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June 7, 2010

Good morning,

As you may know, the 2009 IRC Code has changed a lot about Deck Connections and the Ledger Connection. Whether you are on this version of the code or not, there has been a great deal of discussion over this section and we at FastenMaster feel it is appropriate to give you the information to evaluate and come to your own conclusions.

Enclosed is an editorial and article from the November 2009 "Professional Deck Builder" which puts this new code ruling in perspective. Please read it and make your decisions accordingly! Obviously, we are as interested as you in making decks safer and preventing accidents.

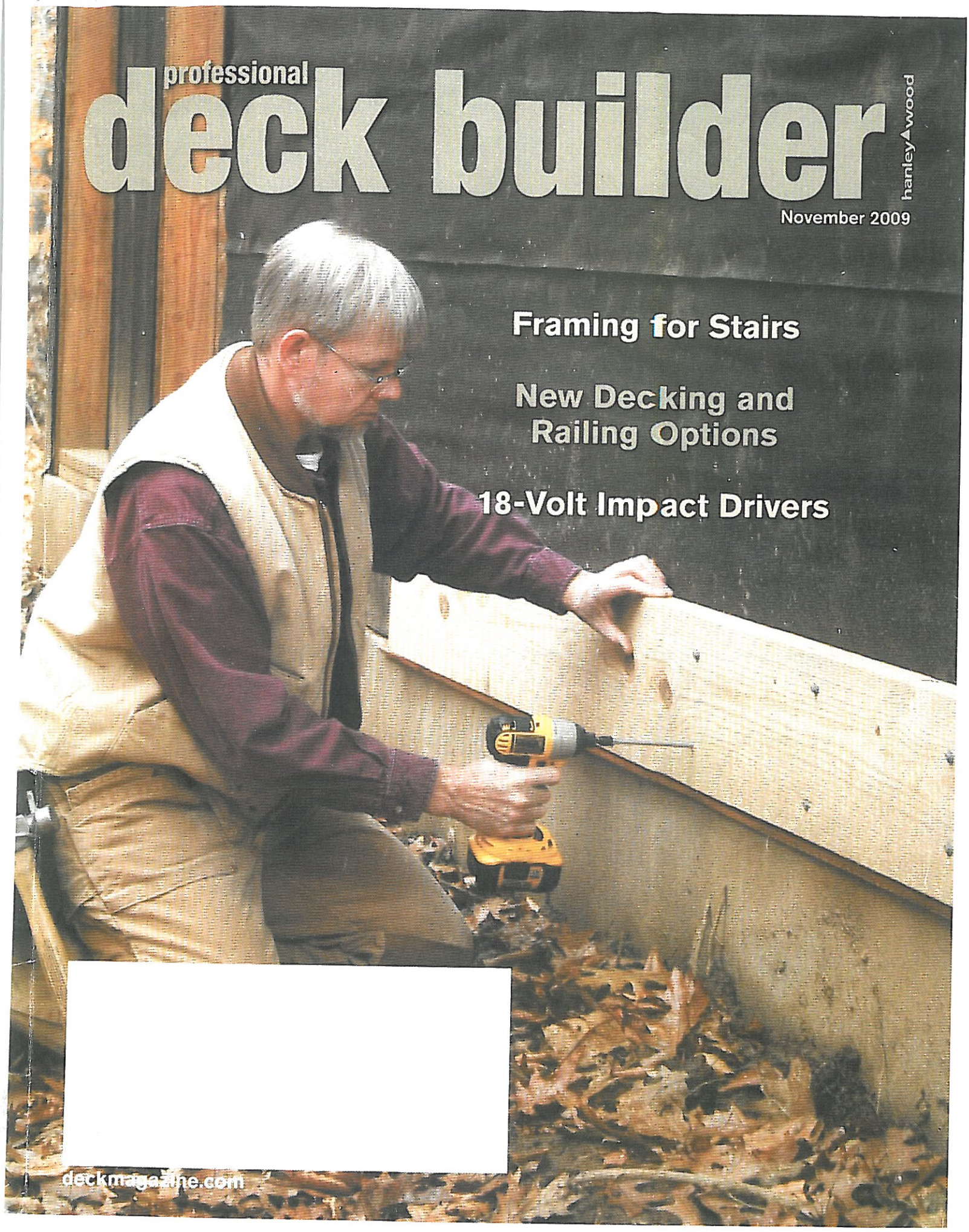
Now, with the deck season in full swing and summer just beginning, we wish you a great, busy and fun summer.

If there is anything we can do to assist you please feel free to contact me at any time.

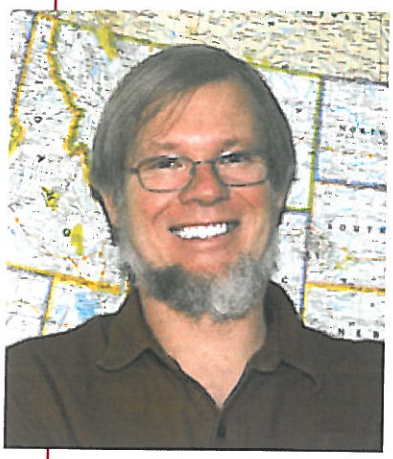
Yours truly,

Brice Hereford
Code Compliance Specialist
FastenMaster
153 Bowles Road
Agawam, MA 01001
800-518-3569

PS- Please find enclosed the revised Deck Ledger to Rim Joist technical bulletin which now accommodates 100 psf loading.


professional
deck builder
hanley wood
November 2009
Framing for Stairs
New Decking and Railing Options
18-Volt Impact Drivers
deckmagazine.com

How About a Better-Thought-Out Lateral Attachment Requirement?



If you aren't familiar with the new lateral attachment requirement for decks in the 2009 IRC, you should read this issue's *Structure* department (see page 24) before reading on here. Working with contributing editor Glenn Mathewson on that *Structure* piece convinced me that this new provision is ill considered and was likely rushed into the code because of the recent press given to deck collapses. I know the International Code Council folks work hard and lateral attachment is important – no one wants decks to fall off houses. But the detail shown in the code is not appropriate in all cases, and as written, it's not even clear when it's actually a requirement. However, I'll bet my first-born son that a lot of jurisdictions will treat that detail as a requirement for all decks.

The new attachment detail isn't a big deal to install in houses with easy access to the floor structure and where the floor joists run perpendicular to the ledger. But when the floor joists are concealed by a finished ceiling, you'll have to be good at drywall repair and interior painting because you're going to be opening up that ceiling. And what about attaching a deck to a house where the floor joists run parallel to the band joist? Mathewson describes a detail that he and ICC staff worked out. But because it's not in the code, some jurisdictions will require engineering. And the attachment requirement is the same whether the deck is 15 feet in the air or 8 inches off the ground – where the main risk during a deck collapse would be to the petunias planted alongside.

On the flip side, some mongo-sized decks with ledgers composed of three or more pieces will be built using only the two specified hold-downs. Hey – it meets code. And how many decks will be built without permits because a contractor or homeowner decided that figuring out an unusual lateral attachment situation was beyond them? The IRC doesn't even provide specific lateral loading requirements to ease design, as it does with floors, roofs, and guards. Even engineers might be left guessing just what the parameters are. The code should provide additional solutions, such as those Mathewson describes in this issue, or as Fairfax County, Va., provides (fairfaxcounty.gov/dpwes/publications/decks/details.pdf).

I could go on, but it would just be a rant about people jumping behind a good idea without considering the unintended consequences. And I know someone reading this is thinking, "So what? It's worth it if it saves one life." Well, if that argument held true, the national speed limit would be 5 mph. We make nuanced decisions about safety all the time.

And really, poorly considered code changes are no one's fault but our own. Who reading this spoke up during the public comment period for the 2009 IRC? Indeed, who pays any attention to the code modification process until something new hits them in the wallet? It's not entirely too late, though. New building codes don't become law until adopted by the local jurisdictions. If you agree that this new requirement has issues, get in touch with whoever is in charge of code adoption where you live and let them know what you think.

Andy Engel
Editor

Unlike most of the people you know, we want your two cents.

While it's nice to hear about what we're doing right, it's more interesting to hear about what we're doing wrong. If you saw something you loved or hated, or if you've got a tip that could help out other readers, we want to know.

E-mail us at **prodeck@hanleywood.com** or mail letters to:
Professional Deck Builder
186 Allen Brook Lane
Williston, VT 05495

New Code for Resisting Lateral Loads

by Glenn Mathewson

A new section in the 2009 International Residential Code (IRC) has stirred up a hornet's nest of questions about attaching deck ledgers. Section R502.2.2.3 and the accompanying figure (see illustration, below) suggest that all decks will now need to be connected to the floor joists of the house by horizontally oriented hold-down devices and long bolts. This new code section states: *The lateral load connection required by Section R502.2.2 shall be permitted to be in accordance with Figure R502.2.2.3. Hold-down tension devices shall be provided in not less than two locations per deck and each device shall have an allowable stress design capacity of not less than 1500lb.*

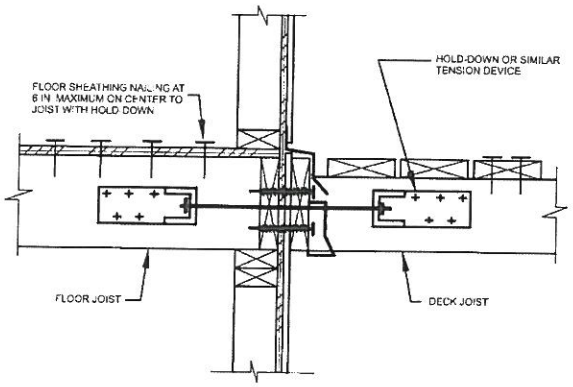


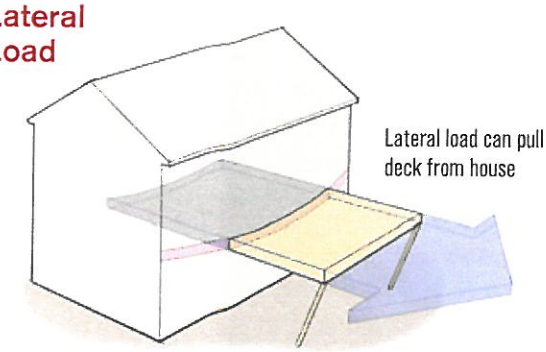
FIGURE 502.2.2.3
DECK ATTACHMENT FOR LATERAL LOADS

It used to be that the bolted connection to the band (or rim) joist was expected to resist all forces applied to the ledger, in both vertical and horizontal directions. The vertical loads are those of the deck itself and the people on it – the dead and live loads prescribed by the code – and they are resisted by the shear strength of the bolts connecting the ledger to the band joist.

The horizontal (lateral) loads work both parallel and perpendicular to the ledger. Those applied parallel to the ledger are resisted by the shear strength of the ledger bolts, like the vertical loads. Those acting perpendicular to the ledger, however, may not be adequately resisted by the bolted connection alone (see illustration, top right). Even when a ledger is sufficiently bolted to the band joist, the load path may not be complete, as the band joist also must be able to resist the horizontal forces.

A band joist properly toenailed to the plate below and

Lateral Load



CHUCK LOCKHART

Historically, the bolted connection between the deck ledger and the house band joist was expected to resist the shear forces from the weight of the deck and its occupants, plus any lateral loads that might tear the ledger from the house. New additions to the IRC are meant to also prevent the band joist from being ripped away.

fastened by the floor sheathing and wall plate above is able to resist some lateral forces. That assumption gets dicey with large and tall decks, sloppy home construction, or location in a seismic zone, any of which may require additional connection beyond the band joist.

How well the band joist is connected can be difficult to assess on an existing home, leaving builders and inspectors uncertain of the sufficiency of the load path. This concern led to the inclusion in the code of Figure R502.2.2.3, which details a connection that bypasses the ledger and the band joist completely.

The History Behind the Change

The IRC modification cycle takes three years, but the lateral-load connection detail in Section R502.2.2.3 made it into the code with little notice. During the development of the 2009 IRC, code modification proposals were published for public review on July 14, 2006, a little over two months before the code hearing. They included a new ledger bolting schedule, Table R502.2.2.1 (see "New Ledger Attachment Requirements Adopted," July/August 2007; free at deckmagazine.com), the preliminary approval of which was published on December 1, 2006, with the following comment: "This is a much needed addition to the

the deck around a corner, or simply dropping the height of the ledger and bolting into the top plates of the wall or foundation below can provide lateral resistance. However, it's likely inspectors will require substantiation by a design professional such as an engineer.

The Problems

Satisfying all the requirements in Figure R502.2.2.3 may be difficult. In all but new construction, it is unlikely that the floor sheathing will be fastened to the joists at 6-inch centers. Table R602.3(1), which governs most structural fastener spacing, requires fastener spacing at only 12 inches on center in the field, and that's all that can be expected. Tearing up the tile floor in the master bathroom to drive a few more nails through the sheathing is not something most homeowners will agree to. Similarly, access for installing the hold-down device may require removal of drywall from the ceiling below.

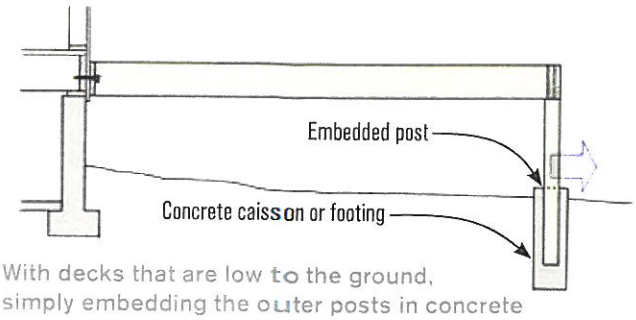
When researching for my book *Deck Construction Based on the 2009 International Residential Code*, I often spoke with the International Code Council's (ICC's) technical staff regarding this new figure. They agreed that this detail is not intended for every deck built under the IRC, but only for those that require lateral load resistance greater than the band-joist-to-floor-system connections provide. Of course, that isn't necessarily easy to quantify. The deck design has to be considered: Are the posts embedded, how high is the deck, does it wrap around a corner, is it in an inside corner, is there bracing in the posts, and is the existing construction of the home visible for inspection?

I also discussed with the ICC staff how to use this detail when the floor joists run parallel to the band joist. Blocking installed between the band joist and the next floor joist, with another block between that joist and the second one in, was found to be a sufficient alternative. The tension device would be installed on the innermost of the two pieces of blocking, so the lateral forces are shared by both the band and the first joist, effectively eliminating the possibility for the band joist to be pulled from the floor system individually.

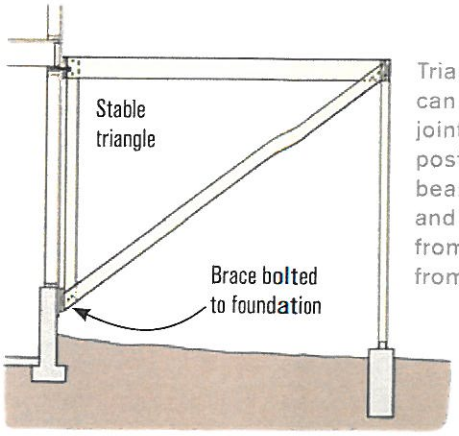
As regulatory authorities across the country adopt the 2009 IRC, be prepared for misguided and unfounded interpretations of this new connection detail and the associated code text. The phrase *shall*

Lateral Loads Can Be Resisted in Other Ways

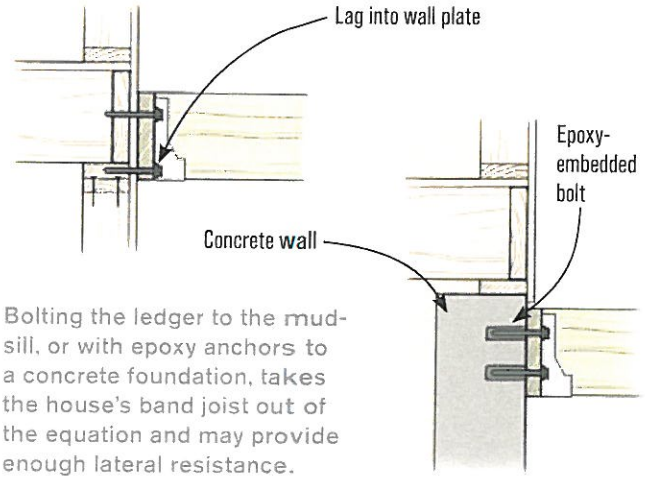
Although a building inspector may require engineering, there are a number of other approaches to resisting lateral loads. The appropriateness of these designs will depend on the deck, but the point to all of them is the same: Prevent the deck from falling away from the house.



With decks that are low to the ground, simply embedding the outer posts in concrete piers may provide sufficient lateral resistance.

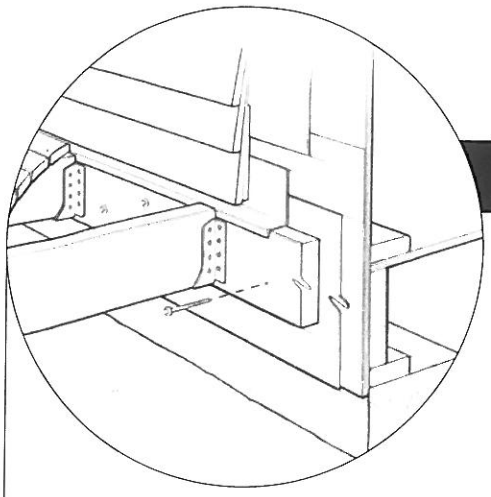


Triangular bracing can prevent the joint between the posts and the outer beam from hinging and so keep a deck from falling away from the house.



Bolting the ledger to the mudsill, or with epoxy anchors to a concrete foundation, takes the house's band joist out of the equation and may provide enough lateral resistance.

CHUCK LOCKHART



DECK LEDGER TO RIM JOIST

CONNECTION DETAILS

The LedgerLok Ledger Board Fastener has been designed specifically for attaching the deck ledger to the rim joist of the house in a code compliant manner.

2009 IRC Code Reference: 502.2.2.2 – Alternate Deck Ledger Connections

As stated in this IRC section, deck ledger connections can be designed in accordance with accepted engineering practices. Using tested and approved values as published in ICC-ES Report #1078, the LedgerLok can be used to meet this code requirement. In addition, the proprietary coating on this fastener exceeds the corrosion resistance of code approved hot-dipped galvanized coatings.

FastenMaster LedgerLok LEDGER BOARD FASTENER

INSTALLATION PROCEDURES

- Choose 3⅝" or 5" LedgerLok so that threads fully engage the rim material and fastener tip extends beyond the inside face of the rim joist.
- Use a high torque, ½" variable speed drill (18V if cordless).
- Follow the minimum spacing and fastening patterns from Figure 1 and Table 1.
- Install fasteners through the ledger and sheathing. Continue into the rim joist until the washer head is drawn firm and flush to the ledger board. Do not overdrive.

CORROSION STATEMENT

LedgerLok has been tested and is approved for use in above ground (.25 pcf) and ground contact (.40 pcf) ACQ treated wood applications.

Under the recently adopted ICC standard (AC257 – Acceptance Criteria for Corrosion-Resistant Fasteners and Evaluation of Corrosion Effects of Wood Treatment Chemicals), the proprietary coating on this fastener has been tested and found to exceed the corrosion protection offered by code compliant hot-dipped galvanized (HDG) coatings. Under the "Alternative Materials" provision of the code (IRC & IBC, Section 104.11), inspecting agencies and specifying design professionals may use the results of this test report to show equivalency of the LedgerLok coating to the approved HDG coatings, thereby meeting code.

For applications within 1,000 feet of saltwater, we recommend the use of a stainless steel fastener.

SPACING REQUIREMENTS

Fasteners should be staggered in a "W" pattern and spaced as follows:

A. Minimum end distance = 3¾"

B. Minimum edge distance = 1¾"

C. On-center spacing = Per Table 1

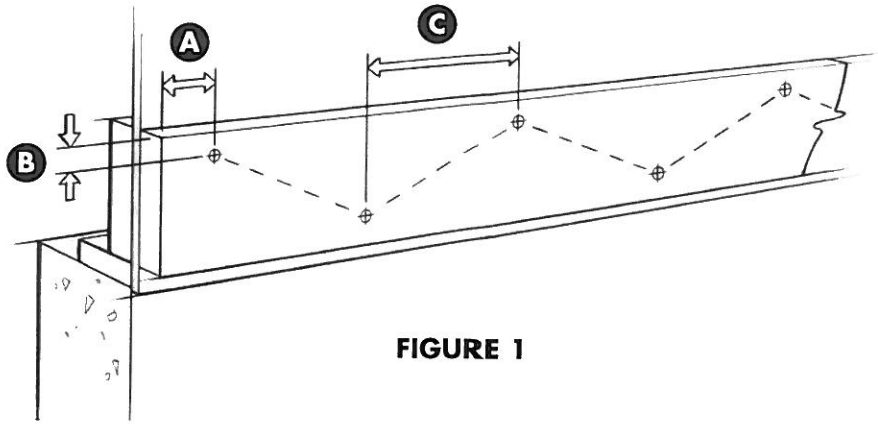


FIGURE 1

R308.6.2 Permitted materials. The following types of glazing may be used:

1. Laminated glass with a minimum 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m^2) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be 0.030 inch (0.76 mm).
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. *Approved* rigid plastics.

R308.6.3 Screens, general. For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of Section R308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in Section R308.6.5.

R308.6.4 Screens with multiple glazing. When the inboard pane is fully tempered, heat-strengthened or wired glass, a retaining screen meeting the requirements of Section R308.6.7 shall be installed below the glass, except for either condition listed in Section R308.6.5. All other panes in the multiple glazing may be of any type listed in Section R308.6.2.

R308.6.5 Screens not required. Screens shall not be required when fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions are met:

1. Glass area 16 square feet (1.49 m^2) or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than $^3/_{16}$ inch (4.8 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
2. Glass area greater than 16 square feet (1.49 m^2). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than 10 feet (3048 mm) above a walking surface or other accessible area.

R308.6.6 Glass in greenhouses. Any glazing material is permitted to be installed without screening in the sloped areas of greenhouses, provided the greenhouse height at the ridge does not exceed 20 feet (6096 mm) above *grade*.

R308.6.7 Screen characteristics. The screen and its fastenings shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and have a mesh opening of no more than 1 inch by 1 inch (25 mm by 25 mm).

R308.6.8 Curbs for skylights. All unit skylights installed in a roof with a pitch flatter than three units vertical in 12 units horizontal (25-percent slope) shall be mounted on a curb extending at least 4 inches (102 mm) above the plane of the roof unless otherwise specified in the manufacturer's installation instructions.

R308.6.9 Testing and labeling. Unit skylights shall l by an *approved* independent laboratory, and bear identifying manufacturer, performance *grade* rat *approved* inspection agency to indicate compliance requirements of AAMA/WDMA/CSA 101/I.S.2/A

SECTION R309
GARAGES AND CARPORTS

R309.1 Floor surface. Garage floor surfaces sha *approved* noncombustible material.

The area of floor used for parking of automobiles vehicles shall be sloped to facilitate the movement of l a drain or toward the main vehicle entry doorway.

R309.2 Carports. Carports shall be open on at least t Carport floor surfaces shall be of *approved* noncor material. Carports not open on at least two sides shal sidered a garage and shall comply with the provisio section for garages.

Exception: Asphalt surfaces shall be permitted level in carports.

The area of floor used for parking of automobile vehicles shall be sloped to facilitate the movement of a drain or toward the main vehicle entry doorway.

R309.3 Flood hazard areas. For buildings locate hazard areas as established by Table R301.2(1), gar shall be:

1. Elevated to or above the design flood elevatio mined in Section R322; or
2. Located below the design flood elevation pro are at or above *grade* on at least one side, are u for parking, building access or storage, meet tl ments of Section R322 and are otherwise con accordance with this code.

R309.4 Automatic garage door openers. Autom door openers, if provided, shall be listed in accordan 325.

SECTION R310
EMERGENCY ESCAPE AND RESCUE OP

R310.1 Emergency escape and rescue required. habitable attics and every sleeping room shall have operable emergency escape and rescue opening. W *ments* contain one or more sleeping rooms, emerg and rescue openings shall be required in each slee Where emergency escape and rescue openings a they shall have a sill height of not more than 44 in mm) above the floor. Where a door opening having below the adjacent ground elevation serves as an escape and rescue opening and is provided with enclosure, the bulkhead enclosure shall comply w R310.3. The net clear opening dimensions required tion shall be obtained by the normal operation o gency escape and rescue opening from the inside. escape and rescue openings with a finished sill heig adjacent ground elevation shall be provided wit

accordance with Section R311.8 or a stairway in accordance with Section R311.7.

R311.5 Construction.

R311.5.1 Attachment. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

R311.6 Hallways. The minimum width of a hallway shall be not less than 3 feet (914 mm).

R311.7 Stairways.

R311.7.1 Width. Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31 1/2 inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are provided on both sides.

Exception: The width of spiral stairways shall be in accordance with Section R311.7.9.1.

R311.7.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

Exception: Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom a maximum of 4 3/4 inches (121 mm).

R311.7.3 Walkline. The walkline across winder treads shall be concentric to the curved direction of travel through the turn and located 12 inches (305 mm) from the side where the winders are narrower. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. If winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used.

R311.7.4 Stair treads and risers. Stair treads and risers shall meet the requirements of this section. For the purposes of this section all dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

R311.7.4.1 Riser height. The maximum riser height shall be 7 3/4 inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

R311.7.4.2 Tread depth. The minimum tread depth shall be 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smalle
more than 3/8 inch (9.5 mm). Consistently shaped v
ers at the walkline shall be allowed within the same f
of stairs as rectangular treads and do not have t
within 3/8 inch (9.5 mm) of the rectangular tread de

Winder treads shall have a minimum tread depth
inches (254 mm) measured between the vertical plar
the foremost projection of adjacent treads at the inte
tions with the walkline. Winder treads shall have a
mum tread depth of 6 inches (152 mm) at any point v
the clear width of the stair. Within any flight of stair
largest winder tread depth at the walkline shall not e
the smallest winder tread by more than 3/8 inch (9.5 m

R311.7.4.3 Profile. The radius of curvature at the n
shall be no greater than 9/16 inch (14 mm). A nosir
less than 3/4 inch (19 mm) but not more than 1 1/4 i
(32 mm) shall be provided on stairways with solid r
The greatest nosing projection shall not excee
smallest nosing projection by more than 3/8 incl
mm) between two stories, including the nosing
level of floors and landings. Beveling of nosings sh
exceed 1/2 inch (12.7 mm). Risers shall be verti
sloped under the tread above from the underside
nosing above at an angle not more than 30 degrees
rad) from the vertical. Open risers are permittec
vided that the opening between treads does not
the passage of a 4-inch diameter (102 mm) spher

Exceptions:

1. A nosing is not required where the tread is a minimum of 11 inches (279 mm).
2. The opening between adjacent treads is n ited on stairs with a total rise of 30 inche mm) or less.

R311.7.4.4 Exterior wood/plastic composite treads. Wood/plastic composite stair treads shall c with the provisions of Section R317.4.

R311.7.5 Landings for stairways. There shall be a l landing at the top and bottom of each stairway. A fl stairs shall not have a vertical rise larger than 12 fee mm) between floor levels or landings. The width landing shall not be less than the width of the st served. Every landing shall have a minimum dimen 36 inches (914 mm) measured in the direction of tr

Exception: A floor or landing is not required at th an interior flight of stairs, including stairs in an e garage, provided a door does not swing over the

R311.7.6 Stairway walking surface. The walking su treads and landings of stairways shall be sloped no than one unit vertical in 48 inches horizontal (2- slope).

R311.7.7 Handrails. Handrails shall be provided or one side of each continuous run of treads or flight w or more risers.

R311.7.7.1 Height. Handrail height, measure cally from the sloped plane adjoining the tread nc

finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. When handrail fittings or bendings are used to provide continuous transition between flights, the transition from handrail to guardrail, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.

R311.7.7.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than $1^1/_2$ inch (38 mm) between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at the turn.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.

R311.7.7.3 Grip-size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of at least $1^1/_4$ inches (32 mm) and not greater than 2 inches (51 mm). If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than $6^1/_4$ inches (160 mm) with a maximum cross section of dimension of $2^1/_4$ inches (57 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).
2. Type II. Handrails with a perimeter greater than $6^1/_4$ inches (160 mm) shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of $^3/_4$ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least $^5/_{16}$ inch (8 mm) within $^7/_8$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least $^3/_8$ inch (10 mm) to a level that is not less than $1^3/_4$ inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be $1^1/_4$ inches (32 mm) to a maximum of $2^3/_4$ inches (70 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

R311.7.7.4 Exterior wood/plastic composite handrails. Wood/plastic composite handrails shall comply with the provisions of Section R317.4.

R311.7.8 Illumination. All stairs shall be provided with illumination in accordance with Section R303.6.

R311.7.9 Special stairways. Spiral stairways and bulkhead enclosure stairways shall comply with all requirements of Section R311.7 except as specified below.

R311.7.9.1 Spiral stairways. Spiral stairways are permitted, provided the minimum clear width at and below the handrail shall be 26 inches (660 mm) with each tread having a $7^1/_2$-inch (190 mm) minimum tread depth at 12 inches (914 mm) from the narrower edge. All treads shall be identical, and the rise shall be no more than $9^1/_2$ inches (241 mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

R311.7.9.2 Bulkhead enclosure stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside *grade* level to the *basement* shall be exempt from the requirements of Sections R311.3 and R311.7 where the maximum height from the *basement* finished floor level to *grade* adjacent to the stairway does not exceed 8 feet (2438 mm) and the *grade* level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other *approved* means.

R311.8 Ramps.

R311.8.1 Maximum slope. Ramps shall have a maximum slope of 1 unit vertical in 12 units horizontal (8.3 percent slope).

Exception: Where it is technically infeasible to comply because of site constraints, ramps may have a maximum slope of one unit vertical in eight horizontal (12.5 percent slope).

R311.8.2 Landings required. A minimum 3-foot-by-3-foot (914 mm by 914 mm) landing shall be provided:

1. At the top and bottom of ramps.
2. Where doors open onto ramps.
3. Where ramps change direction.

R311.8.3 Handrails required. Handrails shall be provided on at least one side of all ramps exceeding a slope of one unit vertical in 12 units horizontal (8.33-percent slope).

R311.8.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

R311.8.3.2 Grip size. Handrails on ramps shall comply with Section R311.7.7.3.

R311.8.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than $1^1/_2$ inches (38 mm) between the wall and the handrails.

SECTION R312
GUARDS

R312.1 Where required. *Guards* shall be located along open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30 inches (762 mm) measured vertically to the floor or *grade* below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Insect screening shall not be considered as a *guard*.

R312.2 Height. Required *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) high measured vertically above the adjacent walking surface, adjacent fixed seating or the line connecting the leading edges of the treads.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
2. Where the top of the *guard* also serves as a handrail on the open sides of stairs, the top of the *guard* shall not be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

R312.3 Opening limitations. Required *guards* shall not have openings from the walking surface to the required *guard* height which allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of a stair, formed by the riser, tread and bottom rail of a *guard*, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. *Guards* on the open sides of stairs shall not have openings which allow passage of a sphere $4^3/_8$ inches (111 mm) in diameter.

R312.4 Exterior woodplastic composite guards. Woodplastic composite *guards* shall comply with the provisions of Section R317.4.

SECTION R313
AUTOMATIC FIRE SPRINKLER SYSTEMS

R313.1 Townhouse automatic fire sprinkler systems. An automatic residential fire sprinkler system shall be installed in *townhouses*.

Exception: An automatic residential fire sprinkler system shall not be required when *additions* or *alterations* are made to existing *townhouses* that do not have an automatic residential fire sprinkler system installed.

R313.1.1 Design and installation. Automatic residential fire sprinkler systems for *townhouses* shall be designed and installed in accordance with Section P2904.

R313.2 One- and two-family dwellings automatic fire systems. Effective January 1, 2011, an automatic residential fire sprinkler system shall be installed in one- and two- family *dwellings*.

Exception: An automatic residential fire sprinkler system shall not be required for *additions* or *alterations* to existing buildings that are not already provided with an automatic residential sprinkler system.

R313.2.1 Design and installation. Automatic residential fire sprinkler systems shall be designed and installed in accordance with Section P2904 or NFPA 13D.

SECTION R314
SMOKE ALARMS

R314.1 Smoke detection and notification. All smoke alarms shall be listed in accordance with UL 217 and installed in accordance with the provisions of this code and the household fire warning *equipment* provisions of NFPA 72.

R314.2 Smoke detection systems. Household fire alarm systems installed in accordance with NFPA 72 that include smoke alarms, or a combination of smoke detector and audible notification device installed as required by this section for smoke alarms, shall be permitted. The household fire alarm system shall provide the same level of smoke detection and alarm required by this section for smoke alarms. Where a household fire warning system is installed using a combination of smoke detector and audible notification device(s), it shall become a permanent fixture of the occupancy and owned by the homeowner. The system shall be monitored by an *approved* supervising station and be maintained in accordance with NFPA 7

Exception: Where smoke alarms are provided meeting the requirements of Section R314.4.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the imme vicinity of the bedrooms.
3. On each additional *story* of the *dwelling*, including *ments* and habitable attics but not including crawl s and uninhabitable *attics*. In *dwellings* or *dwelling* with split levels and without an intervening between the adjacent levels, a smoke alarm instal the upper level shall suffice for the adjacent lowe provided that the lower level is less than one ful below the upper level.

When more than one smoke alarm is required to be in within an individual *dwelling* unit the alarm devices s interconnected in such a manner that the actuation of on will activate all of the alarms in the individual unit.

R314.3.1 Alterations, repairs and additions. Whe *ations*, repairs or *additions* requiring a *permit* o when one or more sleeping rooms are added or cr existing *dwellings*, the individual *dwelling unit* equipped with smoke alarms located as required *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *d* such as the replacement of roofing or sidi *addition* or replacement of windows or

the *addition* of a porch or deck, are exempt from the requirements of this section.

2. Installation, *alteration* or repairs of plumbing or mechanical systems are exempt from the requirements of this section.

R314.4 Power source. Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms shall be interconnected.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power.
2. Interconnection and hard-wiring of smoke alarms in existing areas shall not be required where the *alterations* or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an *attic*, crawl space or *basement* available which could provide access for hard wiring and interconnection without the removal of interior finishes.

SECTION R315
CARBON MONOXIDE ALARMS

R315.1 Carbon monoxide alarms. For new construction, an approved carbon monoxide alarm shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in *dwelling units* within which fuel-fired *appliances* are installed and in dwelling units that have attached garages.

R315.2 Where required in existing dwellings. Where work requiring a *permit* occurs in existing *dwellings* that have attached garages or in existing dwellings within which fuel-fired *appliances* exist, carbon monoxide alarms shall be provided in accordance with Section R315.1.

R315.3 Alarm requirements. Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.

SECTION R316
FOAM PLASTIC

R316.1 General. The provisions of this section shall govern the materials, design, application, construction and installation of foam plastic materials.

R316.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the *label* of an *approved agency* showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the requirements.

R316.3 Surface burning characteristics. Unless otherwise allowed in Section R316.5 or R316.6, all foam plastic or foam plastic cores used as a component in manufactured assemblies used in building construction shall have a flame spread index of not more than 75 and shall have a smoke-developed index of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723. Loose-fill type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

Exception: Foam plastic insulation more than 4 inches (102 mm) thick shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is *approved* in accordance with Section R316.6 using the thickness and density intended for use.

R316.4 Thermal barrier. Unless otherwise allowed in Section R316.5 or Section R316.6, foam plastic shall be separated from the interior of a building by an *approved* thermal barrier of minimum $^1/_2$ inch (12.7 mm) gypsum wallboard or an *approved* finish material equivalent to a thermal barrier material that will limit the average temperature rise of the unexposed surface to no more than 250°F (139°C) after 15 minutes of fire exposure complying with the ASTM E 119 or UL 263 standard time temperature curve. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on NFPA 286 with the acceptance criteria of Section R302.9.4, FM 4880, UL 1040 or UL 1715.

R316.5 Specific requirements. The following requirements shall apply to these uses of foam plastic unless specifically *approved* in accordance with Section R316.6 or by other sections of the code or the requirements of Sections R316.2 through R316.4 have been met.

R316.5.1 Masonry or concrete construction. The thermal barrier specified in Section R316.4 is not required in a masonry or concrete wall, floor or roof when the foam plastic insulation is separated from the interior of the building by a minimum 1-inch (25 mm) thickness of masonry or concrete.

R316.5.2 Roofing. The thermal barrier specified in Section R316.4 is not required when the foam plastic in a roof assembly or under a roof covering is installed in accordance with the code and the manufacturer's installation instructions and is separated from the interior of the building by tongue-and-groove wood planks or wood structural panel sheathing in accordance with Section R803, not less than $^{15}/_{32}$ inch (11.9 mm) thick bonded with exterior glue and identified as Exposure 1, with edges supported by blocking or tongue-and-groove joints or an equivalent material. The smoke-developed index for roof applications shall not be limited.

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. *Attic* access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.