

Guide for Protection of Recessed Boxes in Fire-rated Walls Using Firestop Putty Pads, Box Inserts, Cover Plate Gaskets and Endothermic Mats



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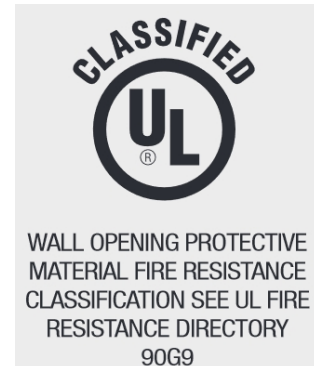
By John Valiulis, IFC Technical Director

A penetration that affects only one side of a rated wall is referred to as a membrane penetration. Such penetrations occur most frequently due to the installation of recessed electrical boxes. Other recessed boxes installed in fire rated walls can include washing machine connections, dryer exhaust recesses, ice maker connections, and medical gas connection boxes. The International Building Code, which is adopted in most US jurisdictions, requires that all recessed fixtures be installed such that the fire resistance rating of the wall not be reduced. One way to prevent boxes from reducing the wall's fire rating and thus meet the IBC performance requirement is by using putty pads or other tested and Certified¹ materials.

Note: All code article numbers reference 2018 IBC. The same requirements exist in the 2012 and 2015 IBC with different article numbers.

Firestop putty pads, firestop box inserts, firestop cover plate gaskets and endothermic mats are products that are often chosen for recessed box protection, but many times the application range and specific code requirements are misunderstood.

As a first step, the products must be subjected to relevant standardized fire tests for each desired installation configuration. The Listing laboratory will publish the installations details and limitations for each Certified product based on the fire resistance rating that is achieved in each of the fire tests. Like other firestopping products, these are subjected to the periodic manufacturing plant follow-up visits by the Listing laboratory. Other conditions must also be met as a precondition for obtaining the Certifications, such as UL-required accelerated aging and high-humidity tests, and labelling of the products and/or packaging with the certification mark of that laboratory and certification category.



What are these products?



Putty pads are permanently soft and moldable thin mastic sheets that include intumescent materials within them. The intumescent component will react to the heat of a fire to expand (“intumesce”) and form a fire-protective barrier. They are applied (self-adhered) to the external surfaces of metallic and nonmetallic electrical boxes, applied to the back surface as well as the three sides of the box away from the wall stud. Putty pads have the additional attribute of significantly reducing the transmission of sound that would otherwise occur

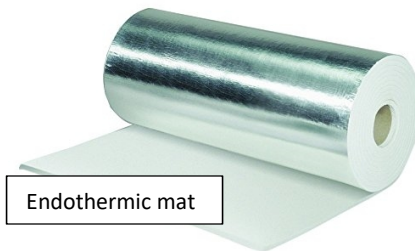
¹ UL is transitioning (2013-2023) to using the term “Certified” to encompass the previous/present terms “Classified” and “Listed”. “Certified” is intended to meet the definition of “listed” in all model codes. This publication thus mostly uses “Certified” and “Certification” instead of the terms “Listed” and “Classified”.

through the wall due to the hole created for the box. Putty pads that fully cover the box and the gypsum cutout are an excellent way to help reduce sound transmission from room-to-room. They are often used even in non-rated walls where reduced sound transmission through the wall is a design goal.

Firestop box inserts are pre-shaped thin rectangular pads of semi-rigid intumescent material, similar in composition to the intumescent wrap strips that are used to firestop plastic pipe penetrations, except thinner. They are placed inside the electrical box, at the back behind the wiring.



Firestop cover plate gaskets are similar to the intumescent box inserts, pre-cut to match the shape of an electrical box cover plate, and are designed to be positioned behind the faceplate of the electrical box.



Endothermic mats are rolls of semi-flexible multi-layered material, usually with one metal foil surface. The endothermic material absorbs heat from a fire via a chemical reaction, thus protecting the wrapped item. The mats are cut and applied to the exterior sides of larger recessed boxes as needed to provide the code-mandated fire resistance rating.

Each of the product types are tested by the listing laboratories to the appropriate fire resistance test standards, such as ASTM E814 and UL 1479. Based on the results of the fire tests, listings and product Certifications are published by the listing laboratory, detailing the acceptable uses for each product and the fire resistance ratings obtained for each precise configuration.

International Building Code requirements

The IBC provides the specific requirements for recessed fixtures (membrane penetrations), explaining what protection is needed to maintain the rating of the wall assembly. This document will focus on the requirements of Section 714.4.2 of the IBC. The full text of that IBC article can be viewed free online at <https://codes.iccsafe.org/content/IBC2018/chapter-7-fire-and-smoke-protection-features>.

This document presents opinions from the International Firestop Council. The final interpretation of any code issue is the legal responsibility of the building official or AHJ.

The rules that govern recessed fixtures in fire-rated walls can basically be broken down into four categories:

- 1) Steel electrical boxes that do not exceed 16 sq. in.,
- 2) Steel electrical boxes that do exceed 16 sq. in.,
- 3) Non-metallic electrical boxes of any size, and
- 4) Boxes other than electrical boxes

Regardless of electrical box size or material, the annular space between the wall membrane and an electrical box is never permitted to exceed 1/8 inch. This requirement appears both in the IBC and in the National Electrical Code.

1. Steel electrical boxes that do not exceed 16 sq. in.



This size and type of electrical box is the most complex when it comes to code requirements due to multiple simultaneous requirements. The IBC permits the installation of unprotected steel outlet boxes not exceeding 16 sq. in within a rated wall assembly as long as the sum total area of openings (wall cutouts) for those boxes does not exceed 100 square inches for any 100 sq. ft. of wall.

In addition, the code has specific requirements for the spacing (separation) of steel electrical boxes (max. 16 sq. in. each) located on opposite sides of the wall. Steel electrical boxes that do not exceed 16 sq. inches (e.g. 4" x 4") installed on opposite sides of a wall must be separated by one of the following:

1. A horizontal distance of not less than 24" if the wall is constructed of individual noncommunicating cavities.
(IBC 714.4.2 Exception 1.1)
2. A horizontal distance greater than the depth of the wall cavity when the wall cavity is filled with rockwool, slag mineral wool insulation or cellulose loose-fill. For example, if you have nominal 2" x 4" studs (3-1/2" actual depth), 16 sq. in. or smaller steel electrical boxes do not have to be protected if boxes on opposite sides of the wall are installed at least 3-1/2" apart if the wall cavity is filled with one of the materials above.
(IBC 714.4.2 Exception 1.2)
3. Solid fire blocking, including nominal 2" thick lumber (steel studs are not considered acceptable fire blocking materials). "Boxing out" recessed electrical boxes with a 5-sided box made of fire-rated gypsum board usually gets accepted based on this exception.
(IBC 714.4.2 Exception 1.3)
4. Putty pads wrapped around boxes on both sides of the wall
(IBC 714.4.2 Exception 1.4)
5. Other listed materials or methods (e.g. firestop box inserts, firestop cover plate gaskets)
(IBC 714.4.2 Exception 1.5)

UL tests and lists the materials referenced in Exceptions 4 and 5 above under listing category CLIV, "Wall Opening Protective Materials". The individual product Certifications within this category (CLIV) indicate the specific applications, limitations, box depth, cover plate type and method of installation for which the materials have been evaluated. For example, some listings specify that a steel outlet box cover plate must be used, whereas others allow a plastic cover.

The UL Certifications for each specific product will document the horizontal separation that must be maintained between electrical boxes on opposite sides of the wall when they are protected with that specific product. Commonly, the Certification will state that the boxes require no horizontal separation. However, many product Certifications indicate that boxes may *not* be installed back to back. A minority of products do allow for back-to-back installation of boxes, though. Certifications can be viewed online via UL's "Product iQ" at <https://iq.ulprospector.com/info/> (access requires creation of a free account).

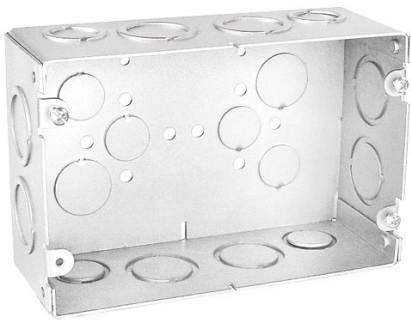
Separating boxes on opposite sides of a wall by a minimum of 24 inches (Exception 1.1 above) is acceptable only for walls that *don't* use a staggered stud or double stud layout. In other words, if the gypsum board doesn't attach to the same stud on both sides of the wall, and each side has its own set of studs (whether lined up parallel or staggered), a 24-inch horizontal separation no longer qualifies as acceptable separation. That's due to the fact that fire and/or smoke could freely travel within the wall regardless of box separation distance if studs don't create non-communicating cavities. One of the other separation options must be used. Putty pads are the most commonly used solution in this situation.



While UL has made unofficial pronouncements that wall opening protective materials could potentially be used to increase the allowable density of boxes installed within 100 sq. ft. of a wall to greater than the 100 sq. in. allowed by the IBC, no manufacturer currently has such a listing. Nevertheless, code officials familiar with the function and performance of putty pads will commonly approve box densities greater than 100 sq. in. per 100 sq. ft. of wall when all boxes within the concerned area have been protected by putty pads.

2) Steel electrical boxes that exceed 16 sq. in.

As discussed above, steel electrical boxes not exceeding 16 square inches essentially get a “free pass” in the IBC, as long as there are not too many of them within 100 sq. ft. of wall area, and that they are not too close to each other on opposite sides of the wall, unless protected by one of the accepted methods. However, boxes larger than 16 sq. in. are not inherently acceptable, unless additionally protected in some way to help preserve the fire resistance rating of the wall. Commonly used steel



boxes measuring 4-¹¹/₁₆ in. square would fall into this category. The IBC does permit the larger steel electrical boxes, but these boxes must all be installed in accordance with the installation instructions and listing limitations for the UL-Certified product being used to preserve the wall's fire resistance. All steel electrical boxes larger than 16 sq. in. must be protected in some manner, regardless of the spacing to other boxes on the opposite sides of wall. The tested and UL-Certified protection methods can once again be found in UL's CLIV category. The CLIV putty pad Certification listings will typically indicate the largest steel box that can be protected with the specific

putty pad. For example, one manufacturer's putty pad can be used to protect steel boxes 14" x 4" x 2-1/2" deep or smaller. Another product certification indicates that a certain manufacturer's Firestop Box Insert can be installed on steel boxes up to 4-11/16" x 4-11/16" and 4-1/2" x 8-1/2". There are product Certifications for the protection of large steel boxes recessed in fire-rated walls, such as used for circuit breaker panels. Those are not found in listing category CLIV. Rather, they are found in UL listing category XHEZ, “Through-penetration firestop systems”.

UL Product iQ™

REFINE RESULTS

Build or filter your results by keyword and/or adding criteria like document type, file number and country name.

Keyword

box Search

UL Category Control Number

x XHEZ

System Number

x Value Contains: W-L-7

Company Name

Click to view and filter values

To find available tested systems for large recessed boxes, use [UL Product iQ](#) with the following search parameters:

Keyword: box

UL Category: XHEZ

System Number: W-L-7

Note that some of the results obtained will be for other than recessed boxes.

If you are seeking the listings from only one specific product manufacturer, you can optionally enter the **Company name**.

3. Non-metallic electrical boxes

The IBC does permit non-metallic electrical boxes, but these boxes must be installed as they are tested and in accordance with the instructions included in the UL listing. UL has a separate category for non-metallic outlet and switch boxes for use in wall or partition assemblies. UL-listed boxes can be found in listing category CEYY, "Outlet Boxes and Fittings Classified for Fire Resistance". Listed products can be found using [UL Product iQ](#) by inputting that listing category and "wall" as a Keyword. The information provided for each certification includes the model numbers for the classified products, a description of the rated assemblies, the spacing limitations for the boxes and the installation details. The spacing requirements on opposite sides of the wall are dependent upon the exact model of box being installed. Take for example this certification from one manufacturer of non-metallic electrical boxes for use in fire rated construction:

Series 1082, 1084, 1085,, RD-38, RD-42 nonmetallic outlet and switch boxes with various suffixes for use in 1 and 2 hr fire rated gypsum board/wood stud wall assemblies framed with min 3-1/2 in. wide wood studs and constructed as specified in the individual U300 Series Wall and Partition Designs in the Fire Resistance Directory . Clearance between boxes and cut-outs in wall shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 100 sq. in. per 100 sq. ft. of wall or partition area with no opening exceeding 22.0 sq. in. Outlet and switch boxes on opposite sides of a wall or partition within the same stud cavity shall be separated by a horizontal distance of not less than 3 in. Boxes are suitable for installation in staggered stud wall configuration. Outlet and switch boxes on opposite sides of the wall and in separate stud cavities may be separated by a horizontal spacing of not less than 1-1/2 in.

Any of the above listed boxes can be installed unprotected (without putty pads or inserts) within rated walls as long as the total area of opening for boxes does not exceed 100 sq. in. per 100 sq. ft. of wall. The listing also permits these specific boxes to be installed as close as 3" apart on opposite sides of wall, or as close as 1.5" apart when in separate stud cavities, with no additional protection needed. In contrast, most CEYY non-metallic electrical box listings require that boxes on opposite sides of a wall must be separated by at least 24 inches. Since each box model can have its own minimum separation for boxes on opposite sides of a wall, careful adherence to the specific product Certification limits is essential, and must be verified. The 100 sq. in. of aggregate boxes per 100 sq. ft. of wall area is

common to most listings. Unfortunately, electrical box installation limitations are not printed anywhere on the boxes themselves. The box's listing must be consulted for that information.



Non-metallic electrical boxes that have been tested and Certified for use in fire rated walls will have more than just a UL marking. All non-metallic electrical boxes have a listing laboratory marking, such as UL, which simply attests to their acceptable use for electrical applications. This does not indicate acceptability for use in fire rated construction. The Certification marking to look for, for applications in fire rated construction, is as shown in the photo here. The UL logo will be accompanied by the word “Class” or “Classified”, the letters “W” or “C” to indicate if the box is Certified for use in fire rated Walls, Ceilings, or both, and the hourly rating of the wall or ceiling into which the box can be used will be marked as a number of hours (2HR walls in this photo).

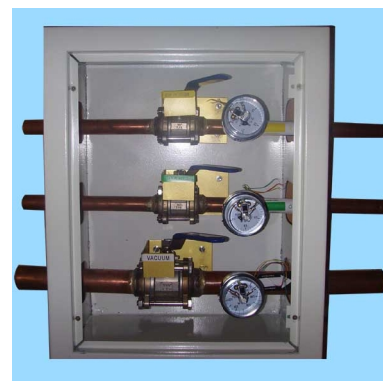
Since most manufacturers of category CEYY non-metallic electrical boxes also manufacture some electrical boxes that are not Certified for use in fire rated construction, it is important to verify that the suitable model numbers are used in rated construction. An informal survey of non-metallic outlet boxes available from one common retail outlet did reveal that *almost* all non-metallic boxes sold do indeed carry the UL-Classified logo indicating acceptable use in rated walls. It is mostly the largest boxes (larger than 16 sq. in.) that might lack this certification.

Many putty pads, discussed earlier for use with steel boxes, are also tested and certified for use together with non-metallic electrical boxes that have been Certified for use in fire rated construction (as illustrated above). Such a combination of Certified box and Certified putty pad is typically used to allow specific non-metallic boxes to have a closer spacing on opposite sides of a wall than would be allowable for the same box without a putty pad. Most non-metallic electrical boxes Certified for use in fire rated walls require 24” horizontal separation between boxes on opposite sides of a wall if they are not protected with putty pads. Details of how any specific combination of putty pad and UL-Classified non-metallic box can be acceptably installed are found in both category CEYY and CLIV listings, although category CLIV has a far greater number of such listings. Even with a putty pad, it is rare for such boxes to have a Certification for back-to-back installation. Any back-to-back installation observed in the field should definitely be verified against the installation limits stated in the listing.

4. Recessed boxes other than electrical boxes

The IBC allows such boxes in rated construction by Exception No. 4 of 714.4.2. The code requirement is that any such box and the annular space between the wall membrane and the box must be protected by an *approved membrane penetration firestop system* installed as tested in accordance with ASTM E814 or UL1479, and shall have an F-rating and T-rating not less than the required fire-resistance rating of the wall penetrated. As with other firestop systems, the box and its protection must be installed in strict accordance with the listing.

Recessed steel boxes for various uses can be protected using putty pads or endothermic mats. Listings for such protection can be found



within the UL category XHEZ listings. You can search *UL Product iQ* for such solutions similarly as for protection of steel electrical boxes larger than 16 sq. in., as described earlier. Some listings for the boxes themselves may specify and include the use of external protective materials such as putty pads or endothermic mats, for example the listings for some large dryer vent boxes that exist under firestop system W-L-7000 series listings.

Some non-electrical recessed boxes exist that require no additional protection. For example, there are listed recessed boxes for use in fire rated construction for washer connections and for ice-maker connections. These are typically made of special polymers with a higher resistance to heat and fire, similar to some of the electrical boxes listed for use in fire rated construction. Others incorporate intumescent material within them or on their exterior surface, as if they had been protected by a factory-attached putty pad or box insert.

Summary

The IBC is specific on the requirements for membrane penetrations by metallic and non-metallic recessed fixtures in rated gypsum walls. The code opens the door to allow such boxes to be installed under less stringent conditions when they are used in conjunction with wall opening protective materials such as Putty Pads, Box Inserts, Firestop Cover Plate Gaskets, or Endothermic Mats. Some recessed boxes are Certified products themselves, suitable for use in fire rated walls.

Current use of wall opening protective materials may allow for (1) reducing the spacing between electrical boxes contained on opposite sides of the wall and/or (2) increasing the size of metallic electrical boxes, and/or (3) using recessed steel boxes other than electrical boxes when protected. There are currently no UL listings for Wall Opening Protective Materials that would allow steel electrical box density to be increased beyond the IBC-allowed 100 square inches per 100 square feet of wall area. The individual Certifications and listings within categories CLIV, XHEZ and CEYY indicate the specific applications and the method of installation for which each specific product has been evaluated, which should be reviewed prior to installation.

Each manufacturer's product certifications will clearly indicate what each product's application limitations are. The UL Certifications are not fast or easy to browse, nor are they searchable based on any application parameters. The best, easiest way to identify a solution to a given recessed box protection problem is to work with an IFC-member manufacturer, who can recommend the correct and the most cost-effective solutions for any given recessed box protection challenge.

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