



WEATHERBOND ROOFING SYSTEMS

Table of Contents

January 2024

The information contained in this generic specification represents a part of WeatherBond's recommendations. Construction materials and practices, building siting and operation, climatic conditions, and other site-specific factors will have an impact on the performance of the roofing systems. WeatherBond recommends that the building owner retain a design professional to determine appropriate design measures to be taken in order to address these factors.

FM 1-28 Summary Update	DR-02-21
FM 1-29 Summary Update – Adhered Roofing Systems	DR-03-21
FM 1-29 Summary Update – Mechanically Fastened Roofing Systems	DR-04-21
Insulation Fastening Patterns	DR-05-22
Withdrawal Resistance Criteria	DR-06-11
CRRC/LEED Information	DR-07-23
Wood Nailers and Securement Criteria	DR-08-11
Considerations for Hail Design	DR-09-11

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DR-02-21

FM 1-28 Summary Update

January 2024

This Design Reference document offers a summary of updates to the FM 1-28 Property Loss Prevention Data Sheet announced by FM Global in February 2020.

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FM 1-28 Recent Update

One key update relates to roof zone dimensions to align with the ASCE 7-16 Design Standards. In some cases (depending on the roof dimensions, building height, and roof slopes), four zones may exist: interior, inner perimeter (also referred to as field), outer perimeter, and corner zones. The Roof Zone table below may be referenced for more detailed information.

Roof Height / Slope	Reference	Corner Zone (Zone 3)	Outer Perimeter Zone (Zone 2)	Inner Perimeter / Field Zone (Zone 1)	Interior Zone (Zone 1')
Building slopes less than 1- 1/2" (7° or less) OR Buildings less than 90' with height to width ratio of 1.0 or less	Figure I	0.6h x 0.6 x 0.2h "L" shaped	0.6h from roof edge	1.2h from roof edge	Covers the remaining roof area
Building slopes 1-1/2" or greater (greater than 7°)	Figure II	The width (a) of the various perimeter and corner zones equals the lesser of 10% of the building width or 0.4h, but not less than 4% of the width or 3ft.		Covers the remaining roof area	N/A
Buildings 90'-high or taller, or buildings higher than 60' with height to width ratio greater than or equal to 1.0	Figure III	The depth of the corner and perimeter zones shall equal 10% of the building width dimension, but not less than 3ft (0.9m). The corner zone shall extend along both perimeters a distance equal to twice the depth forming an "L" pattern.		Covers the remaining roof area	N/A

Note: h = building height

Other important items to note include:

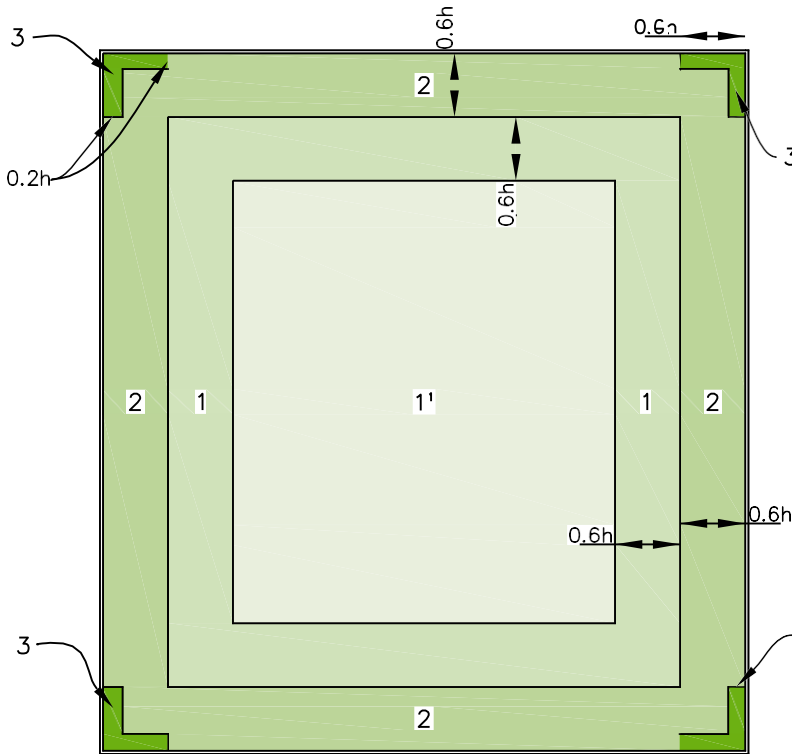
- 1- Revised design wind guidance reflects changes in pressure coefficients (GCP).
- 2- The basic design wind speed maps for the continental United States and Alaska remain unchanged and are still based on ASCE 7-05.
- 3- Wind pressure tables have been removed. Roof pressures can be determined by using either the RoofNav Ratings Calculator or the pressure calculations in section 3.0 of 1-28. Also, pressure coefficients have been provided as outlined in the tables included with Figure I, Figure II, and Figure III.
- 4- A separate 100-year MRI wind map has been provided for each of the islands of Hawaii, instead of using one wind speed for all the islands.

Figure I

Building slopes less than $1\text{-}1/2^\circ$ (7° or less)

OR

Buildings less than 90' with height to width ratio of 1.0 or less

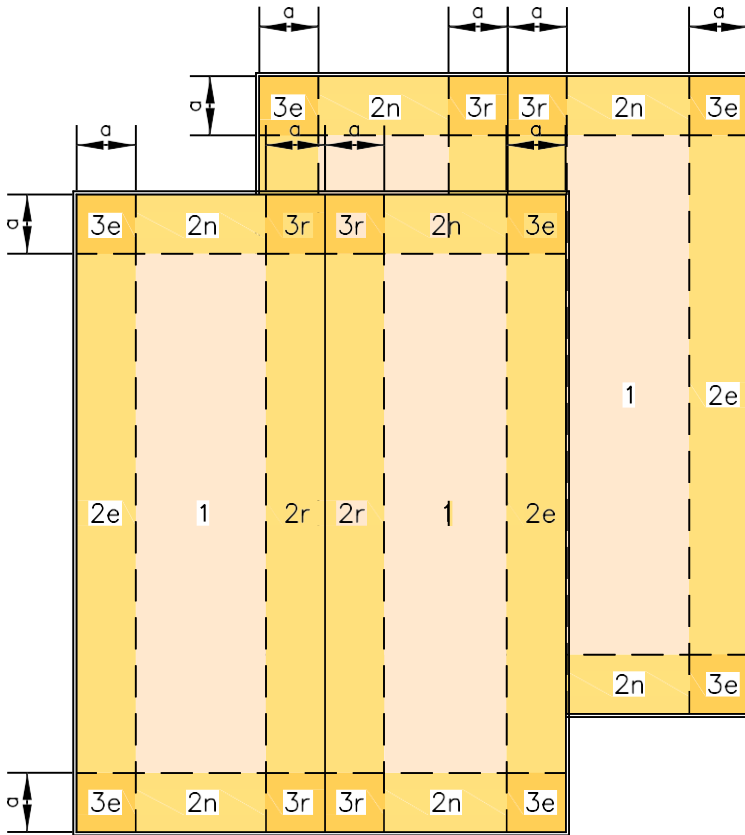


Zone	GCP
Corner Zone (3)	-3.2
Outer Perimeter Zone (2)	-2.3
Inner Perimeter / Field Zone (1)	-1.7
Interior Zone (1')	-0.9

Figure II

Building slopes 1-1/2" or greater (greater than 7°)

Note: a = the width of the various perimeter and corner zones equals the lesser of 10% of the building width or 0.4h, but not less than 4% of the width or 3' (0.9 m).



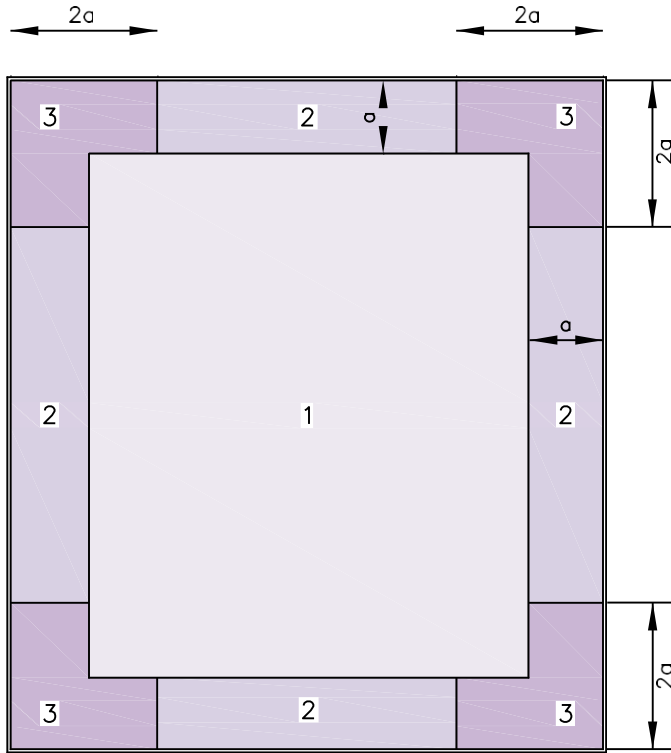
Zone	GC _P
Corner Zone (3r)	-3.6
Outer Perimeter Zone (2n, 2r, 3e)	-3
Inner Perimeter / Field Zone (1, 2e)	-2

This table contains conservative GC_P values for slopes 1-1/2" or greater. For lesser values for steeper slopes, refer to FM 1-28 table 3.2.2d or table 3.2.2c.

Figure III

Buildings 90' high or taller, or buildings higher than 60' with height to width ratio greater than or equal to 1.0

Note: $a = 10\%$ of the lesser horizontal dimension, but not less than 3' (0.9m).



Zone	GCP
Corner Zone (3)	-3.2
Outer Perimeter Zone (2)	-2.3
Inner Perimeter/Field Zone (1)	-1.7

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Additional information may be obtained by logging on to <https://www.roofnav.com> to access the RoofNav number search, RoofNav Ratings Calculator, and all applicable Property Loss Prevention Data Sheets.

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Review the appropriate WeatherBond warranty for specific warranty coverage, terms, conditions and limitations.



FM 1-29 Summary Update Adhered Roofing Systems

January 2024

This Design Reference document offers a summary of updates to the FM 1-29 Property Loss Prevention Data Sheet for adhered roofing systems announced by FM Global in February 2020.

Specifiers, Applicators or Building owners must access the FM website for other related information and contact the local FM office when working on a FM insured property. Enhancements mandated by FM Global for an FM insured property are not necessarily part of WeatherBond's requirements for the issuance of the WeatherBond warranty. When an inspection is performed by WeatherBond, it is not to verify compliance with the FM requirements but to ensure WeatherBond's minimum warranty requirements have been met.

A summary of the changes made to the FM 1-29 document that affect adhered roofing systems include the following:

New designations for field, perimeter and corner areas. Now referred to as Zones 1, 2 and 3, respectively.
Addition of a new secondary interior field area, designated as Zone 1' ("Zone 1 Prime").
Modified perimeter and corner prescriptive insulation attachment enhancements for adhered roofing systems utilizing ribbon adhesive. (Mechanically attached insulation enhancements have not changed).

This Design Reference will focus on the February 2020 FM 1-29 prescriptive enhancement requirements for insulation attachment using mechanical fasteners and ribbons of adhesive on adhered roofing systems.

Prescriptive Enhancements – Adhered Systems

Prescriptive enhancements for Zones 2 and 3 of a building are acceptable when either of the following conditions are met.

- The FM Zone 1 rating in any location does not exceed 1-90, **OR**
- The building is located in a non-tropical cyclone-prone region and the Zone 1 rating does not exceed 1-105.

Buildings that do not meet these criteria must use a roofing system with a FM approved wind uplift rating that meets or exceeds the design rating for each Zone (Zones 1', 1, 2, and 3).

Adhered Systems Using Mechanical Fasteners

The method for prescriptively enhancing adhered systems that utilize mechanically fastened insulation has not changed. The attachment requirements are as follows:

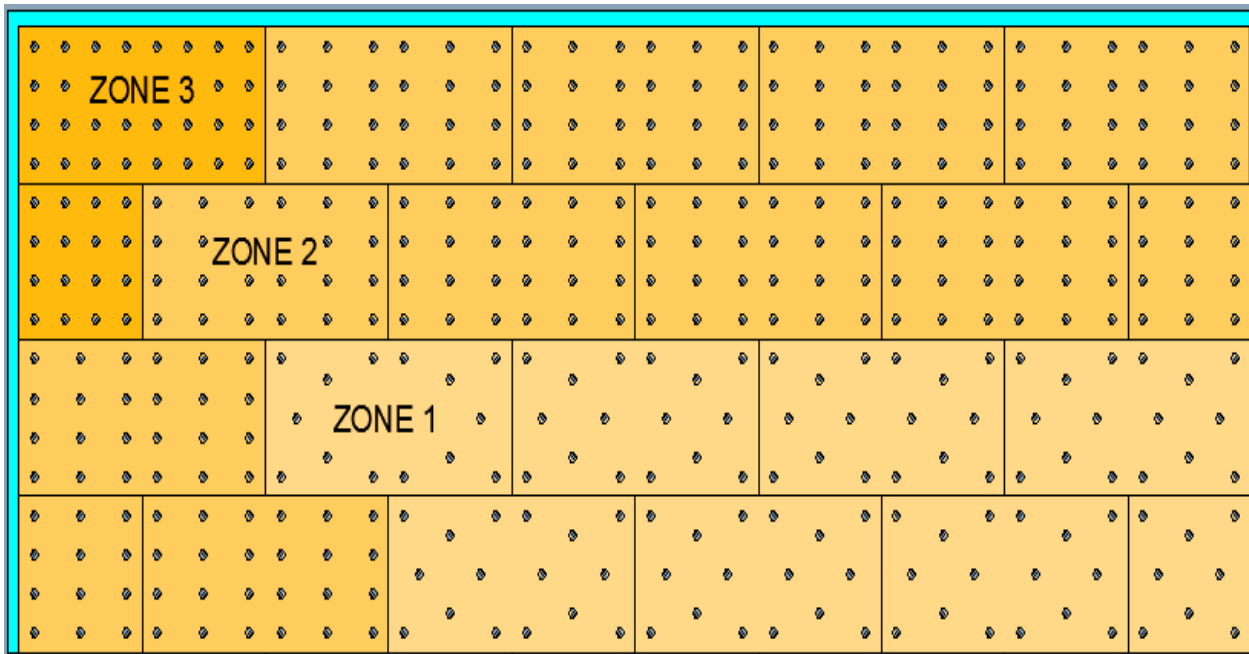
- Zone 2 - 50% increase over Zone 1 but no less than 1 fastener/plate per 2 ft² (16 per 4'x8' board).
- Zone 3 - 1 fastener/plate per 1 ft² (32 per 4'x8' board).

Mechanically Fastened Insulation Example

A roofing assembly specified for use in a non-tropical cyclone-prone region achieves a 1-105 wind uplift rating using 1 fastener/plate per 2 sq. ft. (16 per 4'x8' board). The enhanced Zone fastening would be as detailed in the following table.

1-105 Rated Adhered Assembly – Fastened Insulation			
Zone 1' Fastening	Zone 1 Fastening (Tested)	Zone 2 Fastening (50% increase of Zone 1)	Zone 3 Fastening
Use Zone 1 or alternate system meeting Zone 1' rating requirements	16 fasteners per 4'x8' board	24 fasteners per 4'x8' board	32 fasteners per 4'x8' board

The plan view fastening for this example would appear as shown below. Zone 1' is not shown.



Adhered Systems Using Ribbon Applied Adhesives

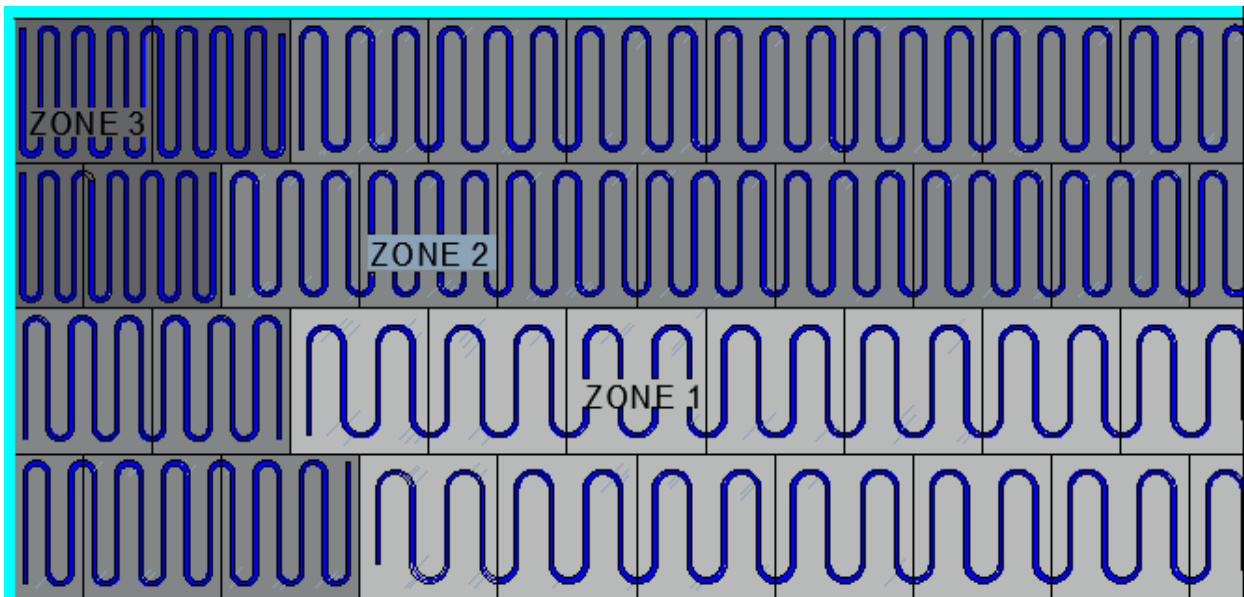
The method for prescriptively enhancing insulation attachment with ribbon applied adhesive on adhered systems has changed. The Zone 2 reduction in spacing between ribbons has changed from 60% (previously allowed) to 67% of the tested Zone 1 spacing. Likewise, the Zone 3 reduction of spacing between ribbons has changed from 40% to 50% of the Zone 1 spacing.

Ribbon Attached Insulation Example

A roofing assembly specified for use in a non-tropical cyclone-prone region achieves a 1-105 wind uplift rating using ribbons of adhesive spaced 12" o.c. The enhanced Zone ribbon spacing would be as detailed in the following table.

1-105 Rated Adhered Assembly – Adhesive Ribbons			
Zone 1' Spacing	Zone 1 Spacing (Tested)	Zone 2 Spacing (67% of Zone 1)	Zone 3 Spacing (50% of Zone 1)
Use Zone 1 or alternate system meeting Zone 1' rating requirements	12" o.c. Max.	8" o.c. Max.	6" o.c. Max.

The plan view ribbon spacing for this example would appear as shown below. Zone 1' is not shown.



Non-Prescriptive Enhancements

The option is always available to provide a roofing system that has been tested to achieve the uplift pressure requirement / FM rating for each roof Zone. As such, a system that meets the Zone 3 requirements may be installed over the entire roof, or multiple systems may be installed to meet the individual Zone 1', 1, 2 and 3 design pressures.

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FM 1-29 Summary Update Mechanically Attached Roofing Systems

January 2024

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An updated version of the FM 1-29 Property Loss Prevention Data Sheet was published in February 2020. Changes made to that document that affect mechanically fastened roofing systems include the following:

New designations for field, perimeter and corner areas. Now referred to as Zones 1, 2 and 3, respectively.
Addition of a new secondary interior field area designated as Zone 1' ("Zone 1 Prime").
Addition of a calculated, performance-based attachment enhancement method for Zones 2 and 3.
Modified prescriptive enhancement attachment requirements for Zones 2 and 3.

This Design Reference will focus on the 2020 FM 1-29 performance-based and prescriptive enhancement requirements for membrane attachment on mechanically fastened roofing systems. This includes linear induction-welded systems.

Performance-Based Enhancement

FM has added an option into 1-29 for the performance-based enhancement of Zones 2 and 3 for mechanically fastened membrane systems. The determination is based on the membrane width and the fastener spacing of the tested assembly chosen for Zone 1. The following example is offered for clarification.

Performance-Based Enhancement Option Example

The FM RoofNav Ratings Calculator was used to determine that an example building requires the following wind uplift ratings:

Zone 1'	Zone 1	Zone 2	Zone 3
90 psf (1-90)	120 psf (1-120)	150 psf (1-150)	210 psf (1-210)

Choose a roofing system that has been tested to meet or exceed the **Zone 1 rating** which for this example is a 12' wide membrane fastened 6" oc. The Zone 1' pressure is less than Zone 1 so the as-tested assembly can be used in Zone 1'. However, since the Zone 2 and Zone 3 pressures exceed the tested Zone 1 pressure (120 psf), the membrane width must be reduced (to increase the membrane fastening density) in these areas while maintaining the 6" oc fastener spacing. The calculations for Zones 2 and 3 are as follows.

Step 1: Determine the area of membrane secured by a single fastener for Zone 1:

- Fastener row spacing *times* the fastener spacing along the row;
 - $11.5 \text{ ft (12' sheet minus seam overlap)} \times 0.5 \text{ ft (6" oc fastener spacing)} = 5.75 \text{ ft}^2$ (per fastener securement area)

Zone 2 Enhancement

Step 2: Determine the needed reduction in the area of membrane secured by a single fastener for Zone 2:

- Zone 1 tested pressure *times* fastener securement area *divided by* Zone 2 pressure;
 - $120 \text{ psf} \times 5.75 \text{ ft}^2 / 150 \text{ psf} = 4.6 \text{ ft}^2$ per fastener

Step 3: Determine the reduction in fastener row spacing for Zone 2:

- Zone 2 area of membrane secured by a single fastener *divided by* fastener spacing;
 - $4.6 \text{ ft}^2 / 0.5 \text{ ft} = 9.2 \text{ ft}$ maximum row spacing with fasteners spaced 6" oc

Zone 3 Enhancement

Step 4: Determine the needed reduction in the area of membrane secured by a single fastener for Zone 3:

- Zone 1 tested pressure *times* fastener securement area *divided by* Zone 3 pressure;
 - $120 \text{ psf} \times 5.75 \text{ ft}^2 / 210 \text{ psf} = 3.3 \text{ ft}^2$ per fastener

Step 5: Determine the reduction in fastener row spacing for Zone 3:

- Zone 3 area of membrane secured by a single fastener *divided by* fastener spacing;
 - $3.3 \text{ ft}^2 / 0.5 \text{ ft} = 6.6 \text{ ft}$ maximum row spacing with fasteners spaced 6" oc

The following table summarizes the performance-based example results calculated above.

Performance-Based Example Summary

Zone 1'	Zone 1 – Tested	Zone 2	Zone 3
Use Zone 1 or system passing 1-90	12' Sheets 11.5' Row Spacing 6" oc Fastener Spacing	9.2' Row Spacing 6" oc Fastener Spacing	6.6' Row Spacing 6" oc Fastener Spacing

Prescriptive Enhancement Option

The FM prescriptive enhancement option has always been available for mechanically fastened systems and is a simple way to determine the reduction in membrane sheet width / fastener row-to-row spacing for Zones 2 and 3. This method, like the performance-based method, is based on the testing results for Zone 1. The following table contains a summary of the prescriptive enhancement requirements.

Zone 1'	Zone 1 – Tested	Zone 2	Zone 3
Use Zone 1 or separately tested system	Tested Spacing	67% of Zone 1 Fastener Row-To-Row Spacing (60% previously)	50% of Zone 1 Fastener Row-To-Row Spacing (40% previously)

Prescriptive Enhancement Option Example

A FM Approved roofing system requires the use of a 12' wide membrane (11.5' oc fastener row spacing) with fasteners spaced 6" oc along the row. The following table identifies the prescriptive enhancement requirements.

Zone 1'	Zone 1 – Tested	Zone 2 (67%)	Zone 3 (50%)
Use Zone 1 or separately tested system	12' Sheets 11.5' Row Spacing 6" oc Fastener Spacing	7.7' Row Spacing 6" oc Fastener Spacing	5.75' Row Spacing 6" oc Fastener Spacing

In summary, either the performance-based enhancement or the prescriptive enhancement option can be used to comply with the FM 1-29 2020 update. Please refer to the FM Global publications for all the applicable requirements.

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DR-05-22

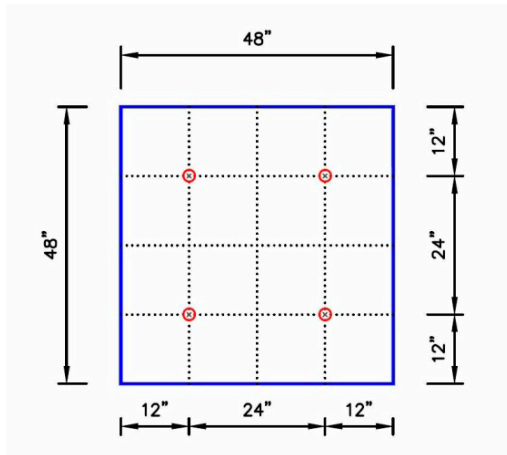
Insulation Fastening Patterns

January 2024

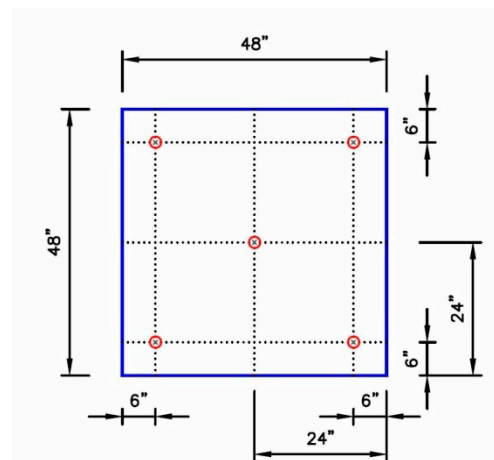
The information contained represents guidelines to address possible requirements as part of the building specification as listed under the Quality Insurance or Performance Article. WeatherBond recommends that the building owner retain a design professional to verify that these guidelines are appropriate.

When enhanced insulation fastening is required as prescribed in Factory Mutual Loss Prevention Data Sheet 1-29, ANSI/SPRI WD-1, or Miami-Dade County, the specifier may consider the enclosed insulation pattern securements. **NOTE: All insulation and underlayments shown are the minimum thickness required for the established rating.**

Insulation Patterns for boards 4' x 4' in size



4 Insulation Fasteners & Plates



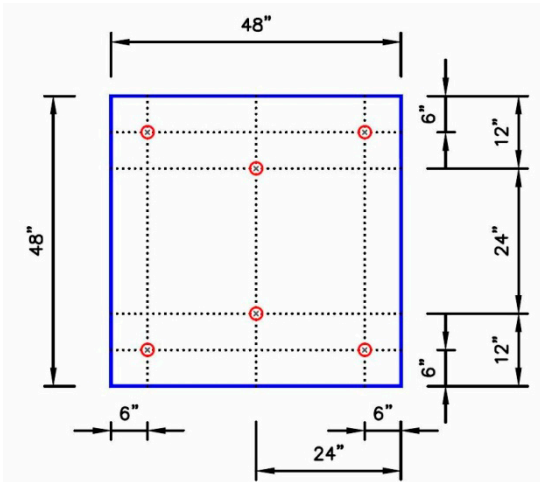
5 Insulation Fasteners & Plates

Only FM 1-90 for:

- 2" XP Polyiso or XFP Polyiso
- 1/2" XFP HD Plus Cover Board
- 5/8" Dens-Deck Prime or Securock

Only FM 1-90 for:

- 1/2" Securock
- 1-1/2" XP Polyiso



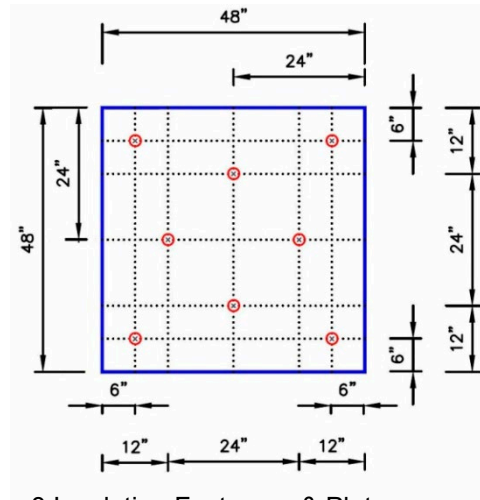
6 Insulation Fasteners & Plates

FM 1-90 for:

1/4" Dens-Deck Prime

FM 1-75 for:

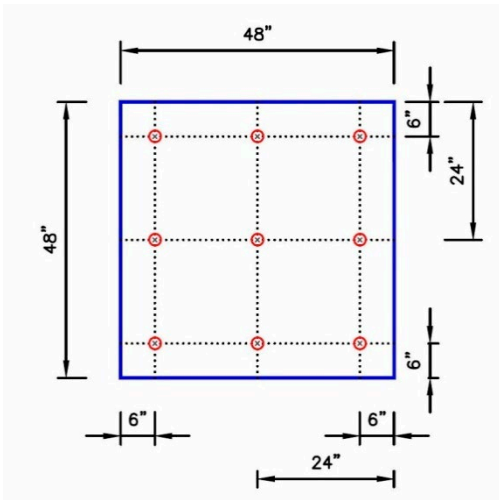
1/4" Securock



8 Insulation Fasteners & Plates

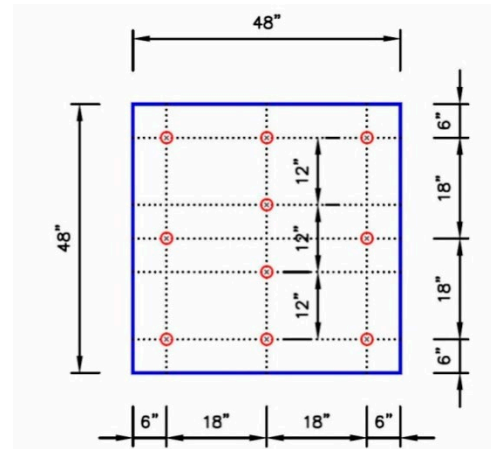
FM 1-90 for all except:

1" XP Polyiso (recover only)



9 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement



10 Insulation Fasteners & Plates

FM 1-150 for:

2" XP Polyiso (EPDM and TPO)

1/2" Securock (EPDM and TPO)

FM 1-135 for:

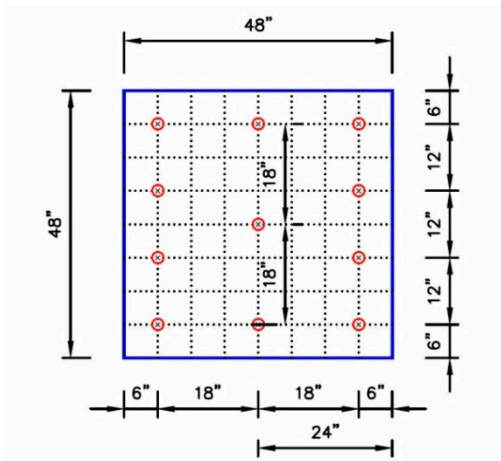
2" XP Polyiso (PVC)

FM 1-105 for:

1/2" Dens-Deck Prime

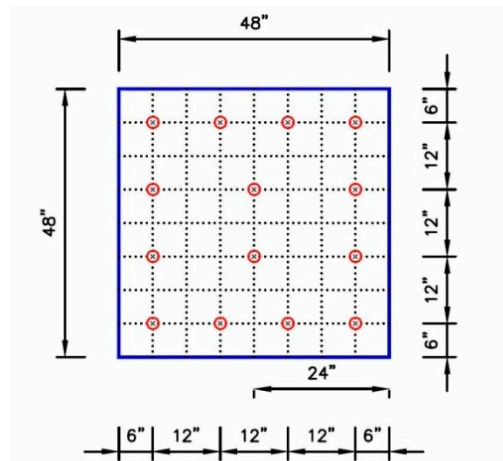
FM 1-90 for:

1-1/2" XP Polyiso (Recover)



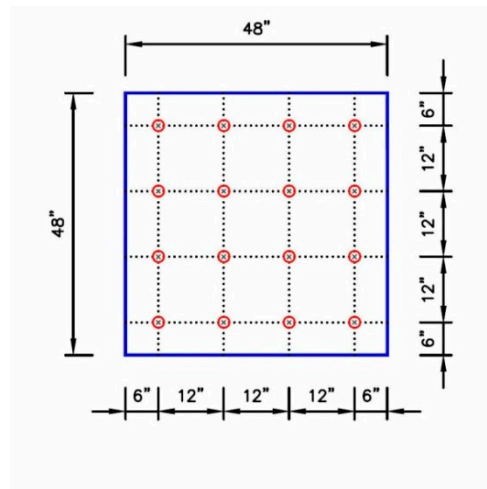
11 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement.



14 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement.



FM I-285 for:

1/2" Dens-Deck Prime (Fleece)

FM 1-225 for:

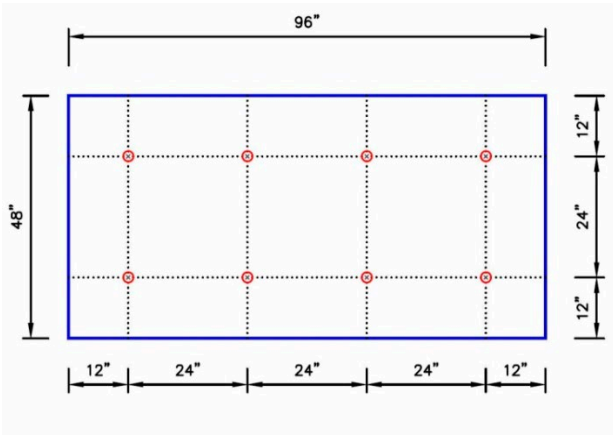
2" XFP Polyiso

1/2" Securock

FM 1-195 for:

2" XP Polyiso (EPDM and TPO)

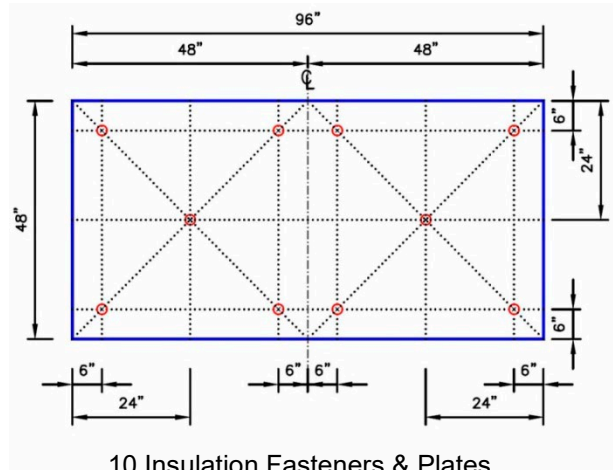
Insulation Patterns for boards 4' x 8' in size



8 Insulation Fasteners & Plates

FM 1-90 for:

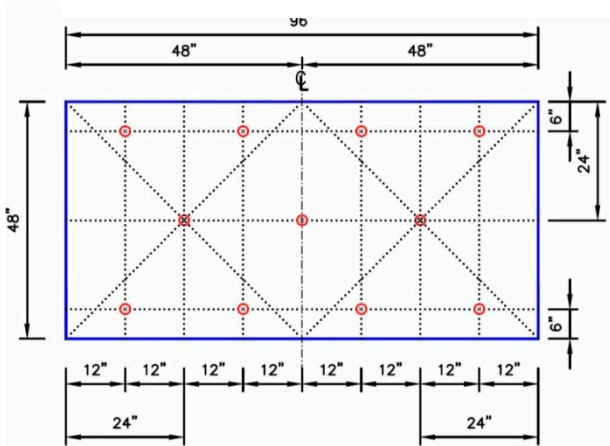
- 2" XP Polyiso or XFP Polyiso
- 1/2" XFP HD PlusCover Board
- 5/8" Dens-Deck Prime or Securock



10 Insulation Fasteners & Plates

FM 1-90 for:

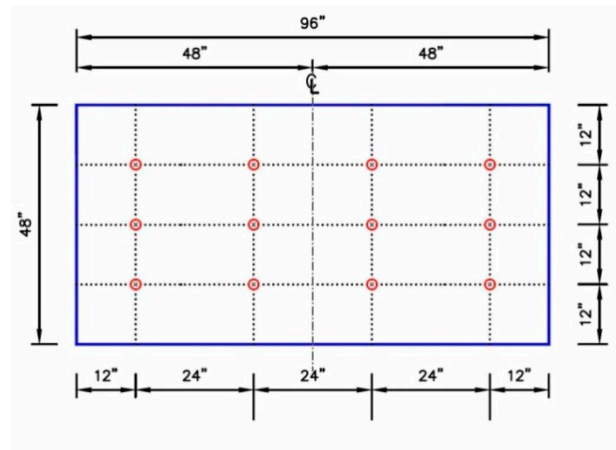
- 1/2" Securock
- 1-1/2" XP Polyiso



11 Insulation Fasteners & Plates

FM 1-90 for:

- 1-1/2" XP Polyiso



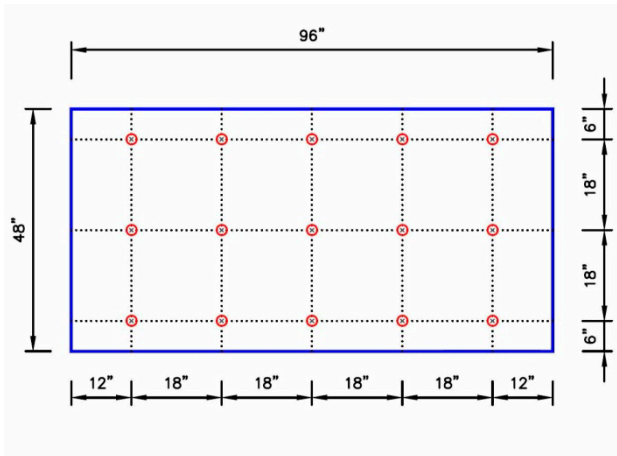
12 Insulation Fasteners & Plates

FM 1-90 for:

- 1/4" Dens-Deck Prime

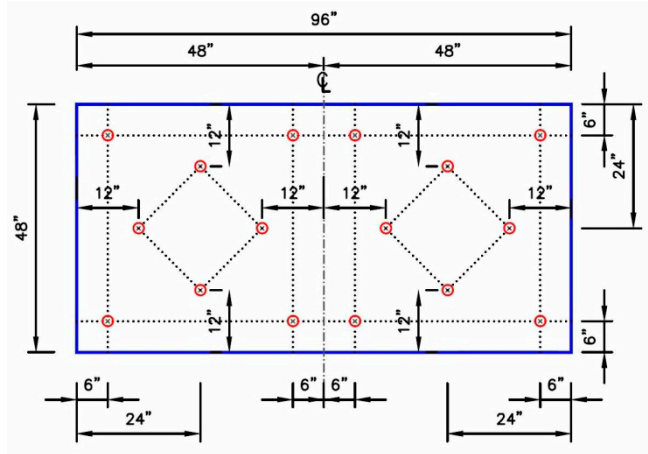
FM 1-75 for:

- 1/4" Securock



15 Insulation Fasteners & Plates

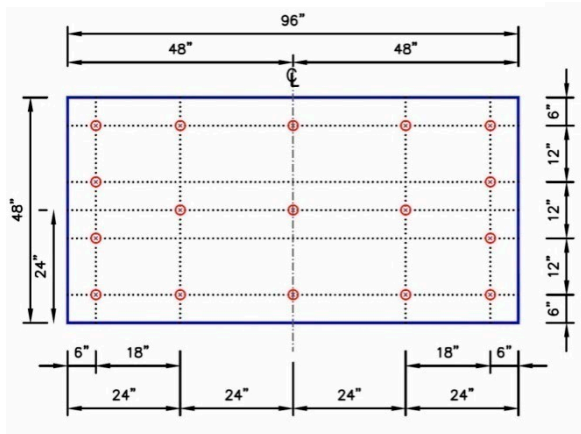
Fastening pattern should only be used when required by FM for perimeter or corner enhancement



16 Insulation Fasteners & Plates

FM 1-90 for all except:

1" XP Polyiso (Recover Only)



17 Insulation Fasteners & Plates

FM 1-105 for:

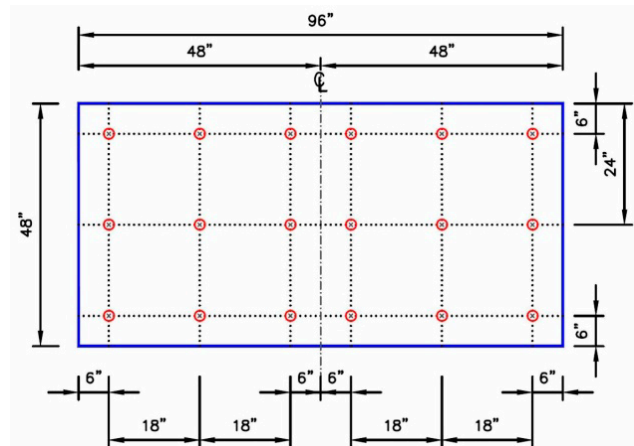
7/16" OSB (EPDM)

FM 1-150 for:

7/16" OSB (TPO)

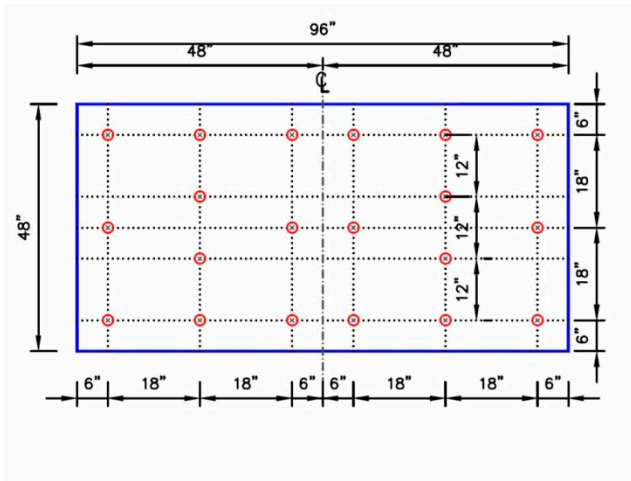
FM-120 for:

7/16" OSB (PVC)



18 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement warranty.



FM 1-150 for:

2" XP Polyiso (EPDM and TPO)

1/2" Securock (EPDM and TPO)

FM 1-135 for:

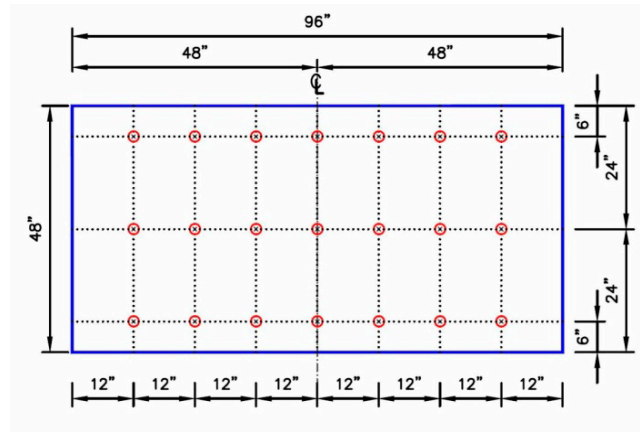
2" XP Polyiso (PVC)

FM 1-105 for:

1/2" Dens-Deck Prime

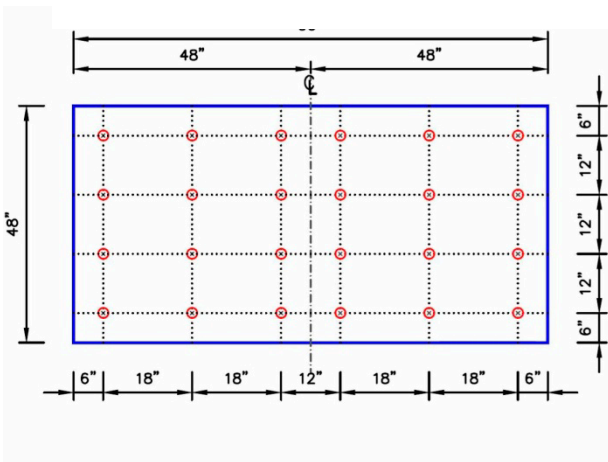
FM 1-90 for:

1" XP Polyiso (Recover)



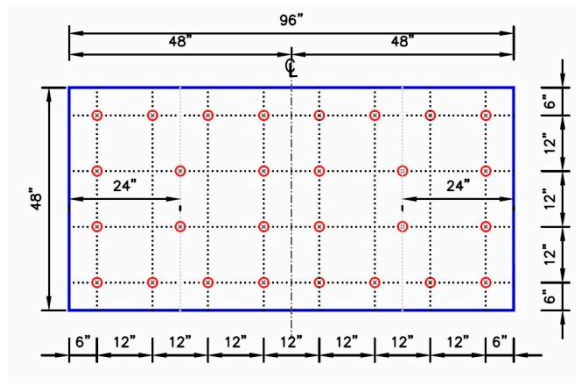
21 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement



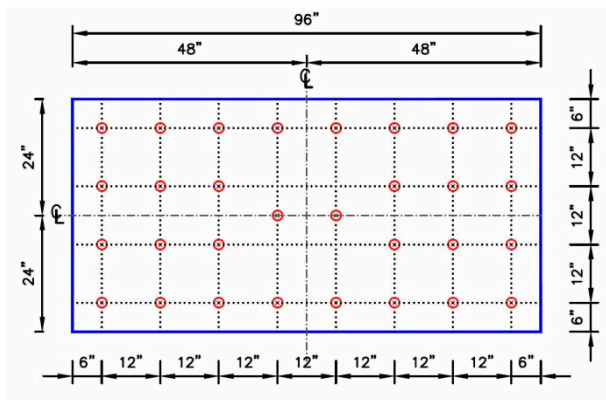
26 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement



28 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement



30 Insulation Fasteners & Plates

Fastening pattern should only be used when required by FM for perimeter or corner enhancement.

32 Insulation Fasteners & Plates

FM 1-225 for:

2" XFP Polyiso

1/2" Securock

FM 1-195 for:

2" XP Polyiso (EPDM and TPO)

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DR-06-11

Withdrawal Resistance Criteria

January 2024

The information contained represents guidelines to address possible requirements as part of the building specification as listed under the Quality Assurance or Performance Article. WeatherBond recommends that the building owner retain a design professional to verify that these guidelines are appropriate.

- A. The following chart indicates the appropriate WeatherBond Fastener for use with the referenced roof deck and includes the **minimum pullout** and fastener penetration requirements for membrane/insulation securement on Mechanically Attached Roofing Systems and for insulation attachment on Adhered assemblies.

Deck Type	Minimum Pullout	Approved WeatherBond Fastener	Minimum Penetration
Steel, 22 gauge or heavier	425 pounds Mech.-Attached (1)	HPW or Sure-Tite Fasteners (4)	3/4"
	360 pounds Adhered	HPW, HPWX, ASAP or InsulTite Fasteners	
Steel, less than 22 gauge	300 pounds Adhered Only (2)	HPW, HPWX, ASAP or InsulTite Fasteners	3/4"
Lightweight Insulating Concrete over Steel (3)	360 pounds	HPW, HPWX, ASAP or InsulTite Fasteners (Adhered) HPW or Sure-Tite Fasteners (4) (Mech. Attached)	3/4"
Structural Concrete, rated 3,000 psi or greater	800 pounds	CD-10 or MD 14-10	1"
Wood Planks	360 pounds	HPW, HPWX, ASAP or InsulTite Fasteners (Adhered) HPW or Sure-Tite Fasteners (4) (Mechanically Attached)	1"
Oriented Strand Board (OSB) minimum 7/16" thick and minimum 15/32" thick Plywood (5)	210 pounds Mechanically Attached	HPW or Sure-Tite (Mechanically Attached)	1-1/2"
	210 pounds Adhered	HPW or HPWX Fastener (Adhered)	1"
Gypsum	300 pounds	GypTec or Lite-Deck	1-1/2" (GypTec) 2" (Lite Deck)
Cementitious Wood Fiber	300 pounds Mechanically Attached	GypTec	1-1/2"
	225 pound Adhered Only		

Notes:

- (1) Mechanically Attached Roofing Systems are not permitted over corrugated steel decks, regardless of gauge.
- (2) Mechanically Attached Roofing Systems are not permitted over steel decks less than 22 gauge unless used in conjunction with lightweight insulating concrete and acceptable pullouts are obtained using HPW or Sure-Tite Fasteners.
- (3) Fasteners are installed through the lightweight insulating concrete into the steel deck below.
- (4) Sure-Tite Fasteners can be used on Mechanically Attached Roofing Systems in conjunction with ST Metal Fastening Bars.
- (5) 7/16" OSB or 5/8" OSB and 15/32" 3-Ply Plywood 3-Ply or 15/32" 5-Ply Plywood.

- B. Withdrawal resistance testing may be conducted by an independent laboratory, fastener manufacturer or a representative of WeatherBond on the following roof decks.

1. **Fully Adhered Roofing Systems:**

- a. Cementitious wood fiber or gypsum decks – GypTec or Lite-Deck (gypsum decks only) Fasteners or an approved fastener by others.
- b. Steel decks lighter than 22-gauge - WeatherBond HPW, HPWX, ASAP, InsulTite Fasteners or an approved fastener by others.
- c. Oriented strand board (OSB) decks (less than 5/8" thick) - WeatherBond HPW, HPW-XL or an approved fastener by others.

2. **Mechanically Attached Roofing Systems:**

- a. Cementitious wood fiber or gypsum decks – GypTec Fastener
- b. Lightweight insulating concrete over steel decks lighter than 22 gauge - WeatherBond HPW or Sure-Tite (with ST Fastening Bars). Fasteners must penetrate the steel deck below the lightweight concrete.
- c. Minimum 7/16" thick oriented strand board (OSB) decks - WeatherBond HPW or Sure-Tite (with ST Fastening Bars)
- d. Minimum 5/8" thick oriented strand board (OSB) decks - WeatherBond HPW or Sure-Tite (with ST Fastening Bars) Fasteners
- e. Plywood decks less than 5/8" thick - WeatherBond HPW or Sure-Tite (with ST Fastening Bars)

3. On all other acceptable roof decks, a withdrawal resistance test is strongly recommended.

C. **Withdrawal Resistance Procedures:**

1. On retrofit projects, a core cutter shall be used to remove existing roofing material prior to conducting the withdrawal resistance test (even if the existing roofing membrane is specified to remain). Existing roofing materials will contribute to a higher, misleading pullout value.
2. The following minimum trial fastener samples must be installed and tested over the roof deck at each level:
 - a. For each roof level of 5,000 sq. ft. or less, conduct a minimum of 3 pullouts.
 - b. For each roof level greater than 5,000 sq. ft. and less than 20,000 sq. ft., conduct a minimum of 10 pullouts.
 - c. For each roof level greater than 20,000 sq. ft. and less than 50,000 sq. ft., conduct a minimum of 15 pullouts.
 - d. For each roof level greater than 50,000 sq. ft. and less than 100,000 sq. ft., conduct a minimum of 20 pullouts.
 - e. For each roof level greater than 100,000 sq. ft., conduct a minimum of 1 pullout per each 5,000 sq. ft.

Note: On projects with multiple roof levels, when pullouts are conducted on the main roof level, smaller canopies, overhangs, penthouses, etc., of 1,000 square feet or less will not require pullout tests providing these areas consist of the same decking material as the main roof level.

3. The trial fastener installations should be tested in various locations of the roof deck including roof corners and perimeters (areas parallel to the edge of the roof with a width which is 0.4 times the building height).

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WEATHERBOND ROOFING SYSTEMS

DR-07-11

CRRC / LEED Information

January 2024

The table below illustrates membrane properties as they pertain to reflectivity, emittance, recyclability and test methods. The data can be referenced when compliance with CRRC standards and LEED pre-requisites are required. Other LEED compliant information could be obtained by contacting WeatherBond. Additional LEED information is contained in various Technical Data Bulletins.

WeatherBond EPDM (white) Membranes - WeatherBond TPO Membranes (White/Gray/Tan) WeatherBond PVC Membranes (White)

Physical Property	Test Method	WeatherBond EPDM	WeatherBond TPO	WeatherBond TPO	WeatherBond PVC	WeatherBond /KEE HP FRS
Membrane Color		White	White	Gray/Tan	White	White
CRRC – Initial solar reflectance	ASTM C1549	0.76	0.79	0.46 / 0.71	0.87	0.86
CRRC – Solar reflectance after 3 years (uncleaned)	ASTM C1549	0.64	0.70	0.43 / 0.64	0.61	0.70
CRRC – Initial thermal emittance	ASTM C1371	0.90	0.90	0.89 / 0.86	0.95	0.86
CRRC – Thermal emittance after 3 years (uncleaned)	ASTM C1371	0.87	0.86	0.88 / 0.87	0.86	0.82
LEED – Thermal emittance	ASTM E408	0.91	0.95	0.95 / 0.95	0.94	0.94
Solar Reflective Index (SRI)	ASTM E1980	105	110	55 / 88	110	109
LEED – Pre-consumer recycled content		0%	10%	10%	10%	10%
LEED – Post-consumer recycled content		0%	0%	0%	0%	0%
LEED – Manufacturing location		Carlisle, PA or Greenville, IL	Senatobia, MS or Tooele, UT	Senatobia, MS or Tooele, UT	Greenville, IL	Greenville, IL

Note: WeatherBond EPDM (Black) Membrane: SRI 9; Pre-consumer recycled content 3%; Post-consumer recycled content; Manufacturing Location Carlisle, PA and Greenville, IL.

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DR-08-11

Wood Nailers and Securement Criteria (Factory Mutual Loss Prevention Data Sheet 1-49)

January 2024

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One of the most often overlooked details on a roofing system is the attachment method for wood nailers at the perimeter of the roof. Factory Mutual Global (FMG) publishes design recommendations for the attachment of wood nailers to various substrates and for the attachment of perimeter flashing details to wood nailers. This information is contained in Factory Mutual's Property Loss Prevention Data Sheet 1-49. In accordance with that Data Sheet, the information listed below should be referenced when selecting an appropriate perimeter attachment method.

General Criteria

A **horizontal wood nailer** is used to provide an effective substrate for some installation details and for other roof accessories. In addition, it is used to provide solid protection for the edge of the membrane underlayment. Minimum thickness of the nailer must be such that the top of the nailer is flush with the top of the membrane underlayment.

1. The width of the nailers must exceed the width of the metal flange of edgings, scuppers, etc.
2. When treated lumber is specified, it is recommended that only lumber that has been pressure treated with salt preservatives be specified. Lumber treated with any of the wood preservatives such as, Creosote, Pentachlorophenol, Copper Naphthenate and Copper 8-quinolinolate will adversely affect the membrane when in direct contact and are, therefore, **unacceptable**.

If non-treated lumber is to be specified, it must be stored to protect from moisture sources. A seal should be provided between the non-treated lumber and a concrete or gypsum substrate (similar to a sill sealer).

3. Methods used to fasten the nailer vary with building conditions; however, it is essential that secure attachment of durable stock be accomplished. Factory Mutual Loss Prevention Data Bulletin 1-49 (Perimeter Flashing) contains options for the spacing and sizing of fasteners based on the project wind zone.
- Wood nailers that are anchored to steel, wood or masonry decking should not be less than 2" X 6" nominal (minimum 1-1/2" X 5-1/2").
 - Wood nailers should be Douglas Fir, Southern Yellow Pine or of wood having similar decay resistant properties.

Attachment to Masonry Walls

When fastening to a masonry wall, a 1/2 inch diameter anchor bolt is placed 48 inches on center at an 8 inch minimum depth (12 inches minimum when masonry walls are composed of lightweight aggregate or cinder) as shown in **Figure 1**. Each anchor bolt is positioned (staggered if the wood nailer is wider than 6 inches) in a block core or air space and tightly filled with concrete to the depth of the bolt.

Note: Plastic parts must not be used with masonry anchors.

FMG has specific requirements concerning filling of cores or voids in the top course of cinder blocks.

For example:

Projects requiring 75-psf or 90-psf ratings - fill the entire top course.

Projects requiring 60-psf ratings - fill only required where anchor bolts are positioned (48 inches on center in the field, 24 inches on center at roof corners).

At outside corners, the fastening density must be increased within the first 8 feet in each direction by positioning anchor bolts 24 inches on center.

An alternate method may be used by installing 3/8 inch diameter anchor bolts spaced 32 inches apart. For outside corners, bolts are fastened 16 inches apart, 8 feet from each side of the corner. If additional wood nailers are needed, refer to **Figure 5** for attachment of additional wood nailers.

Attachment to Steel and Wood Decking

- Penetration of the fasteners should be to the top flutes only. The fasteners must be staggered as shown in **Figure 2**.
- The staggered fastening pattern should be increased within 8 feet from outside corners as shown in **Figure 3A**.
- If the perimeter nailer is to be secured to a steel angle, anchor bolts must be positioned at 48 inch centers as show in **Figure 4**.
- On wood decks, the staggered fastening pattern with galvanized steel screws should be utilized as shown in **Figure 2**.

Caution: Attention should be paid to the FMG requirement which calls for galvanized steel washers (minimum 5/8 inch outside diameter) to be used in conjunction with galvanized screws. This requirement is not recognized in most cases and most often forgotten.

Attachment of Additional Wood Nailers

- When additional wood nailers are required, they must be attached with galvanized nails or lag screws that penetrate into the bottom nailer at 1-1/4 inches using a staggered fastening pattern in two rows at 24 inches apart as shown in **Figure 5**.
- The increased fastening density within 8 feet from outside corners is still required and must comply with **Figure 3**.
- The Data Sheet also contains important information pertaining to attachment of metal fascia/edging especially for those edgings which are shop fabricated.

- Even though not emphasized in the Data Sheet, contractors should examine or question existing conditions to determine if existing wood nailers are attached in compliance with the above criteria. If not, existing wood nailers should be refastened using one of these options and additional wood nailers must be secured following **Figure 5**.

Projects where Factory Mutual is the insurance underwriter should be reviewed by the local Factory Mutual office for specific criteria.

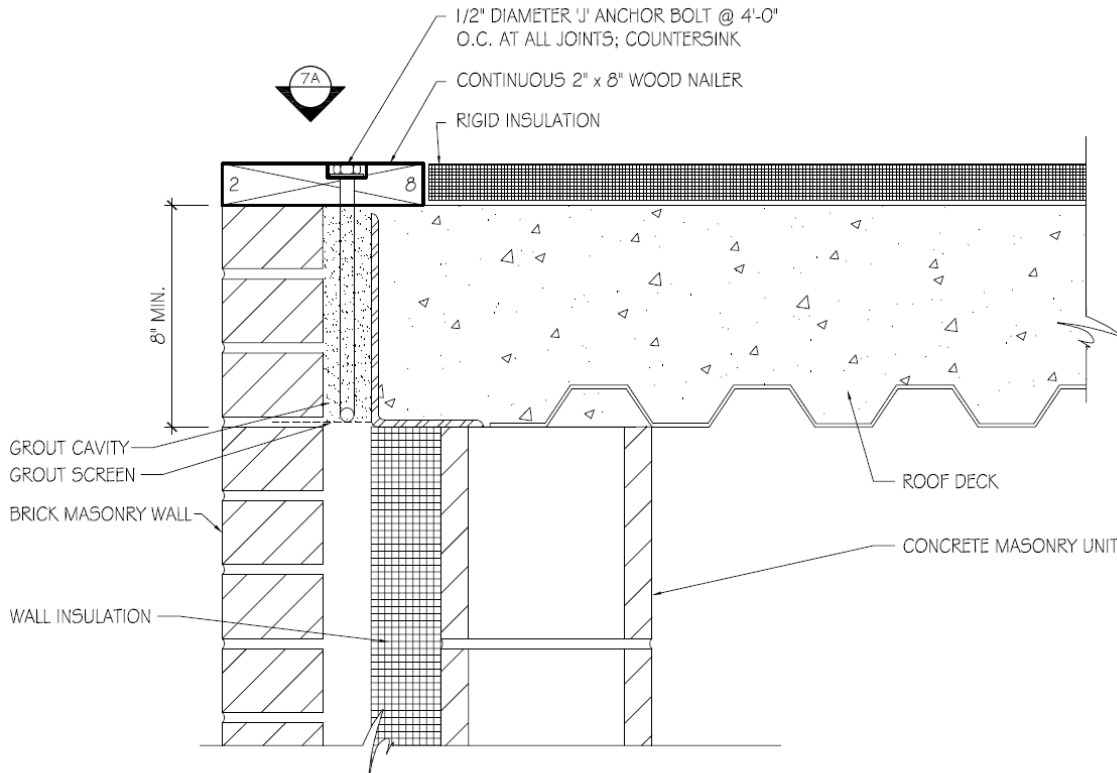


FIGURE 1 - ROOF EDGE WOOD BLOCKING - ANCHOR BOLT SECUREMENT

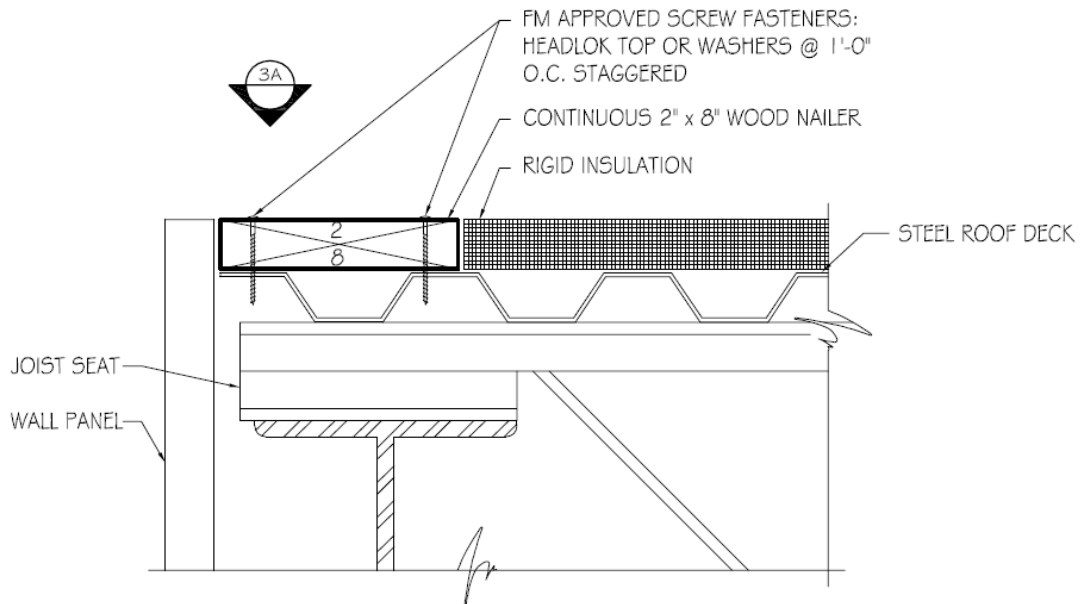


FIGURE 2 - ROOF EDGE WOOD BLOCKING - SCREW FASTENER ANCHORAGE

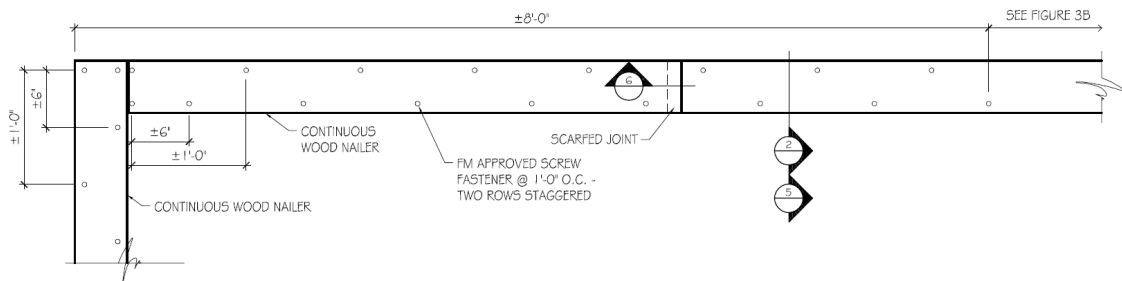


FIGURE 3A - WOOD BLOCKING CORNER ANCHORAGE 8'-0" FROM CORNER

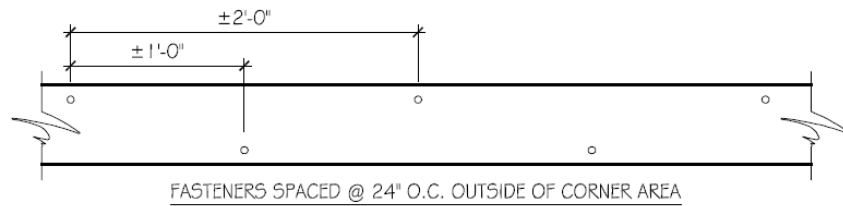


FIGURE 3B - TYPICAL ROOF EDGE WOOD BLOCKING - SCREW FASTENER ANCHORAGE

1/12" = 1'-0"

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NOTES:

1. 3/4" Ø ANCHOR BOLTS @ 48" O.C.
2. AT 8'-0" CORNERS: FASTENING DOUBLED (24" O.C. MAX)

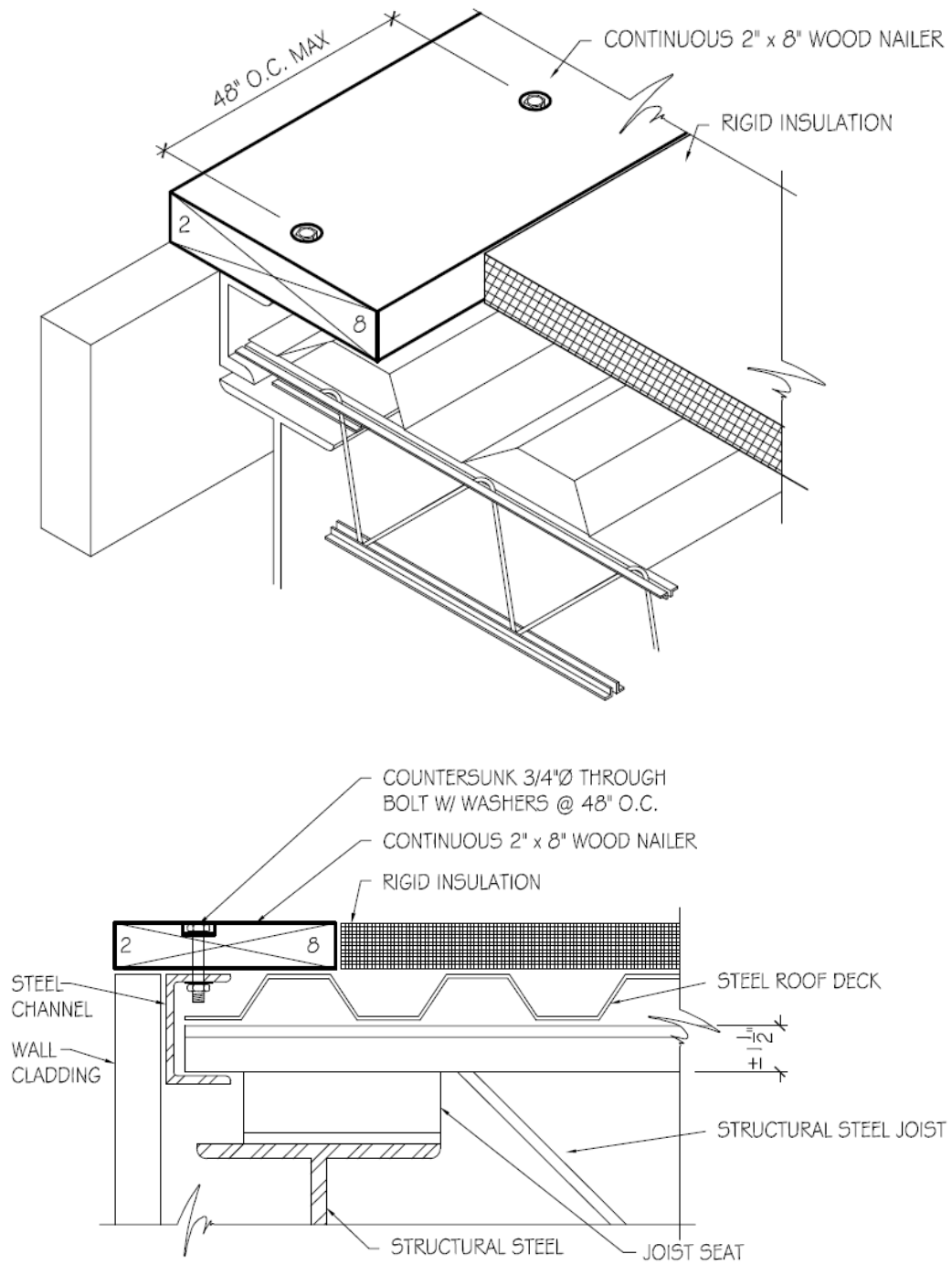


FIGURE 4 - ROOF EDGE WOOD BLOCKING - THROUGH BOLT ANCHORS

NOTES:

1. AT 8'-0" CORNERS, FASTENERS DOUBLED (12" O.C. IN EACH ROW).

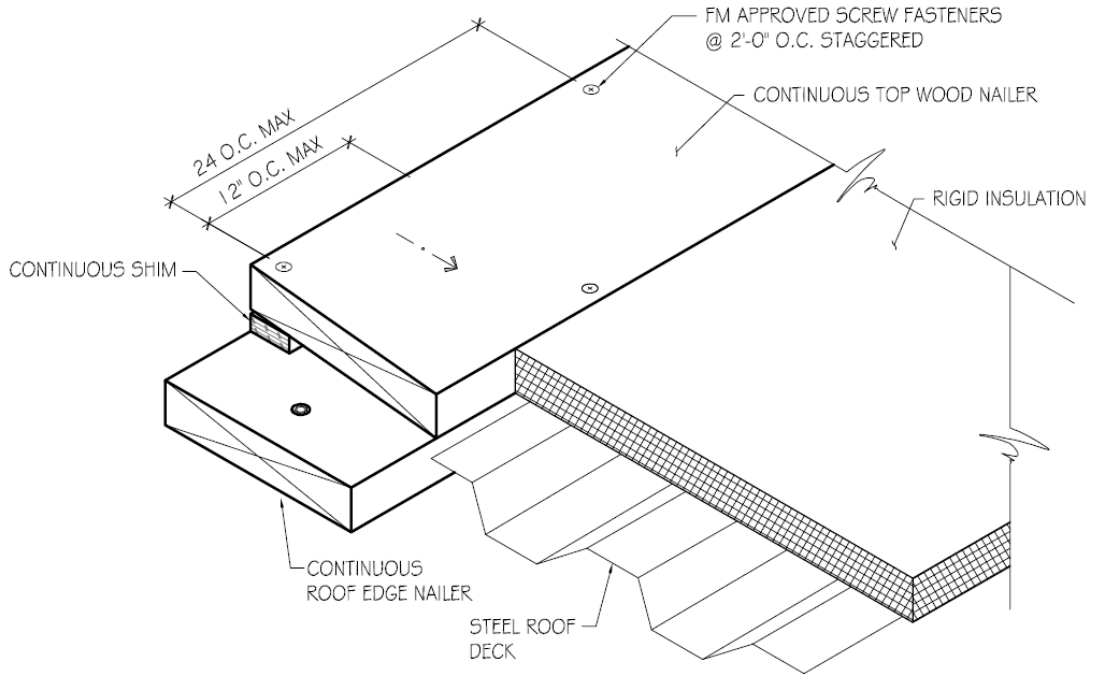


FIGURE 5

STEEL WOOD DECK SCREW FASTENERS AS FOLLOWS:

- 2 x 4 - 2 SCREW FASTENERS
- 2 x 6 - 3 SCREW FASTENERS
- 2 x 8 - 4 SCREW FASTENERS

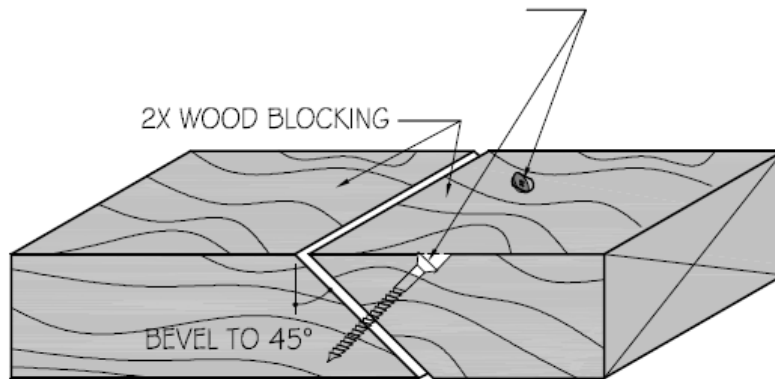


FIGURE 6 - MITERED WOOD JOINT DETAIL

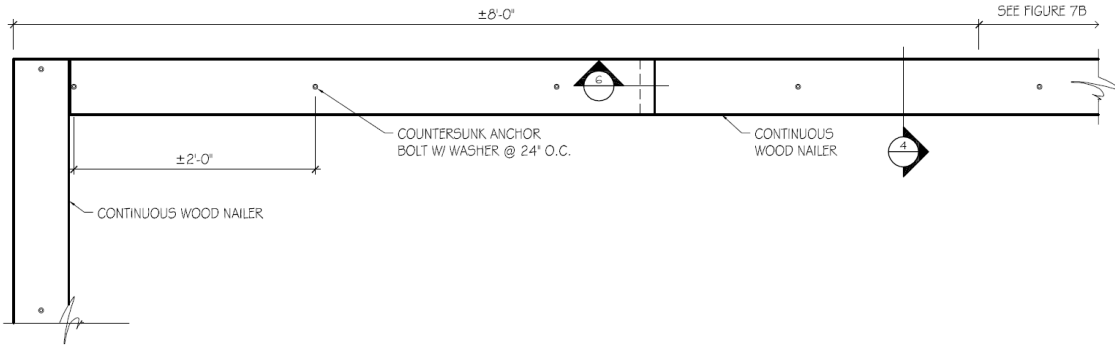


FIGURE 7A - ROOF EDGE WOOD BLOCKING @ CORNER - THROUGH BOLT ANCHORAGE 8'-0" FROM CORNER

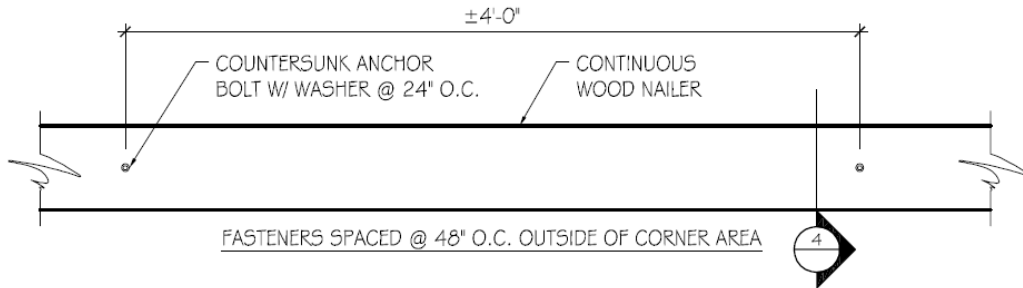


FIGURE 7B - TYPICAL ROOF EDGE WOOD BLOCKING - THROUGH BOLT ANCHORAGE

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WEATHERBOND ROOFING SYSTEMS

DR-09-11

Considerations for Hail Design

January 2024

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The map below (Figure 1) depicts areas of the United States that are more prone to hail storms. In areas of potential hail, the use of a thicker roofing membrane is recommended to provide greater puncture resistance.

1. Large hail areas may warrant the use of thicker conventional EPDM or TPO membrane in conjunction with a rigid membrane underlayment.
2. To eliminate possible damage of membranes, the substrate below the membrane should be adhered. Insulation fasteners and plates are not recommended for use directly beneath the membrane (except where used for membrane securement).
3. The use PVC membrane is not recommended in Hail Zones greater than 1 inch in diameter, unless specifically approved.

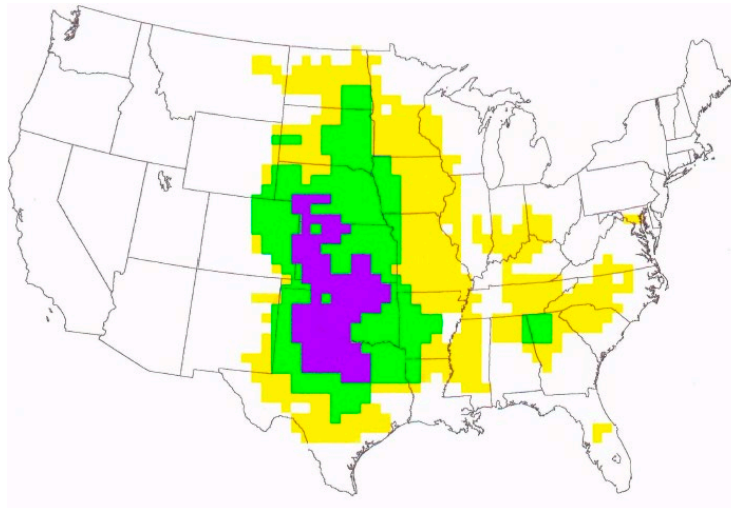





Fig. 1 – U.S. Hail Zone Map

 0.5" – 1.0" Hail

 1.0" – 2.0" Hail

 2.0" – 4.0" Hail

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