up the curing time. The cracks caused by this calcium chloride usually follow the location of the vertical and horizontal steel reinforcement. When the calcium chloride is mixed with moisture a reaction occurs and rust scale develops on the steel reinforcement. This reaction and expansion of the steel reinforcement causes fractures in the concrete. These cracks always start on the exterior surface first.

Remember moisture is required to activate this process. A good coat of paint may help reduce moisture entry but does not eliminate this deterioration.

There are several weak points on this pre-cast concrete fireplace that are susceptible to a seismic event. The chimney, transition, walls of fireplace, as well as the insulation plate. The chimney has a tendency to crack horizontally at several locations. The transition is where the exterior shoulders of the fireplace meet the chimney. This is a common location for a crack due to the movement of the upper chimney. A horizontal crack within the interior flue can be found approximately six inches above the base of the flue liner. This crack correlates with the exterior damage found at the transition. The sides and rear of the fireplace are also very common points of failure. You may find one to three horizontal cracks per side on the fireplace. The rear wall of the fireplace may have both vertical as well as horizontal cracks. In many cases the horizontal cracks at the rear wall will meet up with the horizontal cracks at the side walls. Also note that the cracks on the interior firebox may be slightly different then the exterior cracks. This is due to the calcium aluminate firebox liner and the lightweight structural concrete being laminated together at the time of assembly. Remember that the manufacture states, “Cracks or punctures extending completely through a wall of the firebox area, throat area or chimney section **are not** subject to patching”. Full removal and replacement of the fireplace may be required at this time. The true concern is that the cracks may allow the passage of heated gases into the combustible wall and create a fire hazard.

But by far the **“insulation plate”** is the weakest as well as the least detected point of failure. This plate is located just inside and above the top of the fireplace opening. On a masonry fireplace this area is known as the breast of the fireplace. This calcium aluminate plate may vary from only one to two inches thick and has a tendency to fracture both vertically and horizontally. This damage occurs when the concrete structure is twisted. The additional lightweight aggregate concrete applied to this plate also follows this same fate. This damage is usually caused by one of two conditions. The first cause being mishandling of the product during delivery. In some cases the fireplaces were literally thrown from the truck during the delivery process. The uneven impact with the ground caused the structure to twist and therefore damage the insulation plate. The second cause is a seismic event such as an earthquake. This event also causes the structure to twist and again causes damage to the insulation plate. These cracks pass through the concrete wall of the fireplace and travel into the wood framed wall of the dwelling. This condition allows the free passage of heated gases into the combustible wall as proven by a destructive testing and smoke testing. When this damage exists, the fireplace should not be operated with gas or solid fuel due to this potential fire hazard. To add to the already low

detection rate, the insulation plate may be fractured without any indication of damage to the exterior concrete structure or interior veneer.

If your evaluation has determined that the damage is beyond repair you must then determine the course of action. It would be nice if we could simply place a metal insert into the fireplace, but we can not. The metal inserts are tested and approved for use in **undamaged** fireplaces only. The current standards do not require the determination of the temperature generated between the existing firebox and the metal insert. However with a damaged fireplace structure this temperature may be a true concern. The majority of all dwelling fires, where the fireplace is determined to be the point of origin, is due to heat exposure,.… not sparks or flame. When combustible material is exposed to heat, the ignition temperature drops. The speed of this change is directly related to the temperature of the heated gases, the time of exposure, the materials being exposed and several other related factors. Since these unknown factors exist, we can not recommend this application without placing our clients and ourselves at risk.

There is one additional location of concern that should be considered a high fire hazard. In many cases with the pre-cast concrete fireplaces there is a separation or gap between the face of the firebox and the decorative detail applied around the fireplace opening. This gap or crack located just inside the fireplace opening poses a real fire hazard. This separation could be due to seismic activity or simply the failure to close this area at the time of the veneer installation. In both cases this opening may cause a secondary chimney that will actually draw the heated gases into the wood framed wall. In time this exposure may cause ignition based on time of exposure, temperatures of the heated gases and the materials being exposed. This condition is easily corrected with the use of an approved material to block the passage of the heat.

In conclusion, remember that this pre-cast concrete fireplace is truly a different animal. Always refer to the manufacture's specifications and do not vary from the repair methods and materials. Please note that the Superior and Municipal Courts of California have both ruled based on the Fireplace Manufacture's Specifications. Based on these facts, any deviation from these specifications may cause a potential hazard to your client as well as a financial burden to yourself.

The Author
DALE W. FEB
ICBO, Certified Building Inspector # 0871896-10
ICBO, Certified Mechanical Inspector # 0871896-40
ICBO, Certified Combination Dwelling Inspector # 0871896-55
California State Licensed Mechanical Contractor (C-20) # 619485
California Real Estate Inspection Association, Certified Professional Inspector # 0017
Fireplace Investigation, Research & Education Service, Certified Fireplace Inspector # FP-001
Chimney Safety Institute of America, Certified Chimney Sweep # 4797

For additional educational material on pre-cast concrete fireplaces, please contact:

Fireplace Investigation, Research & Education Service
5325 Commerce Ave. Unit # 5, Moorpark, California 93021
Phone (805) 552-9954 e-mail fireservice@earthlink.net
Web site F-I-R-E-Service.com, Author's C.V., fireplaceinspections.com