

The most often heard contractor phrase:

No one else makes me do that, so why do I have to ...

... follow the certification limitations for nonmetallic electrical boxes used in rated floor/ceiling assemblies?

Violation : Nonmetallic electrical boxes in rated ceiling (or rated walls) without proper documentation
 Code Section : 2008 NEC 110.3(B) and 2010 FBC-Building 713.3 (for walls) / 713.4 (for ceilings)
 Comments : Contractor shall provide certification listing information for the nonmetallic electrical boxes installed in rated ceiling/wall for verification of opening limitations in 100 sq ft of ceiling area and box separation. Typical limitation is two 4" round nonmetallic electrical boxes in 100 sq ft of ceiling area, there are four 4" round nonmetallic electrical boxes in 100 sq ft of ceiling area.

Frequently, electrical contractors install nonmetallic electrical boxes in rated assemblies – walls and horizontal assemblies (floor-ceiling and roof/attic-ceiling) – without complying with the certification limitations of use instructions. They look inside the box for a 2 HR UL rating designation and, upon seeing that, assume the nonmetallic electrical box is suitable for installation for use, without any limitations, in a rated assembly up to 2 hours.

The 2 HR UL designation simply indicates that the nonmetallic electrical box is certified for use in up to a 2 hr rated assembly – provided it is installed and used within the limitations specified in the certification listing instructions.

Some electrical contractors realize that nonmetallic (plastic) electrical boxes are not suitable for installation in rated walls without limitations or opening protectives (i.e., putty pads) so they substitute a different nonmetallic (fiberglass or similar) electrical box without checking its certification limitations for use in rated walls. This is based on habit rather than an understanding and recognition of the certification limitations of nonmetallic electrical boxes. The typical result is an installation which is not in compliance with its certification and listing limitations.

Rarely, from what I've seen, do architects/contractors consider the limitations of use for nonmetallic electrical boxes installed in wood rated walls/horizontal assemblies in residential projects such as apartment or condo buildings.

The limitations of use for nonmetallic electrical boxes in rated assemblies are applicable whether the project is a residential or a commercial project; whether wood frame or metal frame; the electrical boxes are still penetrations of the rated assembly – the boxes may be through penetrations, but the boxes are usually membrane penetrations.

Nonmetallic electrical boxes are permitted to be used in rated assemblies provided the nonmetallic box is:

- listed for that use – i.e., has the 2 HR UL designation inside the boxes
- installed in accordance with its certification listing instructions
- number of boxes (openings) and spacing between boxes (openings) does not exceed the limitations

Electrical boxes of any type installed in rated assemblies must meet the following code requirements:

- National Electrical Code, 110.3(B) Installation and Use. This requires that listed or labeled equipment be installed and used in accordance with any instructions included with the listing or labeling. This includes the certification limitations when used in rated assemblies, as stated in the certification instructions for use in rated assemblies.
- Florida Building Code, Section 713 Penetrations.
 - 713.3 (Rated Walls) This section contains requirements and restrictions for through penetrations and membrane penetrations of fire-resistance-rated wall assemblies, electrical boxes are typically membrane penetrations. This section refers to the certification listing limitations of use for electrical boxes of any material (steel and nonmetallic).
 - 713.4 (Rated Ceilings) This section contains requirements and restrictions for through penetrations and membrane penetrations of horizontal assemblies, electrical boxes are typically membrane penetrations. This section includes specific conditions for steel electrical boxes; this section also refers to the certification listing limitations of use for electrical boxes of any material (steel and nonmetallic) which are classified and listed for use in rated assemblies.

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Improper use of nonmetallic electrical boxes in rated assemblies is most prevalent in wood frame construction where ceiling membranes of rated wood truss floor-ceiling and attic-ceiling assemblies' are penetrated by electrical ceiling boxes. The aggregate square inch of box opening area in square inches exceeds the maximum allowed opening area per 100 square feet of ceiling area. The nonmetallic electrical boxes may also be too close together to meet minimum required separation between boxes. Improper installation in rated walls of wood stud construction is a close second.

Note that the 100 square feet of ceiling area is not limited to being measured as a square. The code specifies "100 square feet of ceiling area" and does not specify shape. The following is from my discussions with UL and are from their examples stating how to measure the 100 square feet of ceiling area:

- The 100 square feet is to be measured in any shape which encompasses the greatest total opening area in 100 square feet of ceiling area, for example: the area being measured could be 2 feet by 50 feet, 5 feet by 20 feet, 10 feet by 10 feet; the area could be triangular, circular, or any contiguous shape which equals 100 square feet, the area could be an "L" shape for boxes lined up in an "L" pattern.

Attached are three examples of certification listing limitations for nonmetallic electrical boxes to be used in rated assemblies. These certification documents address use in rated wall assemblies and use in rated horizontal assemblies (ceilings). The following was taken from the manufacturer's certification listing information (underlining below is mine for highlighting purposes), click the link to view the complete certification document

- Thomas & Betts – The following is taken from [CEYY.R9140](#) (←link to document):
 - (see box catalog numbers on certification document – too many types and restrictions to list)
For use in fire resistance assemblies, with 2 hr or less classification period, consisting of wood joists and gypsum wallboard ceilings or walls constructed of wood or nonbearing steel studs and gypsum wallboard. Clearance between boxes and cutouts in ceiling shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 20 sq in. per 100 sq ft of ceiling area with no opening exceeding 13.0 sq in. No box shall be located within 6 ft of another. The area of openings for boxes used in wall or partition assemblies shall not aggregate more than 100 sq in per 100 sq ft of wall or partition area with no opening exceeding 25.0 sq in. I.e., ***only 1* *4" round*** nonmetallic electrical box above is allowed per 100 sq ft of ceiling area. Limiting factor: "area of openings ... shall not aggregate more than 20 sq in"
One 4" round box = 12.56 sq in; two 4" round boxes = 25.1 sq in
 - (see box catalog numbers on certification document – too many types and restrictions to list)
For use in fire resistance floor-ceiling assemblies, constructed with wood joists, wood flooring and gypsum wallboard ceilings with 2 hr or less Classification periods. Clearance between boxes and cutouts in ceiling shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 31 sq. in. per 100 sq ft of ceiling area with no opening exceeding 13.0 sq in. No box shall be located within 4.5 ft of another. I.e., ***only 2* *4" round*** nonmetallic electrical box above is allowed per 100 sq ft of ceiling area. Limiting factor: "area of openings ... shall not aggregate more than 31 sq in"
One 4" round box = 12.56 sq in; two 4" round boxes = 25.1 sq in
- Legrand Pass & Seymour/Slater – The following is taken from [CEYY.R9194](#) (←link to document):
 - Types P1-16-R, -16-W, -18-P50, -18-R, -18-W, -22B, -22C, -22-R, -22-W, PH1-22B, S1-16-R, -16-W, -18-P50, -18-R, -18-W, -18-S25, -18-S50, -22B, -22C, -22-R, -22-S50, -22-W, SH1-22B with or without suffixes CP, N, S, V, nonmetallic outlet boxes not intended for fixture support. For use in fire resistance floor-ceiling assemblies constructed with wood joists, wood flooring and gypsum wallboard ceilings with 2 hr or less classification periods. Clearance between boxes and cutouts in ceiling shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 31 sq in. per 100 sq ft of ceiling area with no opening exceeding 8 sq in. No box shall be located within 4.5 ft of another box. I.e., ***0* *4" round*** nonmetallic electrical box above is allowed per 100 sq ft of ceiling area. Limiting factor: "with no opening exceeding 8 sq in"
One 4" round box = 12.56 sq in

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- Types C1-18-H, -18-HG, -18-R, -18-RG, S1-20-B-FAN, -20-H, -20-HG, -20-J, -20-J-FAN, -20JG, -20R, -20R-FAN, -20RG, with or without suffixes CP, S, V, nonmetallic outlet boxes. The boxes may also have the additional suffix AC. For use in fire resistance floor-ceiling assemblies constructed with wood joists, wood flooring and gypsum wallboard ceilings with 2 hr or less Classification periods. Clearance between boxes and cutouts in ceiling shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 31.0 sq in. per 100 sq ft of ceiling area with no opening exceeding 13.0 sq in. No Box shall be located within 4.5 ft of another box.
I.e., ***only 2* *4" round*** nonmetallic electrical box above are allowed per 100 sq ft of ceiling area.
Limiting factor: "area of openings ... shall not aggregate more than 31 sq in".
One 4" round box = 12.56 sq in; two 4" round boxes = 25.1 sq in; three 4" round boxes = "more than 31 sq in."
- Allied Moulded – The following is taken from [CEYY.R9379](#) (←link to document):
 - Series PC213, PC234, PC223OW, 1082, 1084, 1085, 1086, 1088, 1096, 1098, 1099, 9301, 9304, 9305, 9307, 9318, 9323, 9324, 9327, 9328, 9331, 9332, 9333, 9334, 9335, 9336, 9337, 9338, 9350, 9351, 9355, 9356, 9358, 9363, 9364, 9365, 9366, 9367, 9368, 9369, 9370, 9373, 9374, 9375, 9390, 9395, SB-CB, SB-CBFR, nonmetallic outlet boxes with various suffixes, intended for fixture supports. For use in fire resistance floor-ceiling assemblies consisting of wood floor, solid or preengineered wood joists or trusses and gypsum board ceiling with Classification periods of 2 hrs or less. Clearance between boxes and cutouts in ceiling shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 64.7 sq in. per 100 sq ft of ceiling area, with no opening exceeding 12.5 sq in. No box shall be located within 4.5 ft of another box within a common joist cavity. When the supports are solid wood joists or pre-engineered wood joists with solid web members, the distance between boxes in adjacent cavities may be reduced to 5-1/2 in. center-to-center.
I.e., ***0* *4" round*** nonmetallic electrical box above is allowed per 100 sq ft of ceiling area.
Limiting factor: "with no opening exceeding 12.5 sq in"
One 4" round box = 12.56 sq in
 - Types P-116OW, P122SC, P-108E, P-108H, P-181H, P181, P201, P241, P-122OW, PJ20, PJ32, SB1, SB1-H, SB2, and SB3, nonmetallic outlet boxes not intended for fixture support. For use in fire resistance floor-ceiling assemblies consisting of wood floor, solid or pre-engineered wood joists or trusses and gypsum board ceiling with Classification periods of 2h or less. Clearance between boxes and cutouts in ceiling shall not exceed 1/8 in. The area of openings for boxes shall not aggregate more than 26.5 sq in. per 100 sq ft of ceiling area, with no opening exceeding 12.5 sq in. No box shall be shall be located within 4.5 ft of another box. The boxes shall be installed in compliance with the National Electrical Code.
I.e., ***2* *4" round*** nonmetallic electrical box above is allowed per 100 sq ft of ceiling area.
Limiting factor: "area of openings ... shall not aggregate more than 26.5 sq in"
One 4" round box = 12.56 sq in; two 4" round boxes = 25.1 sq in; three 4" round boxes = "more than 31 sq in."

Note:

- Allied Moulded specifically includes "solid or pre-engineered wood joists or trusses" in their certification listing.
- The others do not ... the others state "wood joists".
- Does this indicate that the others are not classified for use in floor-ceiling assemblies constructed using pre-engineered wood joists or trusses? Are the others relegated only for use with "wood joists" systems?
- This is one more aspect to contemplate while clarifying the certification limitations stated in each of the different certification listing documents.

Links to useful UL information regarding electrical boxes certified for use and installation in rated assemblies:

- (click links below to go to the documents)
 - [UL CEYY Guide Information](#)
 - [Certifications directory](#)
 - [UL Certifications search](#)

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... follow the certification limitations for nonmetallic electrical boxes used in rated floor/ceiling assemblies?

The intent of this newsletter is to help level the playing field between inspectors/plan reviewers and contractors, possibly even tilting the playing field in favor of the inspectors/plan reviewers by keeping inspectors/plan reviewers abreast of what other inspectors/plan reviewers encounter.

Many contractors say "No one else makes me do that ... " as though that is a reason not to meet minimum code.

The reality is that many inspectors/plan reviewer are making contractors "do that" ... you are not alone on your inspections/plan reviews as other inspectors/plan reviewers are making the same calls.

If you have any items, issues or tips you would like to share with other inspectors/plan reviewers, please send them to the following for inclusion in the newsletter: jerry@jerrypeck.com Editor/Publisher, *Inspectors' Field Comments Newsletter©*.

All contributors will be acknowledged and given credit for their contributions.

I look forward to all contributions.

Respectfully submitted,



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Please use the email address above if:

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