

SOUTH CAROLINA SAFE HOME PROGRAM
CONTRACTOR'S RETROFIT MANUAL

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SCSAFEHOME



SOUTH CAROLINA
DEPARTMENT OF INSURANCE

Intent & Purpose

This guide is intended for application in the South Carolina Safe Home Program. Techniques contained within this guide are based on established building retrofit practices developed in conjunction with the Federal Alliance for Safe Homes, Inc. (FLASH®). Code requirements established in the 2018 South Carolina Residential Code for One and Two Family Dwellings are implemented as part of the guide.

Other significant resources have been used in the compilation of this guide including the Federal Emergency Management Agency, Coastal Construction Manual (FEMA P-55), the Federal Emergency Management Agency, Home Builder's Guide to Coastal Construction (FEMA P-499) and the Federal Emergency Management Agency, Wind Retrofit Guide for Residential Buildings (FEMA P-804). These FEMA documents are available free of charge at the FEMA Document & Resource Library (<http://www.fema.gov/resource-document-library>).

The procedures detailed in this guide have been specifically identified as accepted retrofit measures for the South Carolina Safe Home Program. While these measures have been identified by the resources cited as being acceptable for other coastal structures, the scope for this guide is intended specifically for the coastal areas of the State of South Carolina and those participating counties in the South Carolina Safe Home Program.

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A. INTRODUCTION

This document is designed for use in the development and offering of tax credits as required by section 12–6–3660 of the Omnibus Coastal Property Insurance Reform Act of 2007 as amended by Act 28, Section 38-75-470, Code and Laws of South Carolina passed in the 2017-18 session. It is divided into six sections and includes common building considerations and detailed information of the following mitigation techniques:

1. Roof deck attachment
2. Secondary water barrier
3. Roof coverings
4. Gable end bracing
5. Reinforcing roof-to-wall connections
6. Opening protection for windows, exterior doors, garage doors, and skylights

Each of the above items is described in detail to allow the homeowner, contractor, and inspector to determine the correct products to be used and the procedures for completing each mitigation technique. The use of products and installation procedures deemed acceptable to the local building official is mandatory for this program. Securing permits and obtaining all necessary inspections are also mandatory requirements of this program.

Building officials may approve the use of products and techniques after reviewing documentation such as testing and/or evaluation reports from a source they deem appropriate. For example, at their option, the building official may approve products based on evaluation reports produced by one of the following:

- ICC Evaluation Service, (http://www.icc-es.org/Evaluation_Reports/index.shtml)
- Miami-Dade County Product Approval (http://www.miamidade.gov/buildingcode/pc-search_app.asp).

SC Safe Home does not approve products to be used for retrofits. All impact rated products must meet the ASTM E 1886 & ASTM E 1996 impact testing standards. Asphalt shingles must be H-rated and any other roof covering must be installed as per the manufacturer's specifications for high-wind. In all cases where this manual does not specify an exact code-plus construction/installation technique we rely on the most recently adopted version of the building code and the authority of the local building official in whose jurisdiction the retrofit is being completed.

In all cases, products used in the above mitigation techniques must meet the minimum requirements of the South Carolina Building and South Carolina Residential Codes and those outlined in this document. The product's manufacturer frequently provides specific installation instructions and requirements for their specific product(s). If there is a conflict between this document and specific product installation instructions, the **manufacturer's instructions shall prevail**.

The following pages of this document contain a checklist to be completed by the homeowner, contractor, or inspector to certify their retrofits were completed and completed in accordance with these instructions.

Additionally, the individual certifying the retrofits were completed must certify that the fortification measure is not simply a repair or replacement of an existing item, but that the retrofits increase the residence's resistance to hurricane or catastrophic windstorm event damage.

CHECKLIST FOR COMPLETED WORK

1. Roof deck attachment was completed in accordance with the South Carolina resource document.

Printed Name

Signature

Date Completed

2. Secondary water barrier was installed in accordance with the South Carolina resource document.

Printed Name

Signature

Date Completed

3. Roof coverings were installed in accordance with the South Carolina resource document.

Printed Name

Signature

Date Completed

4. Gable end bracing was installed in accordance with the South Carolina resource document.

Printed Name

Signature

Date Completed

5. Roof-to-wall connections were strengthened in accordance with the South Carolina resource document.

Printed Name

Signature

Date Completed

6. Opening protection for the following items was installed in accordance with the South Carolina resource document:

- a. Windows
- b. Doors with glass
- c. Doors without glass
- d. Garage door
- e. Skylights

7. The retrofits completed were not just a repair or replacement of an existing item; the retrofits will increase the residence's resistance to hurricane, rising floodwater, or catastrophic windstorm event damage.

Printed Name

Signature

Date Completed

B. ROOF DECK ATTACHMENT

The roof deck attachment has been recognized as an important factor in maintaining structural integrity of a home during a high wind event. Traditionally, the sheathing used, either plywood or Oriented Strand Board (OSB) was attached only with a rudimentary nailing schedule. Often times this would result in nails being spaced at 12" on center (o.c.) throughout both the field and edges of the roof sheathing panel. A nailing pattern of this schedule results in only five nails being utilized in the width of a 48" wide panel. Staples were sometimes used in place of nails. Damage assessments conducted after storm events have shown that this nailing schedule is not strong enough to withstand wind forces on the roof sheathing and staples did not provide the necessary surface area the head of a nail can provide to secure the panel. Using the knowledge gained from these post-storm analyses, the enhancement of the roof deck attachment of existing homes has been determined to be a viable technique of mitigation,

For the South Carolina Safe Home Program, when a home is being upgraded as part of the Program and the roof covering is removed and replaced, the following procedure shall be performed if needed according to the nailing patterns detailed in Table B-1.

- A. Fastening shall be in accordance with steps B or C as appropriate for the existing construction. 8d ring shank nails shall be a minimum of 0.113 inch in diameter and shall be a minimum of 2 3/8" long to qualify for the provision of this section for existing nails regardless of head shape or head diameter. **Note: Clipped head nails are not accepted.**
- B. Roof decking consisting of sawn lumber or wood planks up to 12" wide and secured with at least two nails (minimum size 8d) to each roof framing member it crosses shall be deemed to be sufficiently connected. Sawn lumber or wood plank decking secured with smaller fasteners than 8d nails or with fewer than two nails (minimum size 8d) to each framing member it crosses shall be deemed sufficiently connected if fasteners are added such that two round head, or ring shank nails (minimum size 8d) are in place on each framing member it crosses.
- C. For roof decking consisting of wood structural panels, fasteners and spacing required on columns 3 and 4 of Table B-1 are deemed to comply with the requirements of the South Carolina Safe Home Program for the indicated design wind speed range. Wood structural panel connections retrofitted with a two part urethane based closed cell adhesive sprayed onto the joint between the sheathing and framing members are deemed to comply with the requirements of the South Carolina Safe Home Program, provided testing using the manufacturer's recommended application on panels connected with 6d smooth shank nails at no more than a 6 inch edge and 12 inch field spacing demonstrate an uplift resistance of a minimum of 200 psf.

TABLE B-1

Supplement Fasteners at Panel Edges and Intermediate Framing

Existing Fasteners	Existing Spacing	Wind Speed 115 mph or Less Supplemental Fastener Spacing Shall be no Greater Than	Wind Speed 115 mph or Greater Supplemental Fastener Spacing Shall be no Greater Than
Staples or 6d	Any	6" o.c. (a)	4" o.c. (a)
8d Clipped Head, Round Head, Smooth or Ring Shank	6" o.c. or Less	None Necessary	None Necessary
8d Clipped Head, Round Head, Smooth or Ring Shank	Greater than 6" o.c.	6" o.c. (b)	4" o.c. (b)

(a) Maximum spacing determined based on supplemental fasteners only.

(b) Maximum spacing determined based on existing fasteners and supplemental fasteners.

Supplemental fasteners as required by Table B-1 shall be 8d ring shank nails with round heads and the following minimum dimensions:

1. 0.113 inch nominal shank diameter
2. Ring diameter a minimum of 0.012 inch greater than shank diameter
3. 16 to 20 rings per inch
4. A minimum 0.280 inch full round head diameter
5. Ring shank to extend a minimum of 1½" from the tip of the nail
6. Minimum 2 3/8" nail length

Note: Clipped head nails are not accepted.

Roof Deck Attachment Alternate Method Spray Polyurethane Foam (SPF) Adhesive

Typically, the enhancement of the roof deck attachment takes place upon the removal of the existing roof covering (shingles, tile, etc). As was mentioned, additional nails are driven to supplement the existing fasteners used to secure the roof sheathing. However, there does exist some instances whereby the roof covering is not being removed yet an enhancement to the roof deck attachment is still desirable. In this situation, the application of spray polyurethane foam (SPF) adhesive is a viable alternative means of mitigation.

Applying SPF adhesive to the underside of the roof deck at the joints between roof sheathing panels and along all intersections between the roof deck and framing members as shown in the photograph below can achieve two purposes.

1. The connection between the roof deck and supporting structural members is enhanced, which increases the ability of the roof deck to resist uplift during high-wind events.
2. The SPF adhesive seals the joints of the roof deck to help prevent water intrusion. While not as effective as installing a secondary water barrier to the topside of the roof sheathing, the SPF adhesive can minimize water infiltration that can occur from a loss of roof covering during a wind event.



*FEMA Wind Retrofit
Guide for Residential
Buildings
(FEMA P-804)*

Some special considerations must be given when using SPF adhesive.

1. The SPF product selected should be one that has been successfully tested in accordance with Testing Application Standard (TAS) 202-94, Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure (ICC, 1994). The SPF should also meet ASTM 02842, ASTM 02126, ASTM E96, ASTM D1621, ASTM D1623, ASTM C273, and ASTM C2856.
2. Design uplift pressure for the SPF should be equal to or greater than 110 pounds per square foot (psf).
3. The product should also be a two-component SPF system that complies with ASTM D1622, *Standard Test Method for Apparent Density of Rigid Cellular Plastics*.

SPF requires specialized equipment for application. Personal Protective Equipment (PPE) must be worn at all times during installation particularly in the confined space of the attic area. Usage of it should only be performed by trained individuals familiar with the product and application process.

C. SECONDARY WATER BARRIER

A Secondary Water Barrier is a backup system to prevent water intrusion (through the joints in the roof decking) into the home in the event of the primary roof covering and underlayment being blown off during a hurricane.

For the South Carolina Safe Home Program, when a home is being upgraded as part of the Program and the roof covering is removed and replaced, one of the following methods of providing Secondary Water Barrier shall be performed:



*Roof deck joints covered with approved material
Application of underlayment started at lower end of roof deck.*

- (a) All joints in structural panel roof sheathing or decking shall be covered with a minimum 4 inch wide strip of self-adhering polymer modified bitumen tape meeting ASTM D 1970 applied directly to the sheathing or decking. The deck and self adhering polymer modified bitumen tape shall be covered with one of the underlayment systems approved for the particular roof covering to be applied to the roof. See the photograph above.

- (b) The entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970. This can be used on a dimensional lumber deck.



Full Deck coverage = SWB

- (c) An approved self-adhering synthetic underlayment installed in accordance with the manufacturer's installation instructions. No additional underlayment shall be required on top of this sheet. This can be used on a dimensional lumber deck. See Figure C-3.

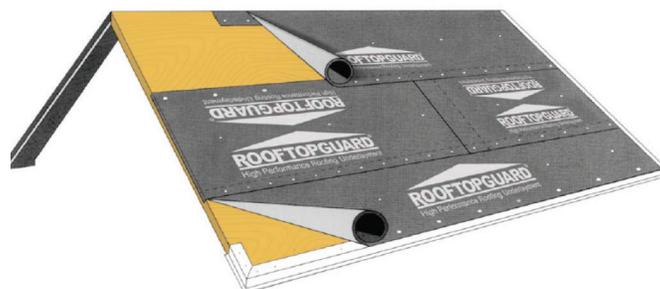
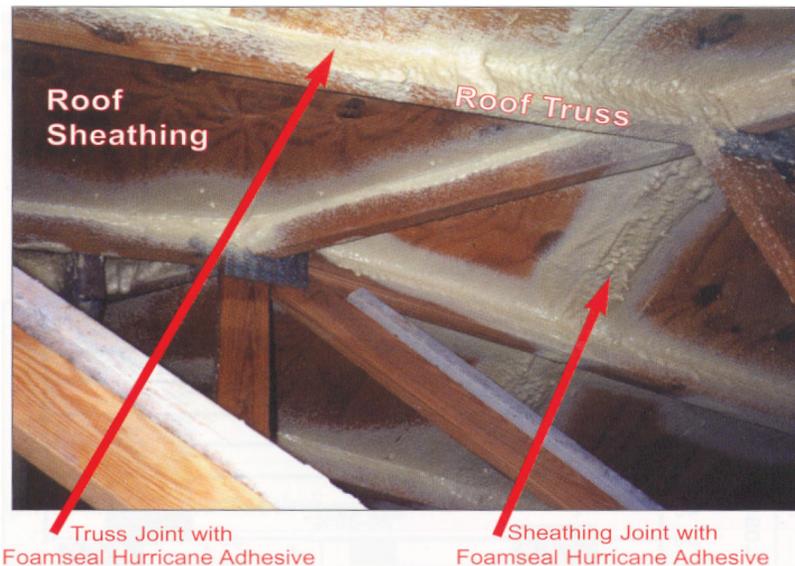


Figure C-3
Example of Synthetic Underlayment

Sealant: Where seams or joints require sealant or adhesive, use only a high quality, low solvent asbestos free plastic roofing cement meeting ASTM D-4586 Type 1 (Asbestos Free), Spec SS-153 Type 1 (Asbestos Free). In areas subject to wind-driven rain where the underlayment will be left exposed to the weather for an extended period of time, seal all seams with a butyl rubber, urethane, or EPDM based caulk or tape sealant.

If any kind of self-adhering material is being considered as the secondary water barrier, including the modified bitumen strips or sheets or the self-adhering underlayment, the type of roof sheathing should be evaluated. Some oriented strand board (OSB) can have a wax coating that can prevent proper adhesion of the modified bitumen to the decking. A test of the adhesive qualities should be made prior to full installation.

- (d) Application of a two-part urethane based closed cell spray-on adhesive to the attic side of the joints between the sheathing shall be deemed to meet the requirements for the secondary water barrier. See photograph below.



Roof deck/truss joint with foam adhesive Sheathing joints with foam adhesive

The same material and safety standards of the SPF adhesive utilized as a roof deck attachment enhancement shall be recognized. These include:

1. The SPF product selected should be one that has been successfully tested in accordance with Testing Application Standard (TAS) 202-94, *Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure* (ICC, 1994). The SPF should also meet ASTM D2842, ASTM D2126, ASTM E96, ASTM D1621, ASTM D1623, ASTM C273, and ASTM C2856.
2. Design uplift pressure for the SPF should be equal to or greater than 110 pounds per square foot (psf).
3. The product should also be a two-component SPF system that complies with ASTM D1622, *Standard Test Method for Apparent Density of Rigid Cellular Plastics*.

SPF requires specialized equipment for application. Personal Protective Equipment (PPE) must be worn at all times during installation particularly in the confined space of the attic area. Usage of it should only be performed by trained individuals familiar with the product and application process.

D. ROOF COVERINGS

Historically, damage to roofing systems has been the leading cause of building performance problems during high wind events. Once the roof system has been compromised and water intrusion begins, resultant damage can quickly become catastrophic.

Within the parameters of the South Carolina Safe Home Program, two distinct roof coverings have been typically used; asphalt shingles and metal roofing. Tile roofs do fall within the parameters of the South Carolina Safe Home Program; however, due to the significantly higher costs, they have not been readily used in the program. If a tile roof is desired, contact should be made with the South Carolina Department of Insurance (SCDOI) and South Carolina Safe Home Program representative to determine the installation parameters and testing standards a tile roof must meet in order to be eligible for the program.

The following two sections cover both asphalt shingles and metal roof coverings.

Roof Coverings – Asphalt Shingles

Two of the most common points of failure with regards to shingle roof coverings are improper installation methods and not using the proper shingle to meet the wind speed rating for the location of the home. Not all shingles are identical even though they may appear to be from a simple visual inspection. It is imperative that the correct rated shingles be used in any re-roof.

When roof coverings are replaced as part of the South Carolina Safe Home Program it is highly recommended that the existing roof deck be examined to determine if the fastening (nails) meet the current building code requirements. If not, it is recommended that the roof deck fastening be upgraded as outlined in Section B of this manual. It is also highly recommended that a Secondary Water Barrier system, described in Section C of this manual, be installed prior to installing the new roof covering.

The two aforementioned processes are only possible upon complete removal of the old roof covering material. New shingles should not be installed as a second layer atop the existing roof as the roof deck cannot be inspected and re-nailed if necessary and a secondary water barrier cannot be installed. While the building code may allow this process of installing a second layer of shingle over an existing layer, it is not an accepted practice in the South Carolina Safe Home Program.

SHINGLE TESTING STANDARDS

In order to assure the proper shingles are being used in the re-roof application, specific testing standards must be met. ASTM D7158 is the standard utilized to measure the wind resistance of asphalt shingles. This test method covers the procedure for calculating the wind resistance of asphalt shingles when applied in accordance with the manufacturer's instructions, and sealed under defined conditions. This standard extends the wind resistance rating system originally employed in ASTM D3161 to higher wind speeds. In addition to the overall rating, this standard has three classes; Class D, G, and H as shown in the table below.

Wind Speed	UL 997 or ASTM D3161	ASTM D7158
60 mph	Class A	–
90 mph	Class D	Class D
110 mph	Class F	–
120 mph	–	Class G
150 mph	–	Class H

It is recommended that for coastal homes being re-roofed as part of the South Carolina Safe Home Program, a Class H shingle should be used.

When evaluating roof shingles, observe the numerous testing standards and material requirements utilized to insure material performance and dependability. If a shingle or roofing component does not indicate it has met the required standard, do not use it!

Unless a local amendment has been adopted to increase the requirements of the Code, the minimum wind resistance of asphalt shingles must meet ASTM D7158 in all areas where the design wind speed equals 110 MPH (3 sec-gust) or greater. Fastening and installation of underlayment must be in accordance with the Code and manufacturer's installation instructions for high wind applications in all areas where the design wind speed equals 110 MPH (3 sec-gust) or greater.

The Asphalt Roofing Manufacturers Association publication *"Asphalt Roofing Residential Manual"*, the South Carolina Building and South Carolina Residential Codes and the manufacturer's installation instructions provide all the required information to install the entire roof covering system to be acceptable for the South Carolina Safe Home Program. Review of the appropriate Codes is recommended:

- Chapter 15 of the 2018 South Carolina Building Code
- Chapter 9 of the 2018 South Carolina Residential Code for One and Two Family Dwellings

Both are available for viewing online at the International Code Council web page:

<https://codes.iccsafe.org/public/collections/south%20carolina>

As aforementioned; improper installation can result in failure of the shingle roof system. It is imperative that the manufacturer's installation instructions be followed precisely. Several different procedures have been established by manufacturers for the installation of eave and rake shingles, starter courses and hip and ridge cap shingles. These processes must be followed not only to insure the successful operation of the roof but to also adhere to the necessary installation requirements to meet the manufacturer's warranty.

Many manufacturer's provide optional installation methods suggested for "high wind" or "coastal locations". These optional items could be anything from additional fasteners, enhanced fastener location or even additional roof sealant to be used to supplement the sealing of the shingles at various locations of the roof which might be subjected to higher wind speeds during a storm event. These optional installation methods must be used and followed precisely as typically within the South Carolina Safe Home Program, the homes being retrofitted are indeed coastal locations and subject to higher winds.

While these optional installation steps may seem as "overkill" or too much extra work, taking these extra measures can be critical to the wind resistance of the roof. These additional measures, which have all been tested by the shingle manufacturer specifically for their product, could be the difference between a roof surviving or failing during a high wind event.

DRIP EDGE AND FLASHING

When replacing roof coverings, a drip edge should be installed at eaves and gables. Guidance can be found in FEMA 499 Technical Fact Sheet No. 5.2 and in FEMA 55, the Coastal Construction Manual.

Roof Coverings – Metal Roofing

Metal roofing systems typically are available in two distinctive design forms that can sometimes be determined for specific use based on the roof slope of the home.

HYDROSTATIC SYSTEMS

Hydrostatic metal roof systems are designed to resist water infiltration under hydrostatic pressure. These roofs typically have a standing seam design whereby the joint between the panels is elevated above the water plane of the roof. The standing seam has sealant in the form of sealant tape or similar to prevent backup from either an ice dam forming during winter months or water being driven into the seam during a high wind event. Hydrostatic systems can be designed as structural roofing systems to allow the panels to span between purlins or nailers.

HYDROKINETIC SYSTEMS

Hydrokinetic metal roof systems are not designed to resist water intrusion under hydrostatic pressure like a hydrostatic system and therefore require a steep slope roof (greater than 3:12) and an underlayment system acting as a secondary means of prevent water intrusion into the roof plane. Hydrokinetic systems can include those with standing ribs and concealed clips.

Regardless of the exact metal roofing system being used, understanding the intent of its performance is critical to insure supplemental components such as the underlayment are installed properly to act in conjunction with the metal roof. While some metal roofing can be installed directly over an existing shingle roof, this is not recommended as part of the South Carolina Safe Home Program as it prevents the ability to re-nail the roof deck attachment as well as prevents the ability to evaluate the condition of the roof deck to determine if any of the roof sheathing requires replacement.

Metal panel roofing systems and their attachment shall be installed in accordance with the manufacturer's installation instructions and shall provide uplift resistance equal to or greater than the design uplift pressure for the roof based on the site design wind speed and exposure category. The metal panels shall be installed over continuous decking and one of the acceptable sealed roof deck options.

Fundamental fastening and basic installation details for metal roof systems can be found in both the FEMA Coastal Construction Manual as well as FEMA Technical Fact Sheet No. 7.6 Metal Roof Systems in High-Wind Regions which can be found as part of the FEMA Home Builder's Guide to Coastal Construction. While both resources provide fundamental guidance on the installation of metal roofing systems, it is recommended that the metal roof being used be installed in accordance with the manufacturer's installation instructions in lieu of any generalized installation guidance.

TESTING STANDARDS

Metal roofing comes in a variety of available materials such as aluminum, zinc, copper, etc. The International Building Code sets forth the testing standards each of the particular materials used for metal roofing shall meet. Metal sheet roof coverings installed over structural decking shall comply with Table 1507.4.3(1) METAL ROOF COVERINGS of the 2015 South Carolina Building Code.

In addition, corrosion resistance of the respective material must meet TABLE 1507.4.3(2) MINIMUM CORROSION RESISTANCE.

E. GABLE END BRACING

There are many instances of gable end failures. This is due to the large flat plane of the gable wall having to resist the direct forces of the wind. Gable end walls are particularly vulnerable to damage in high-wind events due to their structural configuration. Loads created by high winds can quickly exceed the capacity of older gable end walls.

In its unbraced condition, a gable end can fail in one of three modes as described below. An accompanying picture illustrates each mode of failure.



The loss of roof sheathing from the gable end that results in the gable wall losing its bracing along the top edge. When winds blow against the gable end, they push it towards the interior of the house and push up on the roof overhanging the gable end. At the same time the wind flowing over the top of the roof creates large negative pressures (uplift) on the roof sheathing.

As can be seen from the photograph, the gable end; in this instance an engineered truss, has fallen outward after the top connection made by way of the roof sheathing has failed.



Failure at the connection where the lower portion of the gable section meets the wall below.

Notice in the photograph above how the bottom of the gable and the top of the wall below it have moved out of plumb towards the exterior of the structure.



The third mode of failure is the actual framing members that make up the gable end wall structure. In many houses, these members are the structural members of the end roof truss. Consequently, the 2x4 lumber members are bent by wind forces applied to the wide-flat-part of the 2x4s – the direction in which they are the weakest.

As can be seen in the above photograph, the structural components that made up the gable end wall have failed and been pushed inward by the force of the wind.

RETROFIT BRACING

The taller the gable end, the greater the risk of damage in a hurricane. For gable ends that are less than 4-feet tall, the forces applied by a 140 mph wind gust along the top and bottom edges of the gable end wall will be less than 100 pounds per foot of gable width. Most nailed connections will withstand these forces. In addition, if the gable end is less than about 4-feet tall, it will be difficult for a worker to access the gable end to perform the necessary retrofit work from inside the attic.

Gable end walls on rooms with vaulted or cathedral ceilings pose special problems for retrofitting. Being there is often no easily accessible attic area, there is no access for installing any means of bracing. Cathedral or vaulted ceilings will require the design input of an architect or engineer to provide a suitable solution for the retrofit.

Retrofitting gable ends to brace the walls entails **two specific activities**.

- 1. Strengthening and bracing the gable end** which involves making the triangular shape end wall stronger and anchoring this wall to the roof and ceiling structure.
- 2. Strengthening the wall-to-wall connection** which involves connecting the gable end wall to the exterior wall below.



Photograph of completed gable end retrofit – the light colored wood is the lumber added during the retrofit activity

While these are the fundamental aspects of the retrofit, a specific process must be followed to insure all the specific retrofit components are installed in both the required location as well as in the proper sequence. Fortunately, the 2018 South Carolina Existing Building Code contains all the necessary procedures to successfully complete the retrofit process.

When performing gable end retrofits in the attic area, care must be taken so as not to cause any damage to the home. Walking surfaces can be treacherous so individuals should use caution.

THE BUILDING CODE

The 2018 South Carolina Existing Building Code contains significant information and guidance related to the retrofit of gable endwalls. This information can be found in **Appendix C, Chapter C1 - Gable End Retrofit for High-Wind Areas**.

The scope of the retrofits intended for the South Carolina Safe Home Program coincides with the intent of Chapter C1 of the code.

C101

General details the purpose, eligible buildings, and gable end walls and compliance for usage of this section.

The code continues with Section C104 whereby a complete descriptive methodology is provided for the proper retrofits of gable ends. This includes **[BS] FIGURE C104.1.1 BASIC GABLE END RETROFIT METHODOLOGY** which provides a graphic depiction of the fundamentals of the retrofit process including the numbered sequence for the process.

SECTION C104 RETROFITTING GABLE END WALLS TO ENHANCE WIND RESISTANCE

[B] C104.1 General.

These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end construction for out-of-plane wind loads resulting from high-wind events. The ceiling diaphragm shall be comprised of minimum ½" thick (13 mm) gypsum board, minimum nominal 3/8-inch-thick (10 mm) wood structural panels, or plaster. An overview isometric drawing of one type of gable end retrofit to improve wind resistance is shown in Figure C104.1.1.

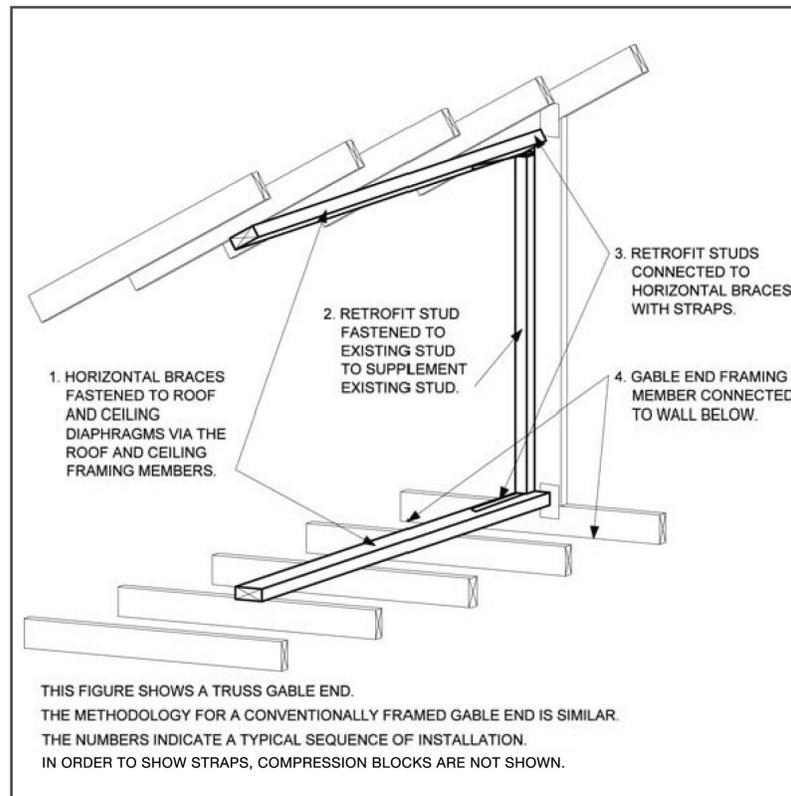


Figure C-104.1.1

It is recommended to use approved screws as fasteners as opposed to nails as the impact from nailing framing members could result in damage to the plaster or drywall ceiling below.

The above excerpts from the 2018 South Carolina Existing Building Code detail the initial intent of the code section and provide the beginning rationale for gable end retrofits. The complete detailed procedure including illustrations and fastening schedules can be found at the following link: <https://codes.iccsafe.org/public/chapter/content/7321/>

Working in an attic can be difficult and dangerous as it is a confined space. In addition, the heat at most times of the year can become a major obstacle to retrofitting gable ends and working in the attic area. Individuals should use caution when working in attic spaces.

F. REINFORCING ROOF-TO-WALL CONNECTIONS

The connection between the roof-to-wall is one of the major components of establishing a continuous load path. Traditionally, this connection was made by toe-nailing the roof framing members to the top of the wall with common framing nails. Research has shown that the simple nailing connection is not sufficient to maintain the roof integrity under the extreme uplift forces during high wind events.

The connection between the roof and load-bearing walls must be capable of transferring design loads corresponding to the design wind speed for the location of the home. This connection is critical for both hip and gable roof homes. However, the gable end wall roof connection is of utmost concern as was discussed in the gable end wall retrofit section. Roof-to-wall connections in any roof geometry must be able to resist both uplift and lateral forces imposed upon them simultaneously.

FUNDAMENTAL REQUIREMENTS

The intersection of roof framing members with the wall below shall provide sufficient resistance to meet the uplift loads specified in Table F-1 either because of existing conditions or through retrofit measures. As an alternative to an engineered design, these prescriptive retrofit solutions provided in Sections A through F shall be accepted as meeting the roof-to-wall retrofit requirements. **Installation of roof to wall connectors is required when re-roofing.**

EXCEPTION:

1. Where it can be demonstrated (by code adoption date documentation and permit issuance date) that roof-to-wall connections and/or roof-to-foundation meets load path requirements of the South Carolina Building Code.

A. Access for Retrofitting Roof-to-Wall Connections. These methods are not intended to limit the means for gaining access to the structural elements of the roof and wall for the purposes of retrofitting the connection. The retrofit of roof-to-wall connections can be made by access through the area under the eave, from above through the roof, or from the interior of the house. Methods for access also include removal of roof panels or sections thereof or removal of portions of roof paneling at selected locations large enough for access, viewing, and installing the retrofit connectors and fasteners.

Where panels or sections are removed, the removed portions shall not be reused. New paneling shall be used and fastened with nails described below:

8d ring shank nails with round heads and the following minimum dimensions:

1. 0.113 inch nominal shank diameter
2. Ring diameter a minimum of 0.012 inch greater than shank diameter
3. 16 to 20 rings per inch
4. A minimum 0.280 inch full round head diameter
5. Ring shank to extend a minimum of 1½" from the tip of the nail
6. Minimum 2 3/8' nail length

If partial roof panels are removed (access holes are cut in the deck) the holes shall be deemed adequately repaired if a patch of paneling is installed with no gap greater than ½" between the patch and the existing sheathing and if the patch is supported using one of the following methods:

- (a) Solid 1½" lumber shall fully support the patch and shall be secured to the existing sheathing with #8 by 1¼" screws spaced a minimum of 3" around the perimeter with screws a minimum of ¾" inch from the near edge of the hole. The patch shall be secured to the lumber with #8 x 1¼" screws spaced on a grid not greater than 6 inches by 6 inches with no fewer 2 screws.
- (b) Holes that extend horizontally from roof framing member to adjacent roofing framing member that are less than or equal to 7" wide along the slope of the roof shall be supported by minimum of 2x4 lumber whose face is attached to each roofing framing members using a minimum of 2 each 3-inch long fasteners (#8 screws or 10d common nails) connecting the two. The patch shall have attached to its bottom running horizontally a minimum of 2x4 either flat wise or on edge secured with #8 x 1¼" screws a maximum of 4 inches on center and no more distant from the end of the added lumber than 3 inches. The patch shall be secured with two #8 x 1¼" screws to each support member.

B. Partially Inaccessible Straps: Where part of an existing strap is inaccessible and if the portion of the strap that is observed is fastened in compliance with these requirements, the inaccessible portion of the strap shall be presumed to comply with these requirements.

C. Prescriptive Method for Gable Roofs on a Wood Frame Wall. At a minimum, the anchorage of each of the exposed rafters or truss within 6 feet of the corner along the exterior wall on each side of each gable end shall be inspected. Wherever a strap is missing or an existing strap has fewer than three fasteners on each end, approved straps, ties or right angle brackets with a minimum uplift capacity of 500 lbs shall be installed that connect each rafter or truss to the top plate below. Adding fasteners to existing straps shall be allowed in lieu of adding a new strap provided the strap is manufactured to accommodate at least 4 fasteners at each end. Wherever access makes it possible (without damage of the wall or soffit finishes), both top plate members shall be connected to the stud below using a stud to plate connector with a minimum uplift capacity of 500 lbs. Use of straps that connect directly from the rafter or truss to the wall stud below shall be allowed as an alternate provided the two members align with no more than 1½" offset.

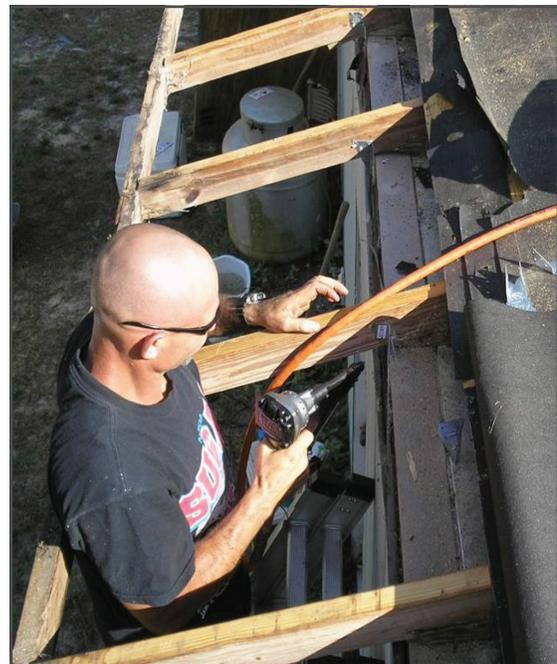
D. Prescriptive method for gable roofs on a masonry wall. At a minimum, the anchorage of each of the exposed rafters or truss within 6 ft of the corner along the exterior wall on each side of each gable end shall be inspected. Wherever a strap is missing or an existing strap has fewer than four fasteners on each end, approved straps, ties or right angle gusset brackets with a minimum uplift capacity of 500 lbs shall be installed that connect each rafter or truss to the top plate below or directly to the masonry wall using approved masonry screws that will provide at least a 2½" embedment into the concrete or masonry. When the straps or right angle gusset brackets are attached to a wood sill plate, the sill plate shall be anchored to the concrete masonry wall below. This anchorage shall be accomplished by installing ¼" diameter masonry screws, each with supplementary ¼" washer, having sufficient length to develop a 2½" embedment into the concrete and masonry. These screws shall be installed within 4 inches of the truss or rafter on both sides of each interior rafter or truss and on the accessible wall side of the gable end truss or rafter.

E. Prescriptive method for hip roofs on a wood frame wall. Unless it is possible to verify through non-destructive inspection or from plans prepared by a design professional that the roof structure is anchored at least as well as outlined below, access shall be provided at a minimum to the hip rafter (commonly known as a “king jack”), to the hip girder and at each corner of the hip roof. The hip rafter, the hip girder and the rafters/trusses adjacent to the hip girder that are not anchored with a strap having at least four fasteners on each end, shall be connected to the top plate below using a strap or a right angle gusset bracket having a minimum uplift capacity of 500 lbs. Adding fasteners to existing straps shall be allowed in lieu of adding a new strap provided the strap is manufactured to accommodate at least 4 fasteners at each end. Wherever access makes it possible (without damage of the wall or soffit finishes), both top plate members shall be connected to the stud below using a stud to plate connector with a minimum uplift capacity of 500 lbs. Use of straps that connect directly from the hip rafter, hip girder or adjacent rafters/trusses to the wall stud below shall be allowed as an alternate provided the two members align with no more than 1½" offset.

F. Prescriptive method for hip roofs on a masonry wall. Unless it is possible to verify through non-destructive inspection or from plans prepared by a design professional that the roof structure is anchored at least as well as outlined below, access shall be provided at a minimum to the hip rafter (commonly known as a “king jack”), to the hip girder and at each corner of the hip roof. The hip rafter, the hip girder and the rafters/trusses adjacent to the hip girder that are not anchored with a strap having at least four fasteners on each end, shall be connected to the concrete masonry wall below using approved straps or right angle gusset brackets with a minimum uplift capacity of 500 lbs. Adding fasteners to existing straps shall be allowed in lieu of adding a new strap provided the strap is manufactured to accommodate at least 4 fasteners at each end. The straps or right angle gusset brackets shall be installed such that they connect each rafter or truss to the top plate below or directly to the masonry wall using approved masonry screws that will provide at least a 2½" embedment into the concrete or masonry. When the straps or right angle gusset brackets are attached to a wood sill plate, the sill plate shall be anchored to the concrete masonry wall below. This anchorage shall be accomplished by installing ¼" diameter masonry screws, each with supplementary ¼" washer, with sufficient length to develop a 2½" embedment into the concrete and masonry. These screws shall be installed within 4 inches of the truss or rafter on both sides of each interior rafter or truss and on the accessible wall side of the gable end truss or rafter.

G. Priorities for mandated roof-to-wall retrofit expenditures. Priority shall be given to connecting the exterior corners of roofs to walls where the spans of the roofing members are greatest. For houses with both hip and gable roof ends, the priority shall be to retrofit the gable end roof-to-wall connections unless the width of the hip end is more than 1.5 times greater than the width of the gable end.

Figure F-1



Adding fasteners to existing house after removing roof sheathing.

The roof-to-wall connection can be one of the most difficult retrofits to perform due to accessibility to where the connectors must be installed. Proper planning and project coordination is necessary when performing this retrofit based on the method of access to be utilized.

Table F-1
Required Uplift Capacities For Roof-To-Wall Connections
(Pounds Per Linear Foot)

	BASIC WIND SPEED	ROOF SPAN (FEET)							OVERHANGS
		12	20	24	28	32	36	40	
Within 6' of Building Corner	85	-69.85	-116.42	-139.70	-162.99	-186.27	-209.55	-232.84	-27
	90	-82.67	-137.78	-165.34	-192.90	-220.45	-248.01	-275.57	-30.3
	100	-110.51	-184.18	-221.01	-257.85	-294.68	-331.52	-368.36	-37.4
	110	-141.27	-235.45	-282.55	-329.64	-376.73	-423.82	-470.91	-45.3
	120	-174.97	-291.62	-349.94	-408.26	-466.59	-524.91	-583.23	-53.9
	130	-211.60	-352.66	-423.19	-493.72	-564.26	-634.79	-705.32	-63.2
	140	-251.15	-418.59	-502.31	-586.02	-669.74	-753.46	-837.18	-73.3
	150	-293.64	-489.40	-587.28	-685.16	-783.04	-880.92	-978.80	-84.2
	170	-387.40	-645.67	-774.81	-903.94	-1033.08	-1162.21	-1291.35	-108
Greater than 6' of Building Corner	85	-39.10	-65.17	-78.20	-91.24	-104.27	-117.30	-130.34	-27
	90	-48.20	-80.33	-96.39	-112.46	128.52	-144.59	-160.66	-30.3
	100	-67.95	-113.24	-135.89	-158.54	181.19	-203.84	-226.49	-37.4
	110	-89.78	-149.63	-179.55	-209.48	-239.40	-269.33	-299.25	-45.3
	120	-113.68	-189.47	-227.37	-265.26	-303.16	-341.05	-378.94	-53.9
	130	-139.67	-232.78	-279.34	-325.90	-372.45	-419.01	-465.57	-63.2
	140	-167.74	-279.56	-335.47	-391.38	-447.29	-503.21	-559.12	-73.3
	150	-197.88	-329.80	-395.76	-461.72	-527.68	-593.64	-659.60	-84.2
	170	-264.41	-440.68	-528.81	-616.95	-705.08	-793.22	-881.35	-108

Footnotes:

- a. The required capacities are pounds per lineal foot of building length. For roof framing spaced at 16 inches on center multiply table values by 1.33. For roof framing spaced at 24 inches on center multiply table values by 2.
- b. The required capacities include an allowance for 10 pounds of dead load.
- c. The required capacities do not account for the effects of overhangs. The overhang loads given shall be multiplied by the overhang projection and added to the required capacities in the table.

G. OPENING PROTECTION

Overview

The protection of the openings in a home is recognized as one of the most important retrofits that can be made to increase the home's resistance against high wind events. Securing the openings in the building envelope achieves two aspects including keeping wind-blown rain from entering the home as well as preventing the home from being pressurized by the wind should an opening be breached.

It is important to understand that when protecting the openings in a home's building envelope, ALL the openings must be protected in order to achieve a complete level of protection. This includes not only windows and doors but skylights and garage doors. Any large vents or openings that penetrate the building envelope for other purposes must also be considered.

Several options exist for protecting the home's exterior openings (windows, doors, skylights and garage doors) from windborne debris damage. Frequently these options are divided into two categories:

1. Permanently installed systems such as:
 - a. Impact rated windows, doors, garage doors and skylights
 - b. Shutters: roll, both metal and fabric, accordion, colonial, and bahama
2. Temporarily installed products - those that are deployed only when a storm threatens:
 - a. Storm panels - aluminum, steel and polycarbonate
 - b. Screen/fabric products
 - c. Structural wood (plywood or OSB) panels

Ease of use and initial cost are the two most common factors in determining which product(s) will be used. It is important to note that all opening protection products to be used must meet the requirements of the International Building Code.

NOTE: Plywood or OSB panels to be used as shutters are NOT accepted as part of the South Carolina Safe Home Program.

The 2018 South Carolina Residential Code for One and Two Family Dwellings requires:

R301.2.1.2 Protection of Openings.

Exterior glazing in buildings located in windborne debris regions shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 as modified in Section 301.2.1.2.1. Garage door glazed opening protection for windborne debris shall meet the requirements of an *approved* impact-resisting standard or ANSI/DASMA 115.

The Building Official may elect to allow the use of products tested in accordance with test standards other than ASTM E 1886 and E 1996. Some of these other standards are: TAS-201 and 203 or PA 201 and 203.

The FEMA Coastal Construction Manual also suggests window, skylight and door products should be tested to demonstrate compliance with ASTM E1233 for applicable design pressures related to cyclical wind loads.

Permanently installed impact resistant windows, doors and skylights generally cost more than other products and are always in place, thus requiring little to no homeowner action when a storm threatens. Roll, Accordion, Colonial and Bahama Shutters cost somewhat less than impact rated products but do require “deployment” in the event of a storm.

Temporary products such as storm panels are typically the least costly. Consideration for these can include cost but also storage when the item is not being used on the home. Other important factors in determining which product to use are accessibility of the opening to be protected and the capability of the homeowner to deploy the product. A second floor window, for example, may require the use of a ladder to deploy a “temporarily installed” product. In this case and in other ‘hard to reach’ situations the use of a permanently installed product should be considered.

H. PERMANENTLY INSTALLED SYSTEMS

Impact Rated Products

New building codes identify specific windborne debris areas - those areas which are prone to intense winds related to hurricanes and other high wind events. Generally, the design wind speed in these areas is equal to or greater than 120 mph which typically relates to their proximity to the coast, hence the participation in the South Carolina Safe Home Program.

Windows, doors, skylights, and garage doors installed in these areas must meet certain wind and impact test requirements to satisfy stringent hurricane provisions. As mentioned, the International Building Code indicates these requirements as well as the recommended additional testing standards identified in the FEMA Coastal Construction Manual.

WINDOWS

When wind speeds reach hurricane force, impact resistant windows will provide protection from flying debris that can break ordinary window panes. Impact rated windows use a combination of structural systems, anchors and impact rated glass to pass rigorous wind pressure, cyclic pressure differential and windborne debris impact tests. These are testing assemblies of all the combined components. They are not just impact rated glass in a non-impacted rated frame.

It is the contractor's responsibility to insure any local architectural or historical standards are met prior to the ordering of materials and installation.

These impact rated windows are available in a variety of types, styles and architectural shapes. Options include, but are not limited to, casement, single-hung and picture windows. The type of window chosen will often depend on the homeowner's preferences; however, local architectural and historic building standards may be a consideration in some areas.

Choosing the correct window involves determining the Design Pressure (DP) requirements for the specific building in question. Generally, this will require the services of a qualified architect or professional engineer. Installation of impact rated windows into an existing home requires careful assessment of the existing structural opening to determine the correct methods for installing the windows. Once the desired window type, size and shape are determined, the designer must provide instructions to the contractor detailing how to prepare the opening for the new windows. Each manufacturer provides specific installation instructions. Installation instructions provided by the manufacturer may also be found within the Product Approval documents.

The manufacturer's installation instructions for the specific brand and model of window being used are the final determination document for the proper installation of the product.

Building Considerations:

Several factors must be considered to assure windows are properly installed:

1. Type of window to be installed
 - a. Aluminum, with fins or without
 - b. Vinyl, with fins or without
 - c. Wood
2. Egress requirements of the Building Code
3. Structure into which the anchors will be installed
 - a. Wood
 - b. Hollow concrete block
 - c. Solid concrete block and solid concrete
4. Rough opening size
 - a. Existing condition
 - b. Required for new windows
5. Water intrusion protection from the interface between the window and structure
 - a. Proper sealants – used as specified by manufacturer
 - b. Proper flashing materials – installed correctly

Documents provided by the Fenestration Manufacturers Association (FMA) and the American Architectural Manufacturers Association (AAMA) shall be followed for all window installations. FMA/AAMA 100-12 (Standard practice for installation of window with flanges or mounting fins in wood frame construction for extreme wind/water conditions) and FMA/AAMA 200-12 (Standard practice for installation of window with frontal flanges for surface barrier masonry construction for extreme wind/water conditions).

It is important that the contractor prepare the existing opening to receive and support the new windows. Correctly prepared rough openings will conform to the manufacturer's recommended clearance around the window and have the required structure to support the new window. The exact fasteners; both type and size should be used to install the window. Particular attention should also be made for large gaps around the window between the frame and structural opening that could allow for wind driven rain to penetrate inside the building envelope.

Proper flashing around the building opening prior to and during the window installation is also critical. The manufacturer of the window typically provides instruction for the proper flashing procedure including what material to use and how it should be installed in conjunction with their window product. These instructions must be followed precisely to insure a properly sealed and structurally strong window installation.

DOORS

Construction and installation considerations for doors generally follow those provided above for windows. Choosing the right products is critical and as with windows, there are many different impact rated products available from which to choose. The following sections provide a brief overview of each type of door system available to the homeowner.

Entry Doors

Entry doors can be damaged or forced open by wind pressure and the impact of flying debris. All doors should have a minimum of three hinges and a security lock with a dead bolt at least 1" long. The door framing should be securely anchored to the wall structure. Unless the door is relatively new or it has sticker indicating that it is rated for wind pressure and impact, it is likely that the door is not impact rated. Doors installed in wood frames rarely provide the recommended protection from wind pressure or windborne debris. Wooden doors with raised panels are particularly vulnerable to splitting apart when they are hit by debris.

Doors that are not impact rated can be protected with a code approved wind pressure and impact rated shutter system. However, at least one door must be operable from inside the living space. This is necessary to provide emergency egress or exiting from the building should the need arise. This can be accomplished by using an accordion shutter system that can be operated from the inside or the outside of the house. Consideration should also be given to replacing at least one entry door with one that is code approved for wind pressure and windborne debris impact appropriate for the area. Having an impact rated door removes the need for having to cover the door opening with any kind of shutter and simultaneously meets the need of having the opening protected as well as still allowing for a path of emergency egress. Local building officials can provide any specific code requirements for the area.

Double entry or "French doors" have been particularly susceptible to failure from wind pressure and should have the highest priority for strengthening or shuttering. If there are glass panels in the doors or wood doors with raised panels, the least expensive option will likely be to shutter the door. If the doors are solid, at a minimum, the anchorage of the fixed door should be strengthened. This may be accomplished by adding heavy-duty barrel bolt anchors at the top and bottom of the door. The barrels should extend into the header and floor; not just the threshold and door frame.

Patio Doors

Newer sliding glass doors use tempered glass, which is stronger and safer than regular window glass. However; tempered glass and impact glass are not the same so a false sense of security should not be made just because the patio door is tempered glass.

Tempered glass; while stronger than plate glass, still does not meet the higher standards of impact glass. A good analogy for tempered and impact glass in the home is that of glass in an automobile.

The glass in the side and rear windows is tempered. If it breaks, it does so into many small pieces so as to prevent large shards of glass from injuring the vehicle's passengers. Impact glass is similar to that found in the front windshield of a car. If it does break, it typically remains in place. It will be broken and some small pieces may become dislodged but for the most part it remains together due to the lamination.

If it is tempered glass, a label indicating this will be etched in one of the corners. However, the loss of one of these doors creates a large opening for wind and water to enter. Shuttering the doors is one of the most effective ways to protect them from flying debris and should help reduce water intrusion.

If the doors open onto a porch or lanai, installing code approved impact resistant screen products around the perimeter may be the most cost effective way to protect all the openings for that area.

Garage Doors

While garage doors typically only serve the garage area, they are just as important to maintaining the integrity of the home during a wind event. Having them protected against high wind pressures and resistant against wind borne debris is just as important as protecting any other opening in the building envelope.

Because of their size, garage doors that do not meet the current building code for wind loads, are highly susceptible to damage from wind, including buckling and twisting off the tracks, and damage from debris impact. Failure of the garage door allows the hurricane winds to act on interior walls, doors, ceiling or roof. This frequently leads to failure of these components and can lead to significant damage including loss of the entire roof.

One of the simplest improvements that can be made is to replace the door and its tracks with a door that is code approved for wind pressure. Another solution is to use a door that is approved for both wind pressure and impact protection. Some people choose to protect the garage door with a shutter or screen product that is rated for both wind pressure and debris impact; it should be noted however that wind pressure will build up on the door behind the shutter system and the door could fail from wind pressure, even though shutters are in place.

After market vertical bracing systems alone will not bring an existing garage door up to current building code wind load requirements. They can be effective for supporting the door against wind pressure, however not all existing garage doors can simply be braced and meet current building code requirements. Permanently attached wood members are often fastened to garages for increased strength. However, consideration must be given to changing the weight distribution or balance of the door, which should be addressed by a professional installer.

Building Considerations:

While similar to the window and door considerations, several additional factors are included below to assure doors are properly installed:

1. Type of the door to be installed
 - a. Wind pressure rated
 - b. Wind and impact rated
 - c. With or without glazing
2. Structure into which the anchors will be installed
 - a. Wood
 - b. Hollow concrete block
 - c. Solid concrete block and solid concrete

Testing Standards

According to the 2018 South Carolina Residential Code for One and Two Family Dwellings, garage doors must meet the following requirements.

R609.4 Garage doors.

Garage doors shall be tested in accordance with either ASTM E 330 or ANSI/ DASHMA 108, and shall meet the acceptance criteria of ANSI/DASHMA 108

In addition, the latter part of Section R301.2.1.2 details the testing standard for glazing which may be part of the garage door.

R301.2.1.2 Protection of openings.

Exterior glazing in buildings located in windborne debris regions shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 as modified in Section 301.2.1.2.1. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved-impact-resisting standard or ANSI/DASMA 115.

While effective standards for the rating of garage doors, ASTM E 330 and ANSI/DASMA 108 do not establish test pressures for the units tested. Therefore; certification data must be closely examined to assure the labeled product is appropriate for the design wind pressures necessary for the home's location. This is the contractor's responsibility to do so.

SKYLIGHTS

Most existing skylights on homes in South Carolina are not likely to be impact rated. As no currently effective means exists for shuttering a skylight, replacement of the existing unit is the only option to provide wind-borne debris protection.

If the homeowner is in agreement, the entire skylight can be removed and the opening closed and covered as part of the re-roofing process. While this does eliminate the risk of having the skylight, it will also reduce any illumination that was previously provided so this measure should only be taken with the homeowner's approval and consent.

For the purposes of this program, the skylights are required to be removed and covered over or replaced with impact rated skylights as outlined in the SC Safe Home program guidelines.

Testing Standards

As cited by the FEMA Coastal Construction Manual, skylights are normally specified to comply with AAMA/WDMA/CSA 101/I.S.2/A440, which references ASTM E330 for wind load testing. However, where the basic wind speed is greater than 150 mph; based on ASCE 7-10, it is recommended that design professionals specify that windows and skylights comply with wind load testing in accordance with ASTM E1233. ASTM E1233 is the recommended test method in high-wind areas because it is a cyclic test method, whereas ASTM E330 is a static test. The cyclical test method is more representative of loading conditions in high-wind areas than ASTM E330. Design professionals should also specify the attachment of the window and skylight frames to the wall and roof curb (e.g., type, size, spacing, edge distance of frame fasteners). Curb attachment to the roof deck should also be specified. For design guidance on the attachment of frames, see AAMA TIR-A14 and AAMA 2501.

While the 150 mph threshold may not be surpassed in the coast areas of South Carolina, it is still recommended that these standards be used for both material selection and installation of any new or replacement skylights. As no currently effective means exists for shuttering a skylight, the only protection the skylight opening receives is from the skylight itself. Therefore; achieving high standards with regards to both material and installation methods is most desirable.

As with any other component being installed, adherence to the manufacturer's installation instruction is crucial.

Shutters

GENERAL COMMENTS

Shutters are frequently used because they are permanently installed on the house and very easy to deploy or close, prior to a storm. It should be noted that all shutters are not made the same; while most if not all the slats are aluminum, different designs incorporate different materials for rollers, hardware and other parts used in the assembly of the shutters. It is important to review the materials of construction for different shutters as there are price differences based on these factors. The use of stainless steel in place of plated steel can mean a significant difference in the life of the shutter, especially when near salt water. One very important thing to remember is proper maintenance and lubrication of the roll shutters once they are installed. If not maintained properly, they may be useless when needed because the parts have “frozen” together from corrosion and/or rust.

COMMON BUILDING CONSIDERATIONS

A number of different construction methods are used in home construction; they include wood and metal frame, concrete block, solid concrete and Insulated Concrete Forms (ICF) and other special systems. The two most common types of construction for residential structures are wood frame and concrete block with most of South Carolina’s housing stock being wood frame. The following section describes the most common construction methods and techniques employed and how they influence decisions regarding opening protection choices and options.

Openings in the building structure that are filled with windows or doors are the “openings” being referred to in this document. While in the true sense of the word, they are not “open”, they are openings in the exterior walls and/or roof of the building. Understanding how the openings are constructed will help guide the homeowner and installer with the appropriate choices for installing wind-borne debris protection in or over the openings.

For installation over openings having brick or faux brick exterior wall cladding, it is imperative that the panels be fastened to the structure behind the wall cladding. Opening protection **CANNOT** be attached to brick or faux brick wall cladding. The mounting bolts must have at least the minimum fastener size and length to achieve the required installation strength.

The photos in Figure H1-1 show how various openings are constructed and show the potential options for anchoring shutters.

Figure H1-1



Wood Frame Construction Notes:

- Double 2 x 4s each side of opening = 3 inches wide.
- Header at top of window is 2 x 6, it could be 2 x 4, 6, 8, 10 or 12, depending on the opening width or structure above. See picture below for example.
- Support under window is one 2 x 4 which provides 1½ inches of structure below the window.
- Note the wood panel on one side of the window and insulation board on the other. There is no structure to fasten shutters to more than 3 inches from the inside of the window opening.



Concrete Block Construction Notes:

- Solid concrete lintel above opening and solid (poured full) cells next the opening provides good anchoring at top and on the sides.



Header is 2 x 8 thus provides anchoring options above the window.

INSTALLATION CONSIDERATIONS

Fastening the shutters to the building must be done in accordance with the manufacturer's installation instructions. These instructions will vary from manufacturer to manufacturer and will depend on the specific construction materials that make up the opening and the type of opening being protected. Therefore, it is critical that the specific installation instructions are reviewed and followed for the product(s) being used.

Roll Shutters

Because the shutter must be anchored to the building structure, the actual shutter width and height will be more than that indicated by the arrows in Figure H2-12. Often, houses will have decorative shutters, light fixtures or other obstructions that have to be considered prior to installation of the shutters.

Figure H2-1 shows the main shutter components that are fastened to the building. Notice that the width of the roll itself is wider than the window opening. The exact width of the shutter versus the window opening will depend on the installation requirement for the side tracks. For wood frame construction, the anchors must go into the wood framing around the window. The location of the framing will dictate placement of the tracks, thus control the width of the shutter.

For installation over openings that have brick or faux brick exterior wall cladding, it is imperative that the panels be fastened to the structure behind the wall cladding. Opening protection CANNOT be attached to brick or faux brick wall cladding. The mounting bolts must be the specified size and length to assure proper anchoring into the building.

Pay particular attention to the requirements for anchors and the fastening into the specific structure of the home.



Figure H2-1
Roll shutter installed



Figure H2-2
Roll Shutter Closed

Accordion Shutters

Because the shutter must be anchored to the building structure, the actual shutter width and height will be more than that indicated by the arrows in Figure H2-12. As discussed in the General Comments section, accordion shutters “stack” to the side(s) of the opening and requires clearance for the shutter to expose the entire door or window opening. Often houses will have decorative shutters, light fixtures or other obstructions that have to be considered prior to installation of the shutters. This applies to all types of openings, doors, windows and garage doors.

Frequently, the “stack” must be split unevenly to accommodate field conditions and in some instances, the “stack” will be all on one side with only a latching mechanism installed on the other side. This installation “flexibility” allows installers to accommodate many different conditions.

For installation over openings having brick or faux brick exterior wall cladding, it is imperative that the panels be fastened to the structure behind the wall cladding. Opening protection CANNOT be attached to brick or faux brick wall cladding. The mounting bolts must be the specified size and length to assure proper anchoring into the building.

Pay particular attention to the requirements for anchors and the fastening into the specific structure of the home.

The shutter shown in Figure H2-4 illustrates one of the most common installations for accordion shutters: one half of the shutter width is “stacked” on each side. Figure H2-5 shows shutters with a larger percentage of the stack on the right – this is most likely a double window and the shutters can be closed and locked from the inside because the latch is in front of one of the windows, not in the middle between the windows.



Figure H2-4
Accordion Shutter Installed



Figure H2-5
Accordion Shutter Closed over window

Colonial Shutters

Colonial shutters can provide excellent hurricane protection while offering pleasing architectural designs. The shutters must be closed, from the outside or inside, and in most cases “storm bars” must be installed to enable the shutters to meet the test performance requirements of the Building Code. Shutters can be ordered in exact sizes to fit most window openings normally found on single family homes.

With colonial shutters, the anchoring takes place at the side of the opening to be protected. This is good because that is the location where building structure is most often found and makes initial installation somewhat easier than some other systems. While it is one of the higher priced shutter systems, they provide necessary hurricane protection.

In choosing the right shutter product, consideration must be given to the effort required when it is time to deploy the product. Colonial shutters are always in place but they do require significant effort to close and properly install the vertical or horizontal storm bars. Homeowners should be sure to read and understand the instructions provided by the manufacturer to be sure they can perform the required tasks when needed.

Bahama Shutters

Bahama shutters offer sun light protection as well as providing easy to operate hurricane protection. These shutter systems are permanently mounted to the home, thus requiring no storage. It is also one of the higher priced shutter systems, but they provide necessary hurricane protection. Bahama shutters are one of the easiest to deploy, as it requires closing the shutter and adding the anchors on each side as shown in the photo on the right below. While it may look like only the top of the shutter is anchored, bolts must be installed on each side to provide necessary wind and impact resistance. Manufacturer’s installation instructions must be followed very carefully to assure proper installation.

Pictured below is a Bahama shutter in its normal open position and in its closed and “ready for the storm” position.



Figure H2-6
Window openings protected with colonial shutters



Figure H2-7
Close up view of colonial shutter



*Figure H2-8
Installed Bahama Shutters*

Fabric and Screen Products

Some of these products are installed permanently while others are installed temporarily; therefore information is included in both sections of this document.

Introduced approximately 10 years ago, fabric and screen products provide flexible systems that provide opening protection for previously difficult or impossible to protect openings. These products come as “see through” screens as shown in Figure H2-9 or vinyl coated fabric. All these products are light weight and easy to install even on large openings. Some are better suited for larger openings where the screen is installed at the perimeter of porches or entrances.

They can be installed as single panels similar to storm shutters or as roll panels that may be manually rolled or mechanically rolled. Various manufacturers offer a wide variety of options for the homeowner to consider.

As with all products, it is very important to verify the required installation of the anchor system for these products. **It is critical that the correct anchors be installed into structure that will support the wind and impact loads experienced during a hurricane.**

Some products may be installed directly over the window or door, as shown in Figure H2-10. It should be noted that in the event of an impact, fabric and screen products installed close to the glass may allow the glass to break during a hurricane. Even if the glass breaks however, water and wind intrusion into the house will likely be limited.

These products are an alternative to rigid steel, aluminum and polycarbonate hurricane panels. These PVC coated woven fabric panels are tested to block wind, rain and storm-driven projectiles and allow light to enter the home. The panels allow for compact storage because they can be rolled up, laid flat or hung up.



Figure H2-9



Figure H2-10
Vinyl coated fabric shutter

Door Measuring Guide

The measurement for the width of the opening for doors should be taken from the edge of the left side of the door to the edge of the right side of the door. The measurement for the height of doors should be taken from the edge at the top of the door to the floor as shown in Figure H2-11 below.

Because the shutter must be anchored to the building structure (not any part of the door frame), the actual shutter width and height will be more than that indicated by the arrows in Figure H2-11. Roll shutters extend beyond the actual opening width, thus requiring clearance for the shutter to expose the entire door or window opening. Often houses will have decorative shutters, light fixtures or other obstructions that have to be considered prior to installation of the shutters. This applies to all types of openings, doors, windows and garage doors.

Window Measuring Guide

The measurement for the width of the opening for windows should be taken from the edge of the left side of the window to the edge of the right side of the window. The measurement for the height of the window should be taken from the edge at the top of the window to the edge at the bottom of the window. (Figure H2-12.) Space for the vertical tracks and mounting options must be considered for each opening. The window shown in Figure H2-12 may not be a good candidate for roll shutters because the space between the top of the window and the bottom of the soffit is limited. However, some roll shutters are available in smaller housings. Always check impact testing and product approval documentation to assure the product is designed to perform the intended function – protect the opening from windborne debris damage.

Many accordion units will accommodate up to 1 $\frac{5}{8}$ " of obstructions (trim, sills, protrusions, etc.) projecting from the wall. Anything beyond 1 $\frac{5}{8}$ " will not allow the accordion to open and close.

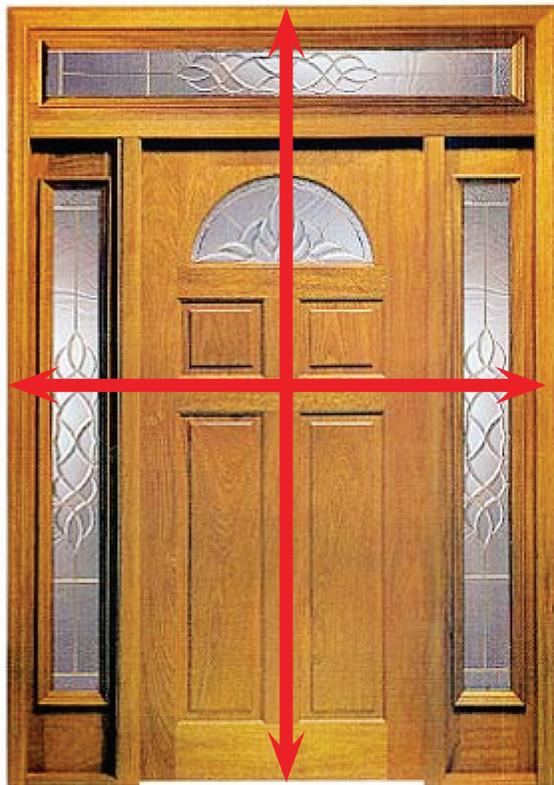


Figure H2-11
Measurement for doors



Figure H2-12
Measurement for Windows

I. TEMPORARILY INSTALLED PRODUCTS

Storm Panels

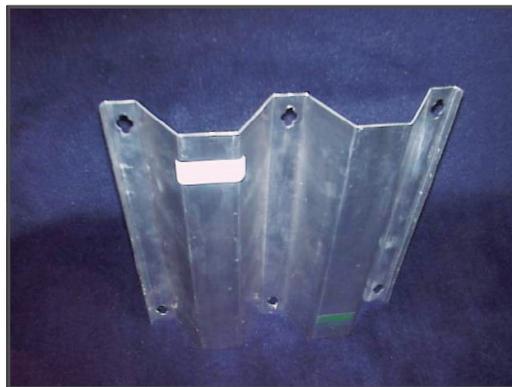
COMMON BUILDING CONSIDERATIONS

Several construction methods are used in some areas. They include metal frame, solid concrete and Insulated Concrete Forms (ICF) or other special systems. The two most common types of construction for residential structures are wood frame and concrete block. Most of South Carolina's housing stock is constructed of wood. The following section describes the most common construction methods and techniques employed and how they influence decisions regarding opening protection choices and options.

Openings in the building structure that are filled with windows or doors are the "openings" being referred to in this document. While in the true sense of the word, they are not "Open", they are openings in the exterior walls and/or roof of the building. Understanding how the openings are constructed will help guide the homeowner and installer with the appropriate choices for installing windborne debris protection in or over the openings.

For installation over openings having brick or faux brick exterior wall cladding, it is imperative that the panels be fastened to the structure behind the wall cladding. Opening protection **CANNOT** be attached to brick or faux brick wall cladding. The mounting bolts must have a minimum 1½" penetration of thread area into wood structure or a minimum 1¼" penetration of thread area into the concrete structure.

Figure H1-1 shows how various openings are constructed and shows the potential options for anchoring the windows, doors and shutter products.



*Figure I3-1
Storm Panel*

Appendix A: Standard Detail Set for Fortified Roof



**STANDARD DETAIL SET
FOR FORTIFIED ROOF™**

2019

FORTIFIED Home™ Standard Details Table of Contents

<u>Detail Number</u>	<u>Detail Title</u>
F-G-1	Corrosion Protection Requirements
F-G-2	Roof and Wall Zone Diagram
F-RS-1	Roof Deck Attachment - Sawn Lumber or Wood Board Roof Deck with No Gaps
F-RS-2	Hurricane - New Construction Roof Deck Attachment - Structural Wood Panels
F-RS-3	High Wind - New Construction Roof Deck Attachment - Structural Wood Panels
F-SRD-1	Roof Deck Attachment and Sealed Roof Deck from Within Using Spray Foam
F-SRD-2	Sealed Roof Deck - Flashing Tape and Underlayment- Shingle or Metal Roof Covers, Steep Slope
F-SRD-3	Sealed Roof Deck - Two Layers Felt Underlayment - Shingle or Metal Roof Covers, Steep Slope
F-SRD-4	Sealed Roof Deck - Self-Adhered Membrane (Showing Bond Break for Asphalt Shingles) - Shingle, Metal, Concrete and Clay Tile Roof Covers, Steep Slope
F-SRD-5	Sealed Roof Deck - Flashing Tape, Underlayment and Roof Tile Cap Sheet - Concrete and Clay Tile Roof Covers, Steep Slope
F-DE-1	Hurricane - Drip Edge Installation Over Underlayment
F-DE-2	Drip Edge Installation Over Anchor Sheet and Under Cap Sheet for Concrete and Clay Tile Roof Covers
F-DE-3	High Wind - Drip Edge Installation Over Underlayment
F-RC-1	Asphalt Shingle Installation Guidance for Steep Slope - Option 1: Peel and Stick Starter Strip Installation at Eave or Rake
F-RC-2	Asphalt Shingle Installation Guidance for Steep Slope - Option 2: Single Strip Starter Installation at Eave or Rake
F-RC-3	Asphalt Shingle Installation Guidance for Steep Slope - Option 3: Shingles Set Directly in Flashing Cement at Rake Only
F-RR-1	Re-Roofing Deck Replacement Fastening Detail
F-RR-2	Re-Roofing New Scab Member Detail for Damaged or Deteriorated Wood Framing Member
F-RR-3	Hurricane - Re-Nailing the Roof Deck (Wood Structural Panels)
F-RR-4	High Wind - Re-Nailing the Roof Deck (Wood Structural Panels)
F-GS-1	Gable Vent Shuttering

FORTIFIED Home™ Standard Details Naming Convention

FORTIFIED Home™ Standard Detail numbers are comprised of three alphanumeric identifications to provide general categorization:

1. First alphabetic identification – FORTIFIED Detail:
 - F = FORTIFIED

2. Second alphabetic identification – Secondary Category
 - G = General Information
 - RS = Roof Sheathing
 - SRD = Sealed Roof Deck
 - DE = Drip Edge
 - RC = Roof Cover
 - RR = Re-Roof
 - GS = Gable Shuttering

3. Numeric identification – chronological order detail was completed

Example: F-RS-1

Fortified Detail → Roof Sheathing Detail → First Detail in this category

FORTIFIED Fastener and Connector Corrosion Protection Requirements

	Structures within 300 ft of saltwater	Structures more than 300 ft but less than 1,000 ft from saltwater ¹	Structures more than 1,000 ft but less than 3,000 ft from saltwater	Structures more than 3,000 ft from saltwater
Fasteners/Connectors				
Roofing nails for shingles	Stainless steel	Stainless steel	Hot-dip galvanized ⁴	Corrosion resistant ⁵
Concrete and clay roof tile fasteners	Stainless steel	Stainless steel	Hot-dip galvanized ⁴	Corrosion resistant ⁵
Metal roof clips and fasteners (exposed)	Stainless steel	Stainless steel	Stainless steel	Corrosion resistant ⁵
Fasteners used for attachment of underlayment to roof deck	Hot-dip galvanized ⁴	Hot-dip galvanized ⁴	Hot-dip galvanized ⁴	Corrosion resistant ⁵
Aluminum soffits	Not allowed	Not allowed	Allowed	Allowed
Soffit and roof vent fasteners	Stainless steel	Stainless steel	Stainless steel	Corrosion resistant ⁵
Metal framing connectors, fasteners, anchors, and hangers in exposed areas²	Stainless steel	Stainless steel	Stainless steel	Stainless steel or G185 galvanized coating
Metal framing connectors, fasteners, anchors, and hangers in vented enclosed areas³	Stainless steel	Stainless steel or G185 galvanized coating	Stainless steel or G185 galvanized coating	Corrosion resistant ⁵

Notes:

- Buildings on open, elevated foundations within 1,000 ft of saltwater shall follow the requirements of structures within 300 ft of saltwater.
- Examples of exposed areas include areas that are under roof overhangs, decks and covered walkways or in any location that is openly or partially exposed to saltwater air.
- Examples of vented enclosed areas include attics with vents.
- Hot-dip galvanized shall meet the requirements of ASTM A153, Class D for nails and screws.
- Corrosion-resistant nails and screws shall meet the requirements of ASTM A 641, Class 1, or an equal corrosion resistance by coating, galvanization, stainless steel, or other suitable corrosion-resistant material. Corrosion-resistant sheet metal connectors, anchors, and hangers shall meet the requirements of ASTM A653, G90.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

CORROSION PROTECTION
 REQUIREMENTS

DRAWING #:

F-G-1

DATE:

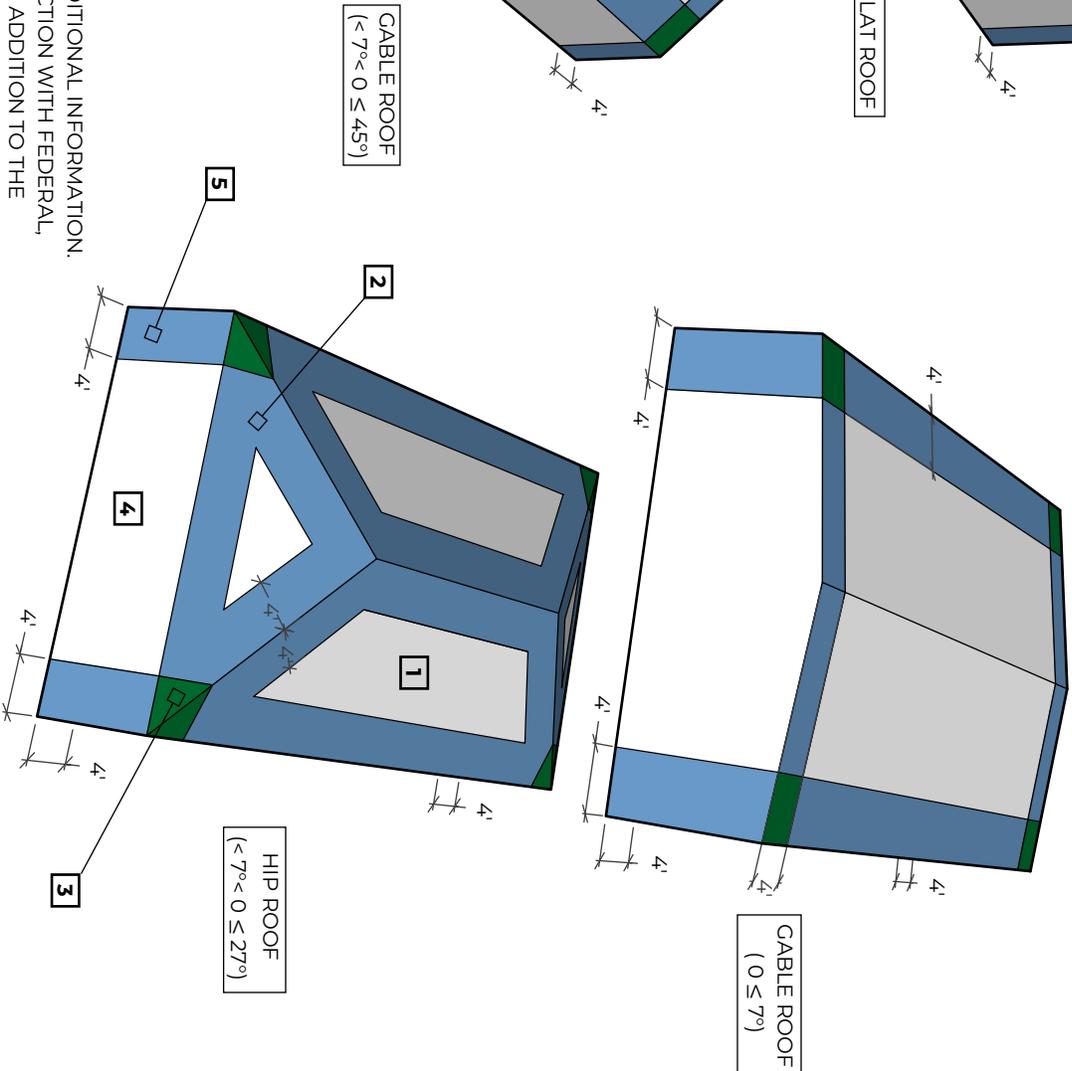
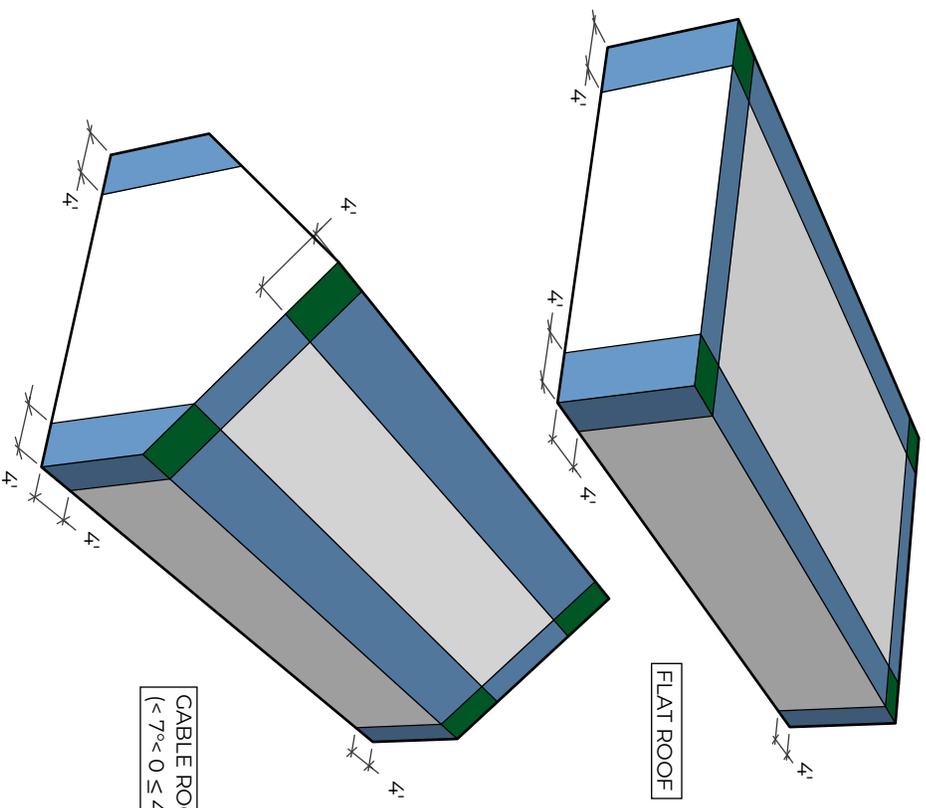
11/18/2019



INTERIOR ZONES
ROOFS - ZONE 1/ WALLS - ZONE 4

END ZONES
ROOFS - ZONE 2/ WALLS - ZONE 5

CORNER ZONES
ROOFS - ZONE 3



GABLE ROOF
($< 7^\circ < 0 \leq 45^\circ$)

HIP ROOF
($< 7^\circ < 0 \leq 27^\circ$)

GABLE ROOF
($0 \leq 7^\circ$)

1. GENERAL NOTES:
REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
2. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

ROOF AND WALL ZONE DIAGRAM

DRAWING #:

F-G-2

DATE: 11/18/2019



- GENERAL NOTES:**
1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
 2. APPLICABLE FOR SHINGLE OR METAL ROOF COVERS.
 3. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER.
 4. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

REFER TO TABLE F-RS-1 FOR REQUIRED SIZE AND NUMBER OF NAILS.

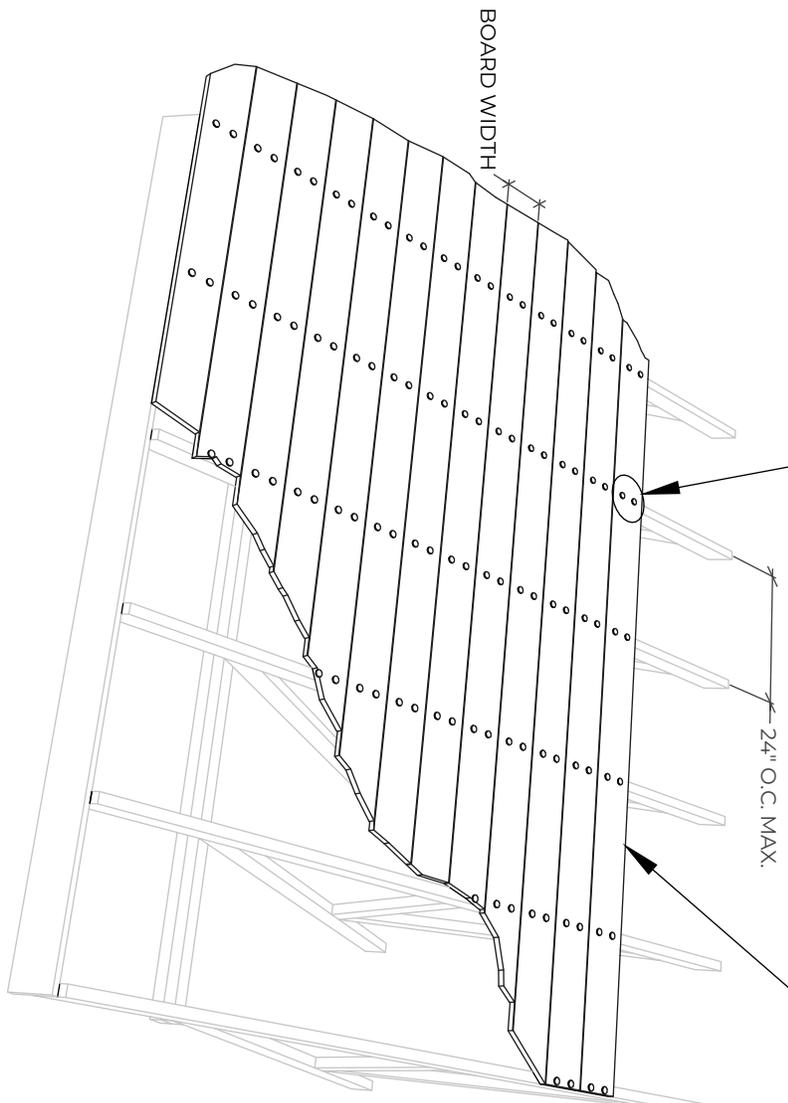


Table F-RS-1: FASTENERS REQUIRED FOR WOOD BOARD DECKING ATTACHMENT.

WOOD BOARD/LUMBER (ROOF DECKING) WIDTH	NUMBER AND MINIMUM DIMENSIONS OF NAILS PER BOARD FOR EACH FRAMING MEMBER IT CROSSES
UP TO 8"	TWO(2) 0.131" Ø MIN. W/ 1 - 5/8" PENETRATION INTO ROOF FRAMING MEMBERS (MIN. LENGTH OF NAIL= 2 - 1/2")
LARGER THAN 8"	THREE(3) 0.131" Ø MIN. W/ 1 - 5/8" PENETRATION INTO ROOF FRAMING MEMBERS (MIN. LENGTH OF NAIL= 2 - 1/2")

NOTE: CLIPPED-HEAD, D-HEAD, OR ROUND-HEAD NAILS SHALL BE ACCEPTABLE PROVIDED THEY HAVE THE REQUIRED MINIMUM DIAMETER AND LENGTH.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

ROOF DECK ATTACHMENT - SAWN LUMBER
 OR WOOD BOARD ROOF DECK WITH NO
 GAPS

DRAWING #:

F-RS-1

DATE:

11/18/2019



- GENERAL NOTES:**
1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
 2. APPLICABLE FOR SHINGLE OR METAL ROOF COVERS.
 3. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER.
 4. FOR CONCRETE AND CLAY TILE ROOF COVERS, MINIMUM SHEATHING THICKNESS IS 15/32."
 5. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES, AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

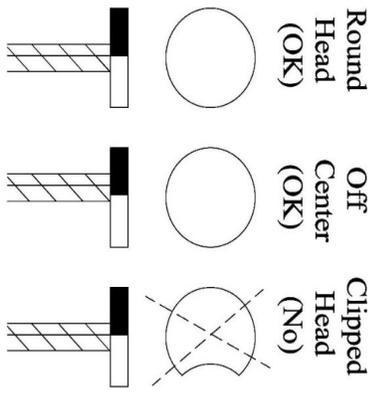
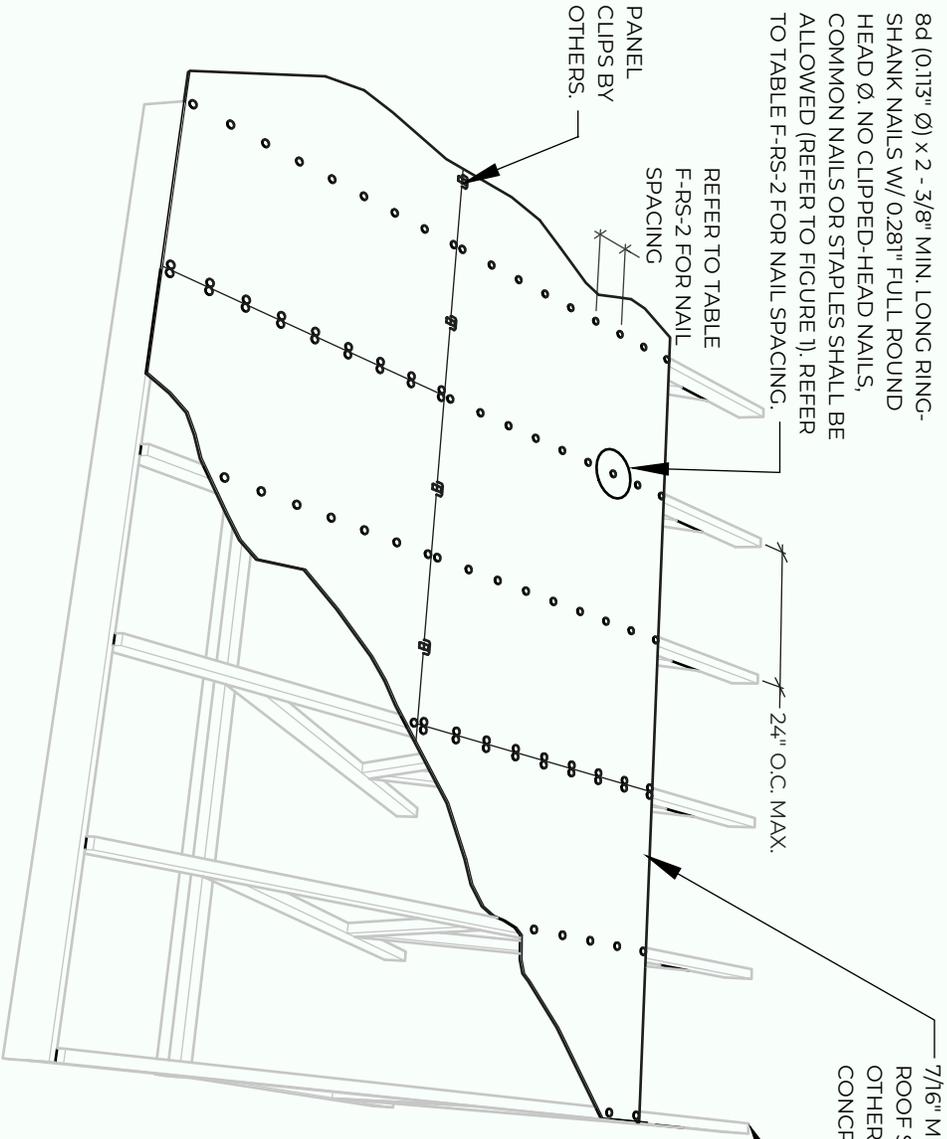


FIGURE 1.

Table F-RS-2: MAXIMUM ALLOWED RING SHANK NAIL SPACING ALONG PANEL EDGES AND INTERMEDIATE FRAMING FOR ATTACHING ROOF DECK WOOD STRUCTURAL PANELS.

DESIGN WIND SPEED		ALL ROOF AREAS
ASCE 7-05 (Vasd)	ASCE 7-10 (Vasd)	
110 MPH OR LESS	130 MPH OR LESS	6" O.C.
GREATER THAN 110 MPH	GREATER THAN 130 MPH	4" O.C.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)

DESCRIPTION:

HURRICANE - NEW CONSTRUCTION
 ROOF DECK ATTACHMENT -
 STRUCTURAL WOOD PANELS

DRAWING #:

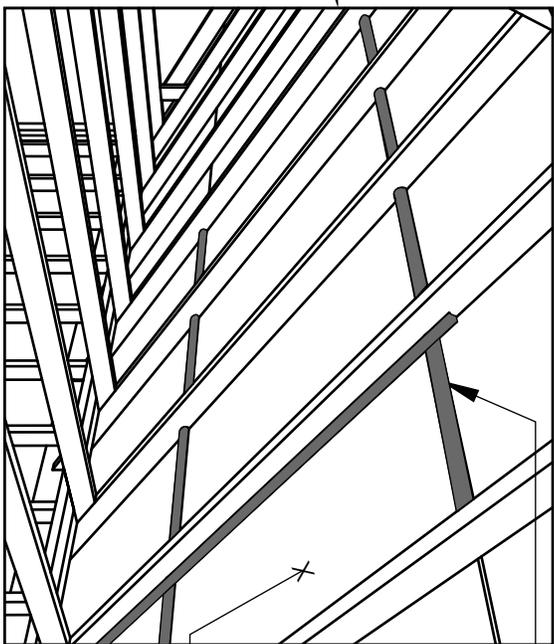
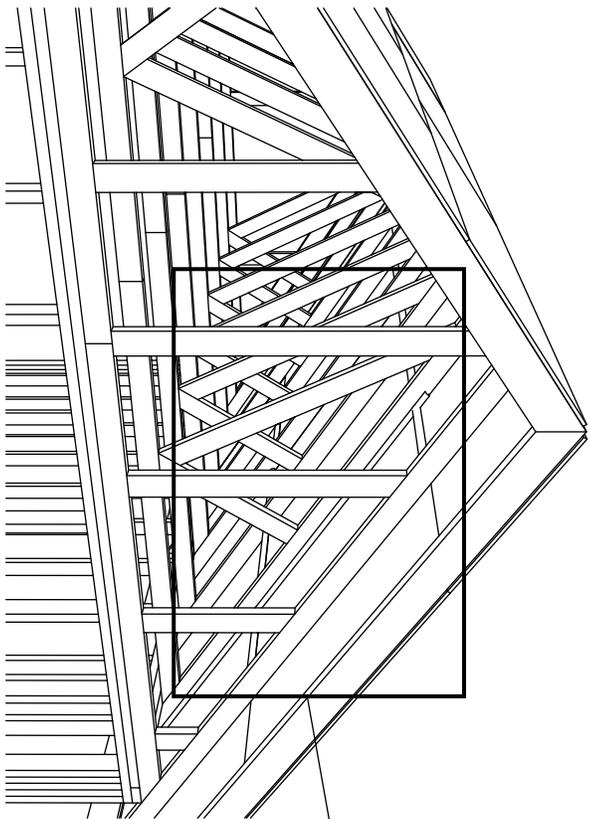
F-RS-2

DATE:

11/18/2019



1. MINIMUM REQUIREMENTS FOR SPRAY ADHESIVES:
PRODUCT MUST BE TESTED AND EVALUATED IN ACCORDANCE WITH EITHER ASTM E530, STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF EXTERIOR WINDOWS, DOORS, SKYLIGHTS, AND CURTAIN WALLS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE (APPLIED TO ROOF SHEATHING) OR TAS 202-94, CRITERIA FOR TESTING IMPACT AND NON-IMPACT RESISTANT BUILDING ENVELOPE COMPONENTS USING UNIFORM STATIC AIR PRESSURE. THE MINIMUM ALLOWABLE DESIGN UPLIFT PRESSURE MUST BE GREATER THAN OR EQUAL TO 110 PSF AND THE PROOF TEST PRESSURE ACHIEVED WITHOUT FAILURE OR STRUCTURAL DISTRESS MUST BE GREATER THAN OR EQUAL TO 165 PSF.
2. ADHESIVE MUST BE A TWO-COMPONENT SPRAY POLYURETHANE FOAM SYSTEM WITH A MINIMUM CORE DENSITY OF 1.5-3.0 PCF IN ACCORDANCE WITH ASTM D1622, STANDARD TEST METHOD FOR APPARENT DENSITY OF RIGID CELLULAR PLASTICS.
3. SPRAY POLYURETHANE FOAM ADHESIVE SYSTEM MUST BE INSTALLED BY A PROPERLY TRAINED AND QUALIFIED APPLICATOR IN ACCORDANCE WITH THE MANUFACTURER'S MAINTENANCE AND INSTALLATION GUIDELINES. DOCUMENTATION FROM THE INSTALLING CONTRACTOR, ON COMPANY LETTERHEAD, IDENTIFYING THE MANUFACTURER AND PRODUCT USED FOR THE IMPROVED ROOF SHEATHING ATTACHMENT/SEALED ROOF DECK MUST BE PROVIDED TO THE CERTIFIED FORTIFIED EVALUATOR TO BE INCLUDED WITH FINAL DESIGNATION CHECKLIST. DOCUMENTATION SHOULD ALSO STATE THAT THE INSTALLATION MEETS THE MANUFACTURER'S REQUIREMENTS FOR AN ALLOWABLE DESIGN UPLIFT PRESSURE OF AT LEAST 110 PSF (PROOF TEST OF AT LEAST 165 PSF).
5. **USE THE MINIMUM DENSITY AND INSTALLATION REQUIREMENTS PRESCRIBED BY THE MANUFACTURER TO MEET A MINIMUM DESIGN UPLIFT PRESSURE ON THE SHEATHING OF 110 PSF FOR HURRICANE OR 80 PSF FOR HIGH WIND.**



UNDERSIDE OF ROOF DECK FROM WITHIN ATTIC

GENERAL NOTES:
REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION. EXISTING SHEATHING REQUIREMENTS: FOR HURRICANE: 7/16" MIN. THICKNESS REQUIRED WITH ROOF MEMBERS @ 24" O.C. MAX.
FOR HIGH WIND: 7/16" MIN. THICKNESS IS REQUIRED FOR GOLD DESIGNATION. FOR ROOF/SILVER DESIGNATION, 3/8" MIN. THICKNESS IS PERMITTED WHEN ROOF MEMBERS ARE 16" O.C. MAX.
FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

1 1/2" TO 3" FILLET OF 2-PART SPRAY-APPLIED CLOSED CELL POLYURETHANE FOAM ADHESIVE AT ALL JOINTS BETWEEN SHEATHING AND AT ALL INTERSECTIONS BETWEEN ROOF SHEATHING AND ROOF FRAMING MEMBERS, AND AT ALL VALLEYS. REFER TO MINIMUM REQUIREMENTS FOR SPRAY ADHESIVES.
EXISTING STRUCTURAL WOOD PANEL ROOF SHEATHING BY OTHERS. REFER TO GENERAL NOTE #2 FOR REQUIREMENTS.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

ROOF DECK ATTACHMENT AND SEALED ROOF DECK FROM WITHIN USING SPRAY FOAM

DRAWING #:

F-SRD-1

DATE:

11/18/2019



1. GENERAL NOTES:
REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
2. REFER TO FORTIFIED STANDARD DETAIL F-G-1 FOR CORROSION PROTECTION REQUIREMENTS.
3. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
- 4.

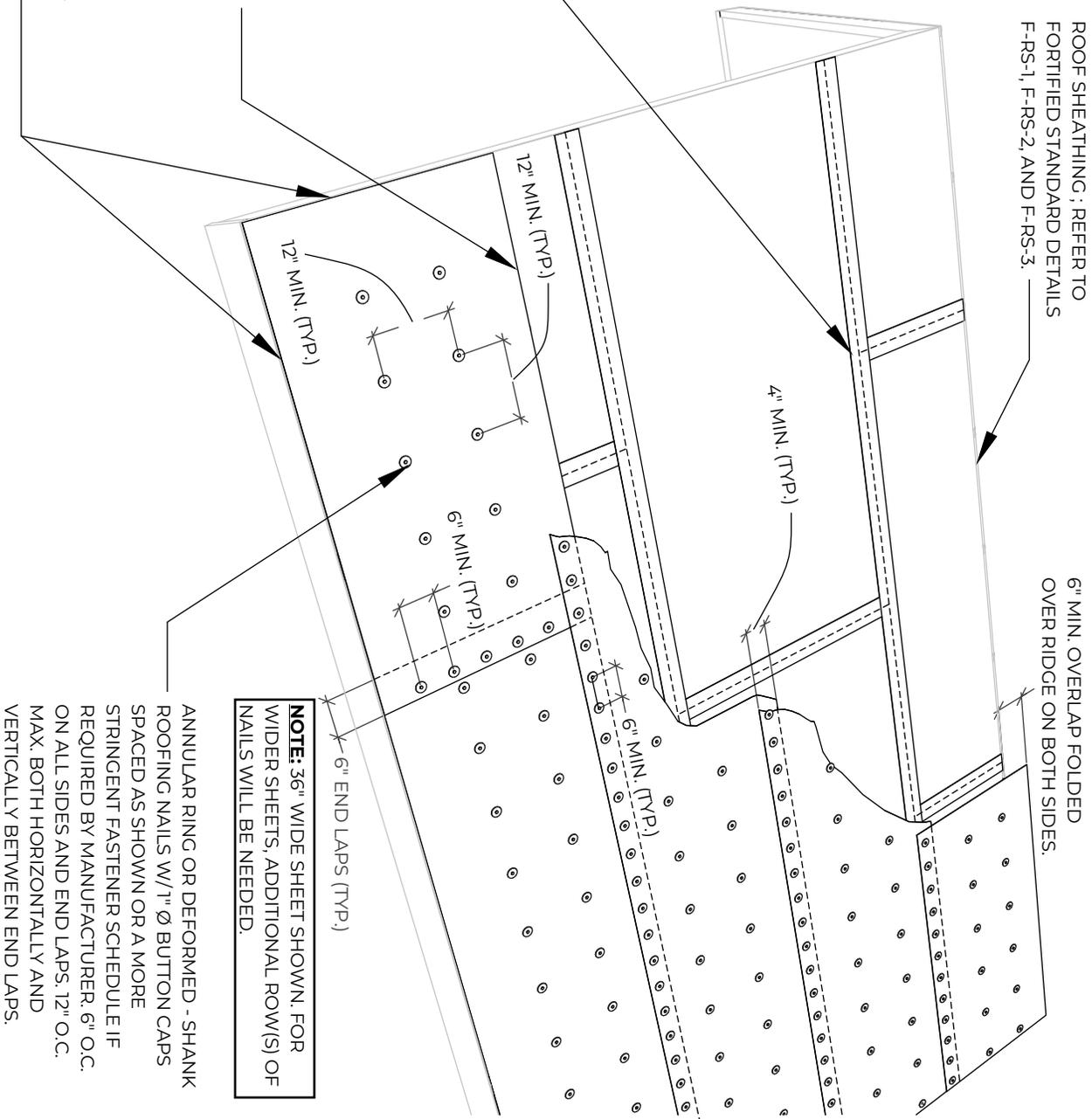
FLASHING TAPE AT ALL PANEL SEAMS FULLY ADHERED W/ NO WRINKLES OR VOIDS USING ROLLER.
 MATERIAL OPTION 1: 4" WIDE ASTM D1970 COMPLIANT SELF-ADHERING POLYMER-MODIFIED BITUMEN FLASHING TAPE.
 MATERIAL OPTION 2: 3 - 1/4" WIDE AAMA 711-13 LEVEL 3 (FOR EXPOSURE UP TO 80°C/176°F) COMPLIANT SELF-ADHERING FLASHING TAPE.

ASTM D226 TYPE II #30 OR ASTM D4869 TYPE III OR TYPE IV #30 UNDERLAYMENT. (FOR ASPHALT SHINGLE ROOF COVERS, ASTM D6757 UNDERLAYMENT IS ALSO ACCEPTABLE)
 ALT: REINFORCED SYNTHETIC ROOF UNDERLAYMENT WITH ICC APPROVAL AS ASTM D226 TYPE II;
 MINIMUM TEAR STRENGTH = 15 LBF PER ASTM D4533
 MINIMUM TENSILE STRENGTH = 20 PSF PER ASTM D5035
 HORIZONTAL LAPS = 4" MIN.
 END LAPS = 6" MIN.

TACK UNDERLAYMENT IN PLACE WITH ROOFING NAILS ONLY AT EDGES. DO NOT INSTALL CAPS AT EDGES UNTIL DRIP EDGE IS IN PLACE. REFER TO F-DE-1 AND F-DE-3 FOR DRIP EDGE INSTALLATION.

ROOF SHEATHING; REFER TO FORTIFIED STANDARD DETAILS F-RS-1, F-RS-2, AND F-RS-3.

6" MIN. OVERLAP FOLDED OVER RIDGE ON BOTH SIDES.



NOTE: 36" WIDE SHEET SHOWN. FOR WIDER SHEETS, ADDITIONAL ROW(S) OF NAILS WILL BE NEEDED.

ANNULAR RING OR DEFORMED - SHANK ROOFING NAILS W/ 1" Ø BUTTON CAPS SPACED AS SHOWN OR A MORE STRINGENT FASTENER SCHEDULE IF REQUIRED BY MANUFACTURER. 6" O.C. ON ALL SIDES AND END LAPS. 12" O.C. MAX. BOTH HORIZONTALLY AND VERTICALLY BETWEEN END LAPS.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

SEALED ROOF DECK - FLASHING TAPE AND UNDERLAYMENT - SHINGLE OR METAL ROOF COVERS, STEEP SLOPE

DRAWING #:

F-SRD-2

DATE:

11/18/2019



- GENERAL NOTES:**
1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
 2. REFER TO FORTIFIED STANDARD DETAIL F-C-1 FOR CORROSION PROTECTION REQUIREMENTS.
 3. WEAVE UNDERLAYMENT ACROSS VALLEYS.
 4. DOUBLE LAP UNDERLAYMENT ACROSS RIDGES (UNLESS THERE IS A CONTINUOUS RIDGE VENT).
 5. LAP UNDERLAYMENT WITH MINIMUM 6" LEG TURNED UP" AT WALL INTERSECTIONS; LAP WALL WEATHER BARRIER OVER TURNED-UP ROOF UNDERLAYMENT.
 6. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER.
 7. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

ROOF SHEATHING BY OTHERS; REFER TO FORTIFIED STANDARD DETAILS F-RS-1, F-RS-2, AND F-RS-3.

ASTM D226 TYPE II #30 OR ASTM D4869 TYPE III OR TYPE IV #30 UNDERLAYMENT LAPPED AS SHOWN. (FOR ASPHALT SHINGLE ROOF COVERS, ASTM D6757 UNDERLAYMENT IS ALSO ACCEPTABLE)

6" END LAPS (TYP.)

6" MIN. OVERLAP FOLDED OVER RIDGE ON BOTH SIDES

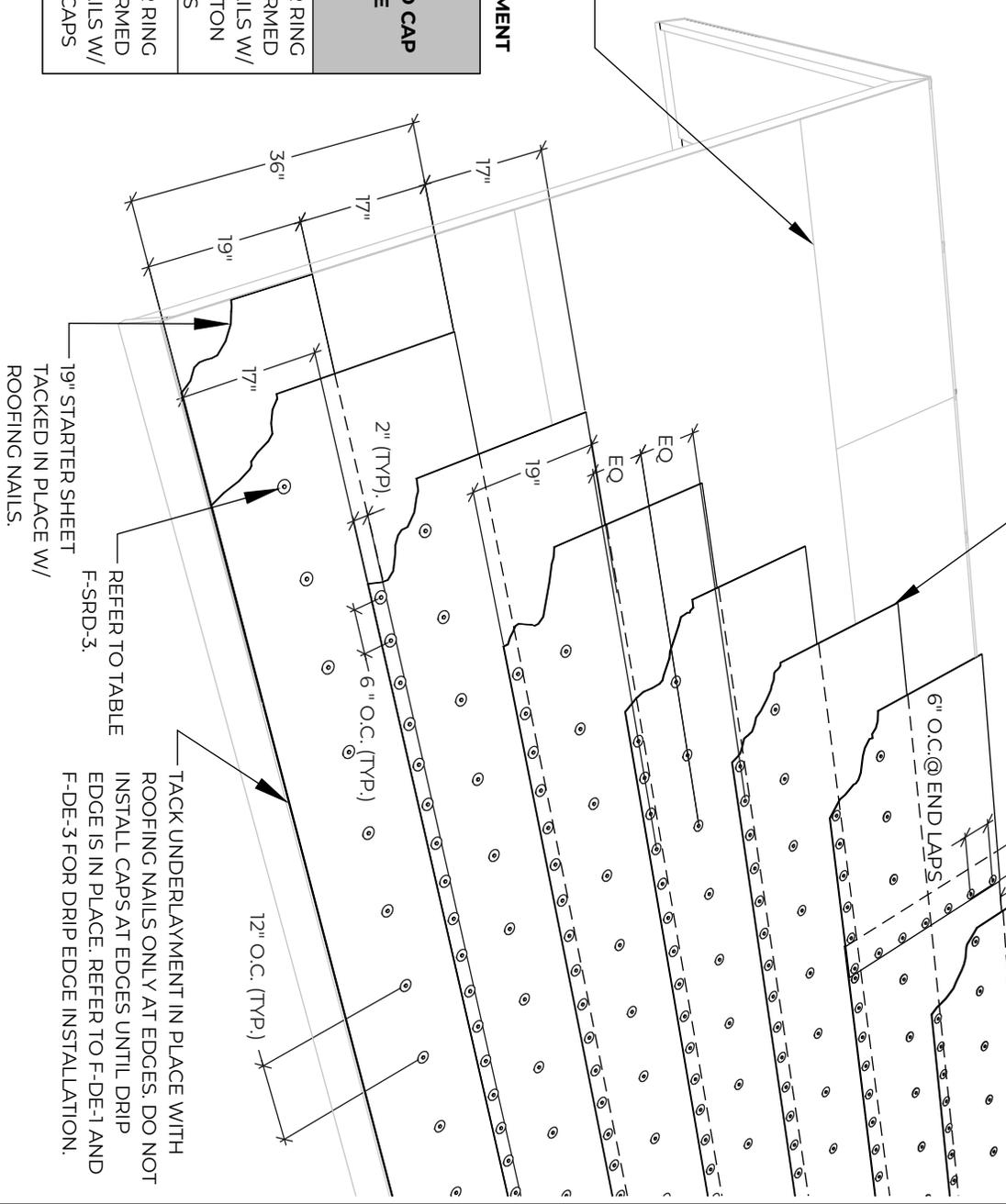


TABLE F-SRD-3: NAIL TYPE FOR ATTACHMENT OF UNDERLAYMENT

DESIGN WIND SPEED	ASCE 7-10 (Vult)	NAIL AND CAP TYPE
ASCE 7-05 (Vasd)	ASCE 7-10 (Vult)	ANNULAR RING OR DEFORMED SHANK NAILS W/ 1" Ø BUTTON CAPS
LESS THAN 140 MPH	LESS THAN 160 MPH	ANNULAR RING OR DEFORMED SHANK NAILS W/ 1" Ø TIN CAPS
140 MPH OR GREATER	160 MPH OR GREATER	ANNULAR RING OR DEFORMED SHANK NAILS W/ 1" Ø TIN CAPS

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

SEALED ROOF DECK - TWO LAYERS
 FELT UNDERLAYMENT - SHINGLE OR
 METAL ROOF COVERS, STEEP SLOPE

DRAWING #:

F-SRD-3

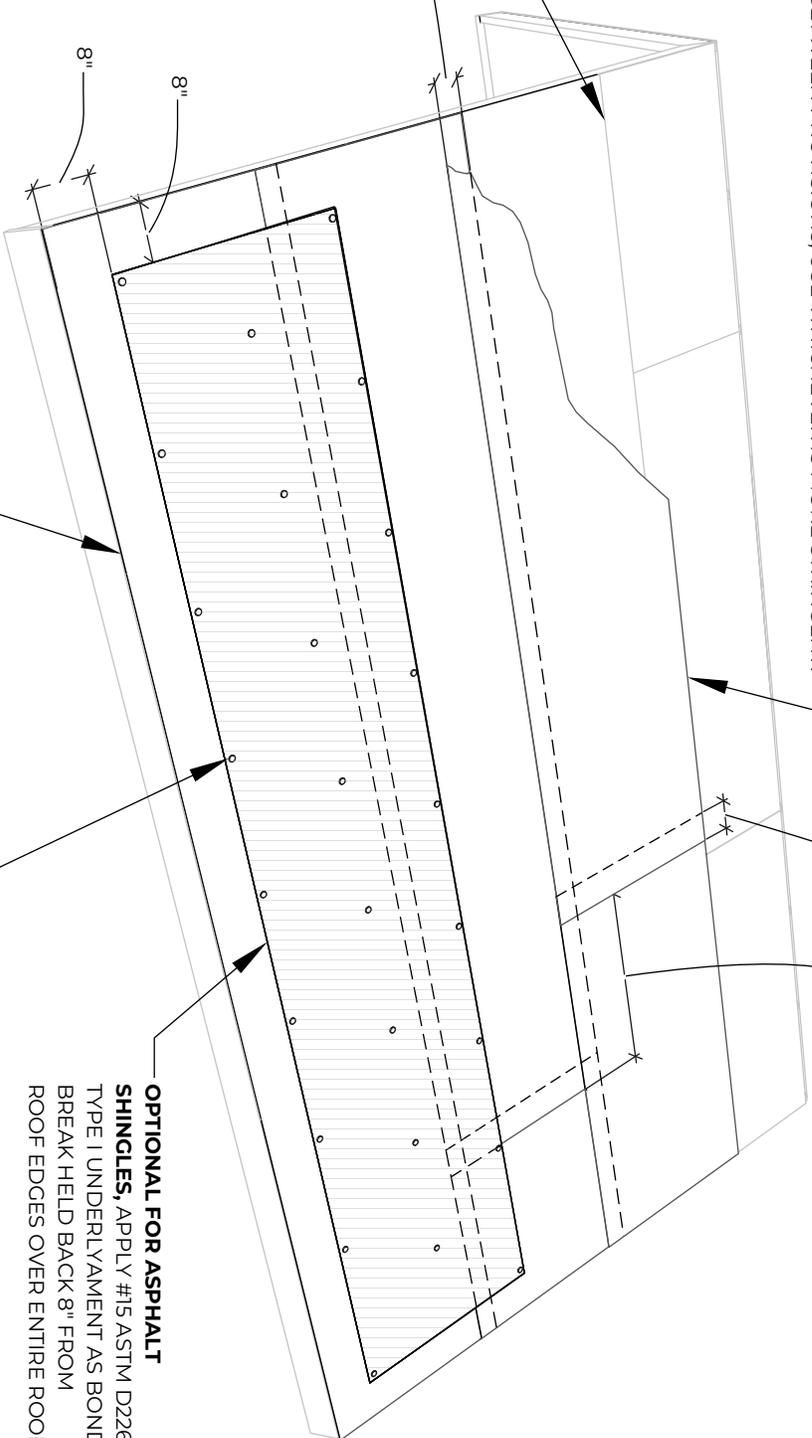
DATE: 11/18/2019



1. GENERAL NOTES:
2. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
3. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER. REFER TO AND INSTALL IN ACCORDANCE WITH MANUFACTURER SPECIFICATIONS AND INSTALLATION INSTRUCTIONS. REFER TO PRODUCT APPROVAL TO VERIFY REQUIRED WIND PRESSURES ARE MET IF APPLICABLE.
4. ADEQUATE ATTIC VENTILATION IS REQUIRED. REFER TO UNDERLAYMENT AND PRIMARY ROOF SYSTEM MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR VENTILATION LIMITATIONS. ALSO CHECK WITH LOCAL BUILDING CODES FOR RESTRICTIONS.
5. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

ROOF SHEATHING; REFER TO FORTIFIED STANDARD DETAILS F-RS-1, F-RS-2, AND F-RS-3. APPLY MANUFACTURER-SPECIFIED COMPATIBLE PRIMER TO ROOF SHEATHING PER MANUFACTURER INSTALLATION INSTRUCTIONS.

4" MIN. SIDELAPS OR GREATER IF SPECIFIED BY MANUFACTURER'S SPECIFICATIONS AND INSTALLATION INSTRUCTIONS.



ASTM D1970 SELF-ADHERING POLYMER-MODIFIED BITUMEN MEMBRANE COVERING ENTIRE ROOF DECK. REFER TO GENERAL NOTES #3 AND #4.

REFER TO MANUFACTURER'S SPECIFICATIONS FOR REQUIRED OVERLAP AND FOLLOW INSTALLATION INSTRUCTIONS.

STAGGER AND INSTALL END LAPS AS SPECIFIED PER MANUFACTURER'S SPECIFICATIONS AND INSTALLATION INSTRUCTIONS.

OPTIONAL FOR ASPHALT SHINGLES, APPLY #15 ASTM D226 TYPE I UNDERLAYMENT AS BOND BREAK HELD BACK 8" FROM ROOF EDGES OVER ENTIRE ROOF.

FASTENED ADEQUATELY TO KEEP IN PLACE UNTIL ROOF COVERING IS APPLIED.

REFER TO F-DE-1 FOR DRIP EDGE INSTALLATION.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

SEALED ROOF DECK - SELF-ADHERED MEMBRANE (SHOWING BOND BREAK FOR ASPHALT SHINGLES) - SHINGLE, METAL, CONCRETE AND CLAY TILE ROOF COVERS, STEEP SLOPE

DRAWING #:

F-SRD-4

DATE:

11/18/2019



GENERAL NOTES:

1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
2. REFER TO FORTIFIED STANDARD DETAIL F-G-1 FOR CORROSION PROTECTION REQUIREMENTS.
3. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER. REFER TO AND INSTALL IN ACCORDANCE WITH MANUFACTURER SPECIFICATIONS AND INSTALLATION INSTRUCTIONS. REFER TO PRODUCT APPROVAL TO VERIFY REQUIRED WIND PRESSURES ARE MET IF APPLICABLE.
5. ADEQUATE ATTIC VENTILATION IS REQUIRED. REFER TO UNDERLAYMENT AND PRIMARY ROOF SYSTEM MANUFACTURERS INSTALLATION INSTRUCTIONS FOR VENTILATION LIMITATIONS. ALSO CHECK WITH LOCAL BUILDING CODES FOR RESTRICTIONS.
6. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

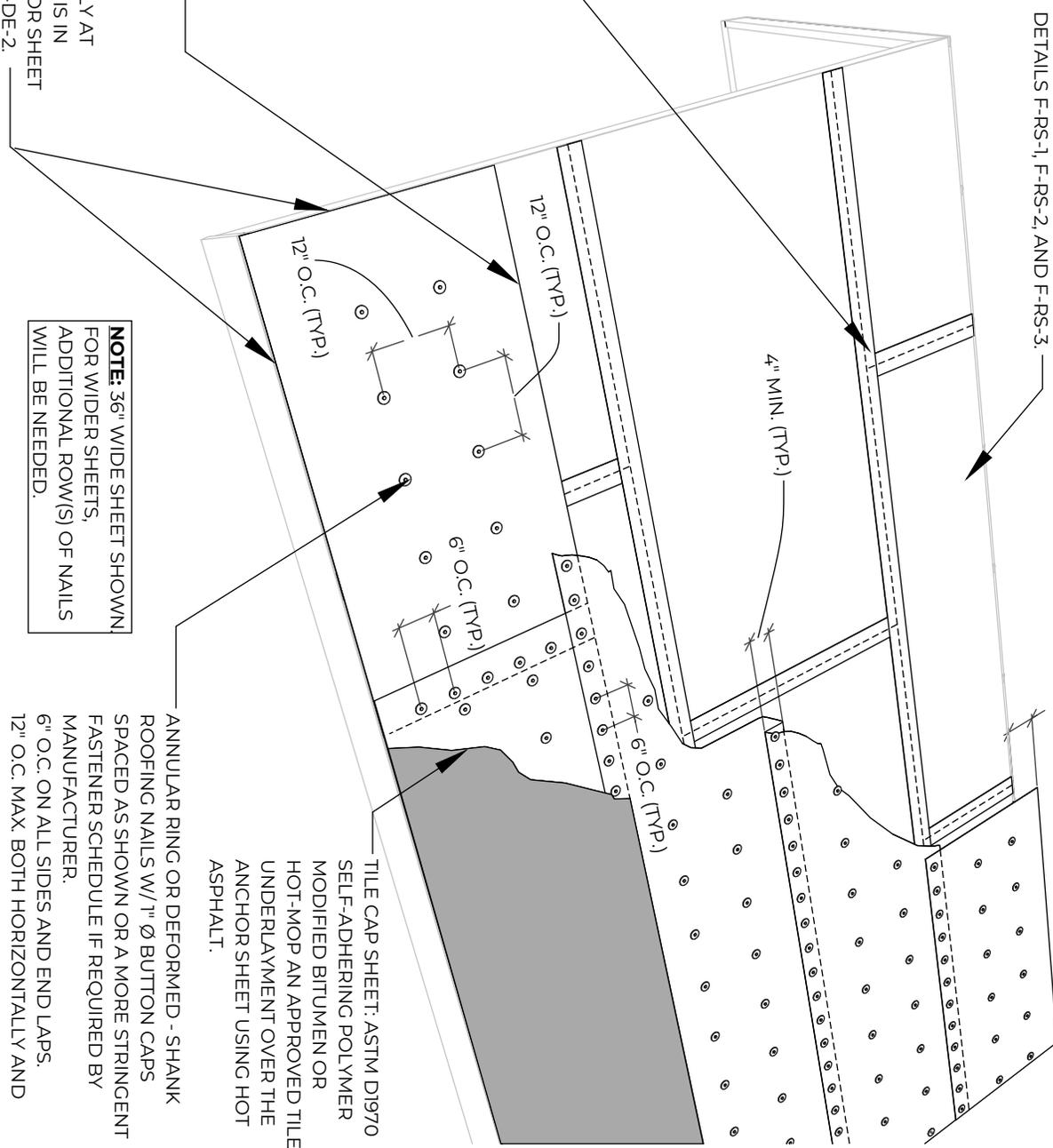
FLASHING TAPE AT ALL PANEL SEAMS FULLY ADHERED W/ NO WRINKLES OR VOIDS USING ROLLER.
 MATERIAL OPTION 1: 4" WIDE ASTM D1970 COMPLIANT SELF-ADHERING POLYMER-MODIFIED BITUMEN FLASHING TAPE.
 MATERIAL OPTION 2: 3 - 1/4" WIDE AAMA 711-13 LEVEL 3 (FOR EXPOSURE UP TO 80°C/176°F) COMPLIANT SELF-ADHERING FLASHING TAPE.

ANCHOR SHEET: ASTM D226 TYPE II #30 UNDERLAYMENT.

TACK UNDERLAYMENT IN PLACE WITH ROOFING NAILS ONLY AT EDGES. DO NOT INSTALL CAPS AT EDGES UNTIL DRIP EDGE IS IN PLACE. DRIP EDGE SHALL BE INSTALLED ON TOP OF ANCHOR SHEET PER F-DE-1 AND F-DE-3, BUT UNDER TILE CAP SHEET PER F-DE-2.

ROOF SHEATHING 15/32" MIN.; REFER TO FORTIFIED STANDARD DETAILS F-RS-1, F-RS-2, AND F-RS-3.

6" MIN. OVERLAP FOLDED OVER RIDGE ON BOTH SIDES.



NOTE: 36" WIDE SHEET SHOWN FOR WIDER SHEETS, ADDITIONAL ROW(S) OF NAILS WILL BE NEEDED.

TILE CAP SHEET: ASTM D1970 SELF-ADHERING POLYMER MODIFIED BITUMEN OR HOT-MOP AN APPROVED TILE UNDERLAYMENT OVER THE ANCHOR SHEET USING HOT ASPHALT.

ANNULAR RING OR DEFORMED - SHANK ROOFING NAILS W/ 1" Ø BUTTON CAPS SPACED AS SHOWN OR A MORE STRINGENT FASTENER SCHEDULE IF REQUIRED BY MANUFACTURER.
 6" O.C. ON ALL SIDES AND END LAPS.
 12" O.C. MAX. BOTH HORIZONTALLY AND VERTICALLY BETWEEN LAPS.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

SEALED ROOF DECK - FLASHING TAPE, UNDERLAYMENT AND ROOF TILE CAP SHEET - CONCRETE AND CLAY TILE ROOF COVERS, STEEP SLOPE

DRAWING #:

F-SRD-5

DATE:

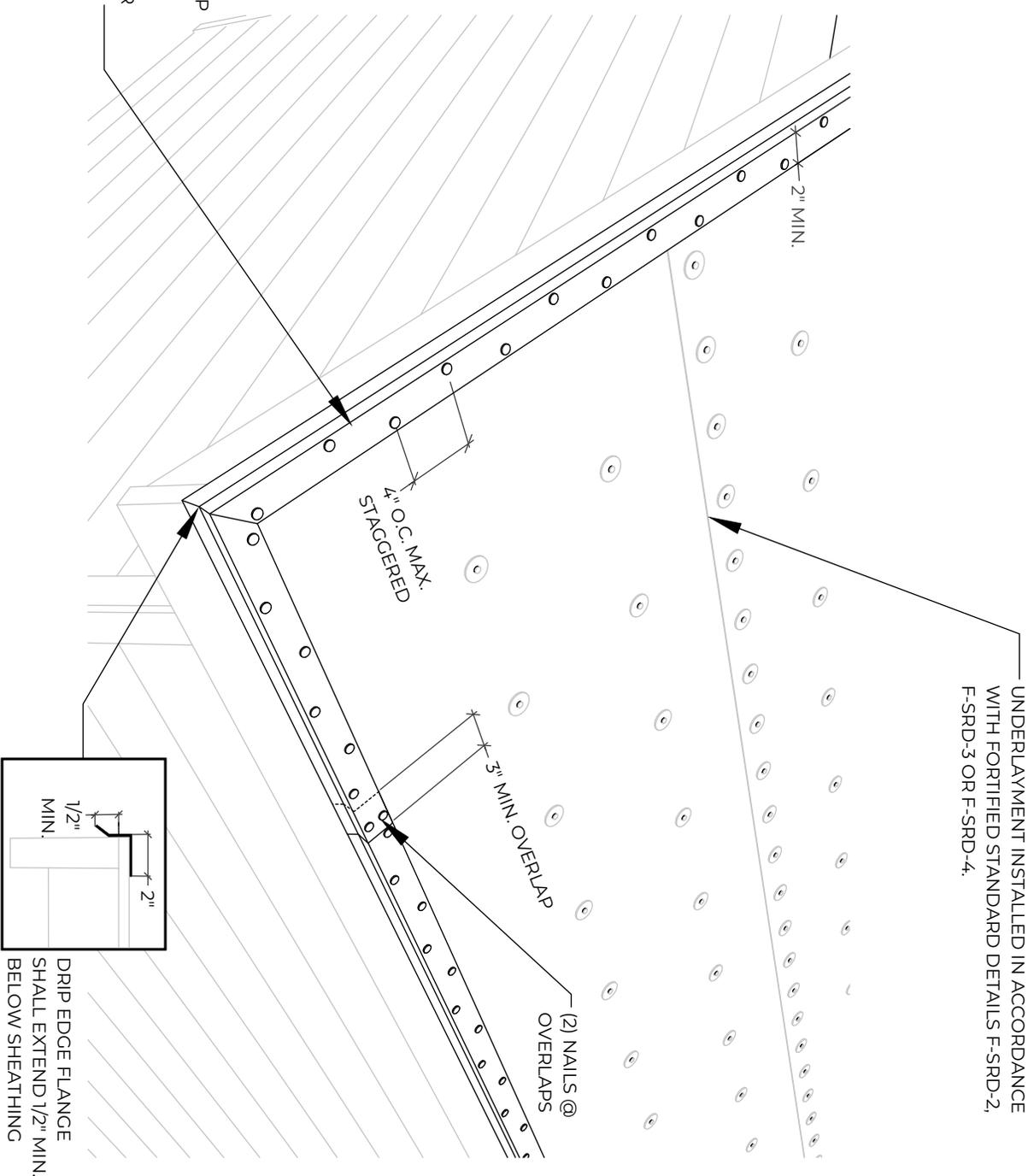
11/18/2019



GENERAL NOTES:

1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION. REFER TO FORTIFIED STANDARD DETAIL F-G-1 FOR CORROSION PROTECTION REQUIREMENTS. BEST PRACTICES TO SEAL THE DRIP EDGE: SINGLE ROOF COVERS; SEAL THE DRIP EDGE, UNDERLAYMENT AND STARTER STRIP AT THE EAVE BY EITHER USING A SELF-ADHERING STARTER STRIP OR APPLYING AN 8" WIDE LAYER OF COMPATIBLE FLASHING CEMENT WITH 1/8" MAX. THICKNESS OVER THE DRIP EDGE AND UNDERLAYMENT.
2. FOR METAL ROOF COVERS; APPLY A COMPATIBLE MANUFACTURER-APPROVED SEALANT BETWEEN THE DRIP EDGE AND ADJACENT UNDERLAYMENT TO PREVENT WATER FROM ACCUMULATING UNDER THE DRIP EDGE OR USE A MANUFACTURER APPROVED 4" SELF-ADHERED SEAM TAPE.
3. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
- 4.
- 5.

METAL DRIP EDGE (CODE-COMPLIANT, MINIMUM GAUGE) ALONG ALL EAVES AND GABLE RAKE EDGES INSTALLED OVER UNDERLAYMENT. MAKE SURE THE TOP SURFACE OF THE DRIP EDGE IS CLEAN, FREE OF OIL, AND IF REQUIRED BY THE STARTER STRIP MANUFACTURER, PRIMED WITH ASTM D41 PRIMER. FOR SEALING THE DRIP EDGE REFER TO GENERAL NOTE #3.



APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)

DESCRIPTION:

HURRICANE - DRIP EDGE INSTALLATION OVER UNDERLAYMENT

DRAWING #:

F-DE-1

DATE:

11/18/2019



1. GENERAL NOTES:
REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION. REFER TO FORTIFIED STANDARD DETAIL F-C-1 FOR CORROSION PROTECTION REQUIREMENTS.
2. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER.
3. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
- 4.

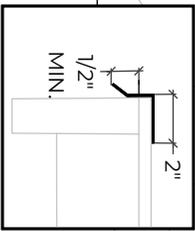
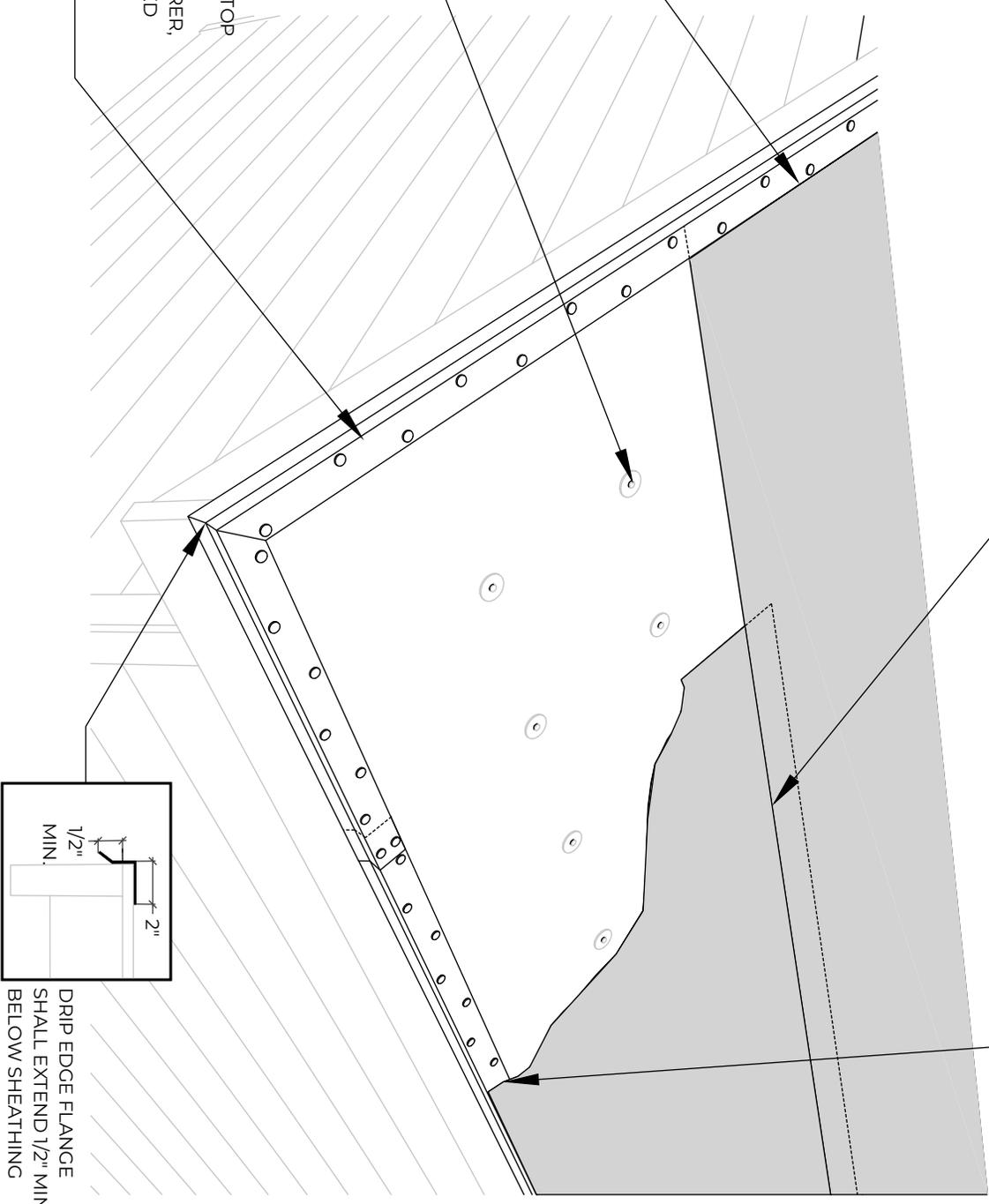
AT RAKES, DRIP EDGE INSTALLED OVER ANCHOR SHEET AND CAP SHEET PER FORTIFIED STANDARD DETAILS F-DE-1 OR F-DE-3.

ANCHOR SHEET INSTALLED IN ACCORDANCE WITH FORTIFIED STANDARD DETAIL F-SRD-5.

TILE CAP SHEET INSTALLED IN ACCORDANCE WITH FORTIFIED STANDARD DETAIL F-SRD-5.

AT EAVES, DRIP EDGE INSTALLED OVER ANCHOR SHEET PER FORTIFIED STANDARD DETAILS F-DE-1 OR F-DE-3 BUT UNDER CAP SHEET AS SHOWN.

METAL DRIP EDGE (CODE-COMPLIANT, MINIMUM GAUGE) ALONG ALL EAVES AND GABLE RAKE EDGES INSTALLED OVER UNDERLAYMENT. MAKE SURE THE TOP SURFACE OF THE DRIP EDGE IS CLEAN, FREE OF OIL, AND IF REQUIRED BY THE MEMBRANE MANUFACTURER, PRIMED WITH ASTM D41 PRIMER. REFER TO FORTIFIED STANDARD DETAILS F-DE-1 OR F-DE-3 FOR INSTALLATION OF DRIP EDGE.



DRIP EDGE FLANGE SHALL EXTEND 1/2" MIN. BELOW SHEATHING

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

DRIP EDGE INSTALLATION OVER ANCHOR SHEET AND UNDER CAP SHEET FOR CONCRETE AND CLAY TILE ROOF COVERS

DRAWING #:

F-DE-2

DATE:

11/18/2019



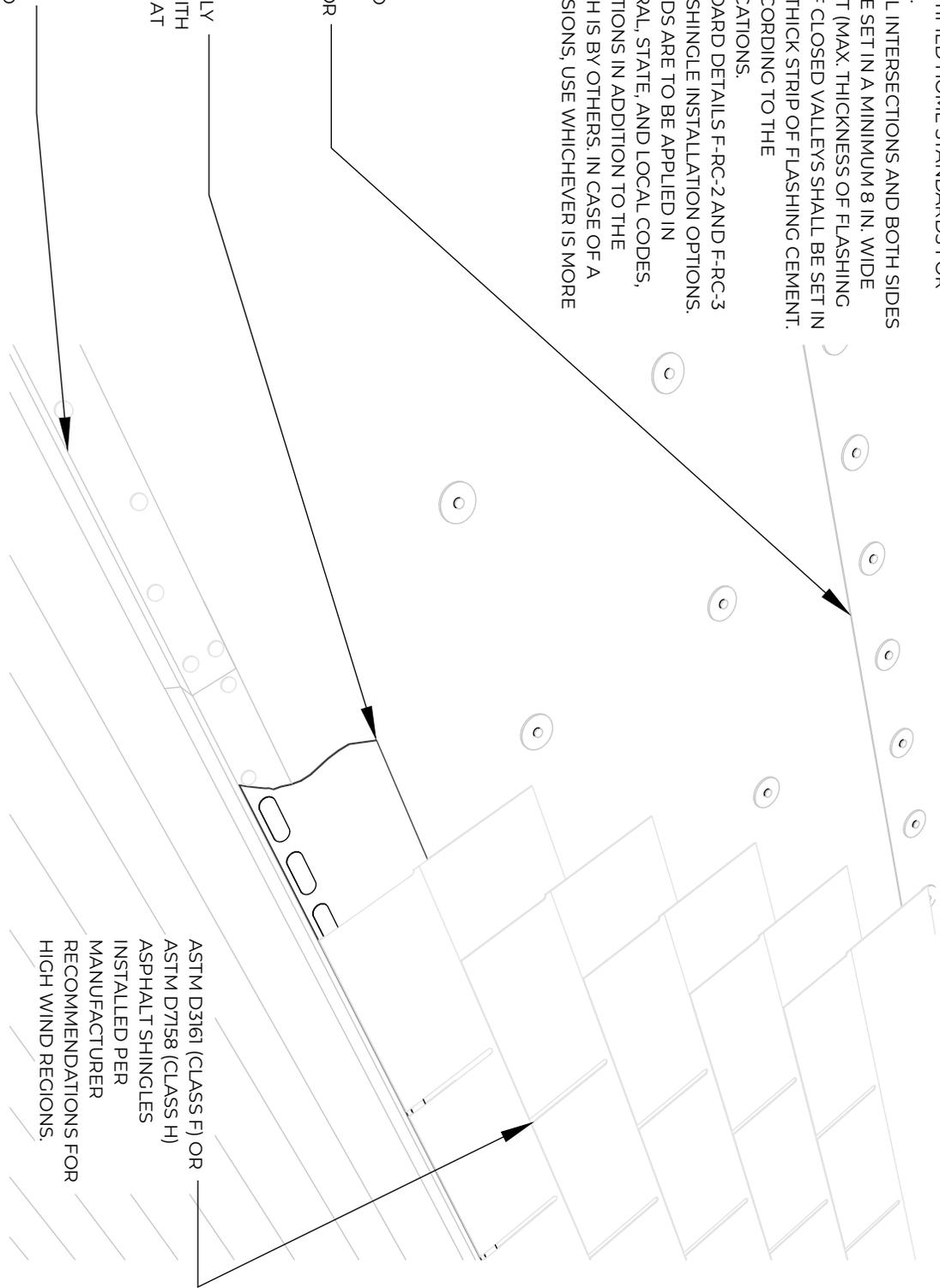
GENERAL NOTES:

1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
2. SHINGLES INSTALLED AT ALL INTERSECTIONS AND BOTH SIDES OF OPEN VALLEYS SHALL BE SET IN A MINIMUM 8 IN. WIDE STRIP OF FLASHING CEMENT (MAX. THICKNESS OF FLASHING CEMENT = 1/8"); CUT SIDE OF CLOSED VALLEYS SHALL BE SET IN A MINIMUM 2 IN. WIDE 1/8" THICK STRIP OF FLASHING CEMENT. WOVEN VALLEYS TO BE ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
3. REFER TO FORTIFIED STANDARD DETAILS F-RC-2 AND F-RC-3 FOR ADDITIONAL ASPHALT SHINGLE INSTALLATION OPTIONS. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS. IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
- 4.

UNDERLAYMENT INSTALLED PER FORTIFIED STANDARD DETAILS F-SRD-2, F-SRD-3, OR F-SRD-4.

SHINGLE MANUFACTURER APPROVED ASTM D1970 FULLY ADHERED STARTER STRIP WITH ASPHALTIC ADHESIVE STRIP AT EAVE.

DRIP EDGE AND ASTM D41 ASPHALT PRIMER INSTALLED PER FORTIFIED STANDARD DETAIL F-DE-1 OR F-DE-2



ASTM D3161 (CLASS F) OR ASTM D7158 (CLASS H) ASPHALT SHINGLES INSTALLED PER MANUFACTURER RECOMMENDATIONS FOR HIGH WIND REGIONS.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

ASPHALT SHINGLE INSTALLATION GUIDANCE FOR STEEP SLOPE - OPTION 1: PEEL AND STICK STARTER STRIP INSTALLATION AT EAVE OR RAKE

DRAWING #:

F-RC-1

DATE:

11/18/2019



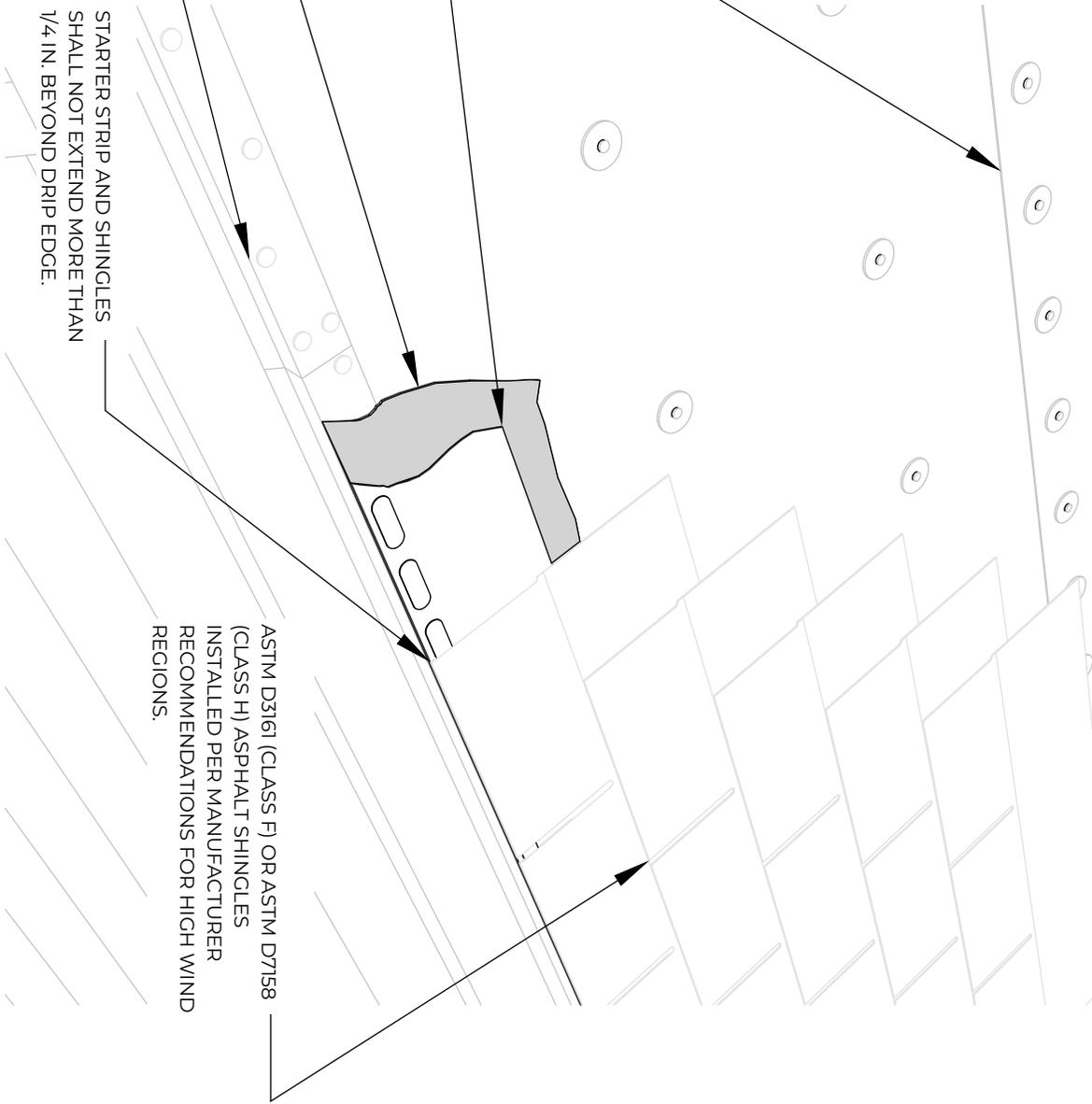
GENERAL NOTES:

1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
2. SHINGLES INSTALLED AT ALL INTERSECTIONS AND BOTH SIDES OF OPEN VALLEYS SHALL BE SET IN A MINIMUM 8 IN. WIDE STRIP OF FLASHING CEMENT (MAX. THICKNESS OF FLASHING CEMENT = 1/8"). CUT SIDE OF CLOSED VALLEYS SHALL BE SET IN A MINIMUM 2 IN. WIDE, 1/8" THICK STRIP OF FLASHING CEMENT. WOVEN VALLEYS TO BE ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
3. REFER TO FORTIFIED STANDARD DETAILS F-RC-1 AND F-RC-3 FOR ADDITIONAL ASPHALT SHINGLE INSTALLATION OPTIONS. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
4. UNDERLAYMENT INSTALLED PER FORTIFIED STANDARD DETAILS F-SRD-2, F-SRD-3, OR F-SRD-4.

SHINGLE MANUFACTURER APPROVED STARTER STRIP SET IN A MINIMUM 8 IN. WIDE STRIP OF COMPATIBLE FLASHING CEMENT (MAX. THICKNESS OF FLASHING CEMENT = 1/8").

VERIFY WITH MANUFACTURER THAT FLASHING CEMENT/ROOF MASTIC IS COMPATIBLE WITH UNDERLAYMENT.

DRIP EDGE AND ASTM D41 ASPHALT PRIMER INSTALLED PER FORTIFIED STANDARD DETAIL F-DE-1 OR F-DE-2.



APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

ASPHALT SHINGLE INSTALLATION GUIDANCE FOR STEEP SLOPE - OPTION 2: SINGLE STRIP STARTER INSTALLATION AT EAVE OR RAKE

DRAWING #:

F-RC-2

DATE:

11/18/2019



GENERAL NOTES:

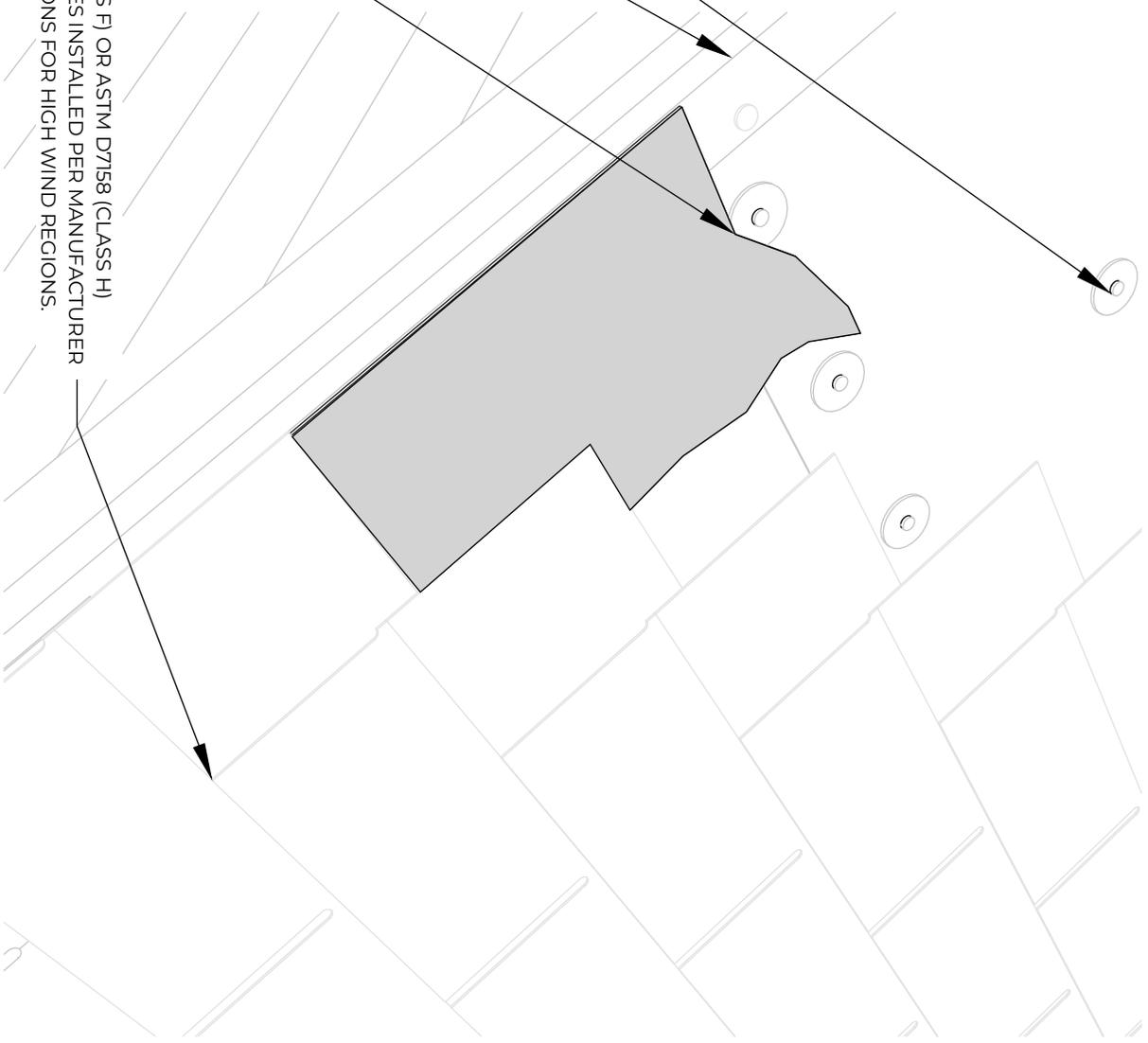
1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
2. SHINGLES INSTALLED AT ALL INTERSECTIONS AND BOTH SIDES OF OPEN VALLEYS SHALL BE SET IN A MINIMUM 8 IN. WIDE STRIP OF FLASHING CEMENT (MAX. THICKNESS OF FLASHING CEMENT = 1/8"). CUT SIDE OF CLOSED VALLEYS SHALL BE SET IN A MINIMUM 2 IN. WIDE, 1/8" THICK STRIP OF FLASHING CEMENT. WOVEN VALLEYS TO BE ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
3. REFER TO FORTIFIED STANDARD DETAILS F-RC-1 AND F-RC-2 FOR ADDITIONAL ASPHALT SHINGLE INSTALLATION OPTIONS. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS. IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS, IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
- 4.

UNDERLAYMENT INSTALLED PER FORTIFIED STANDARD DETAILS F-SRD-2, F-SRD-3, OR F-SRD-4.

D RIP EDGE AND ASTM D41 ASPHALT PRIMER INSTALLED PER FORTIFIED STANDARD DETAIL F-DE-1 OR F-DE-2.

SHINGLES SET DIRECTLY IN A MINIMUM 8 IN. WIDE STRIP OF COMPATIBLE FLASHING CEMENT (MAX. THICKNESS OF FLASHING CEMENT = 1/8"). VERIFY WITH MANUFACTURER THAT FLASHING CEMENT/ROOF MASTIC IS COMPATIBLE WITH UNDERLAYMENT.

ASTM D3161 (CLASS F) OR ASTM D7158 (CLASS H) ASPHALT SHINGLES INSTALLED PER MANUFACTURER RECOMMENDATIONS FOR HIGH WIND REGIONS.



APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

ASPHALT SHINGLE INSTALLATION
GUIDANCE FOR STEEP SLOPE - OPTION 3:
SHINGLES SET DIRECTLY IN FLASHING
CEMENT AT RAKE ONLY

DRAWING #:

F-RC-3

DATE:

11/18/2019



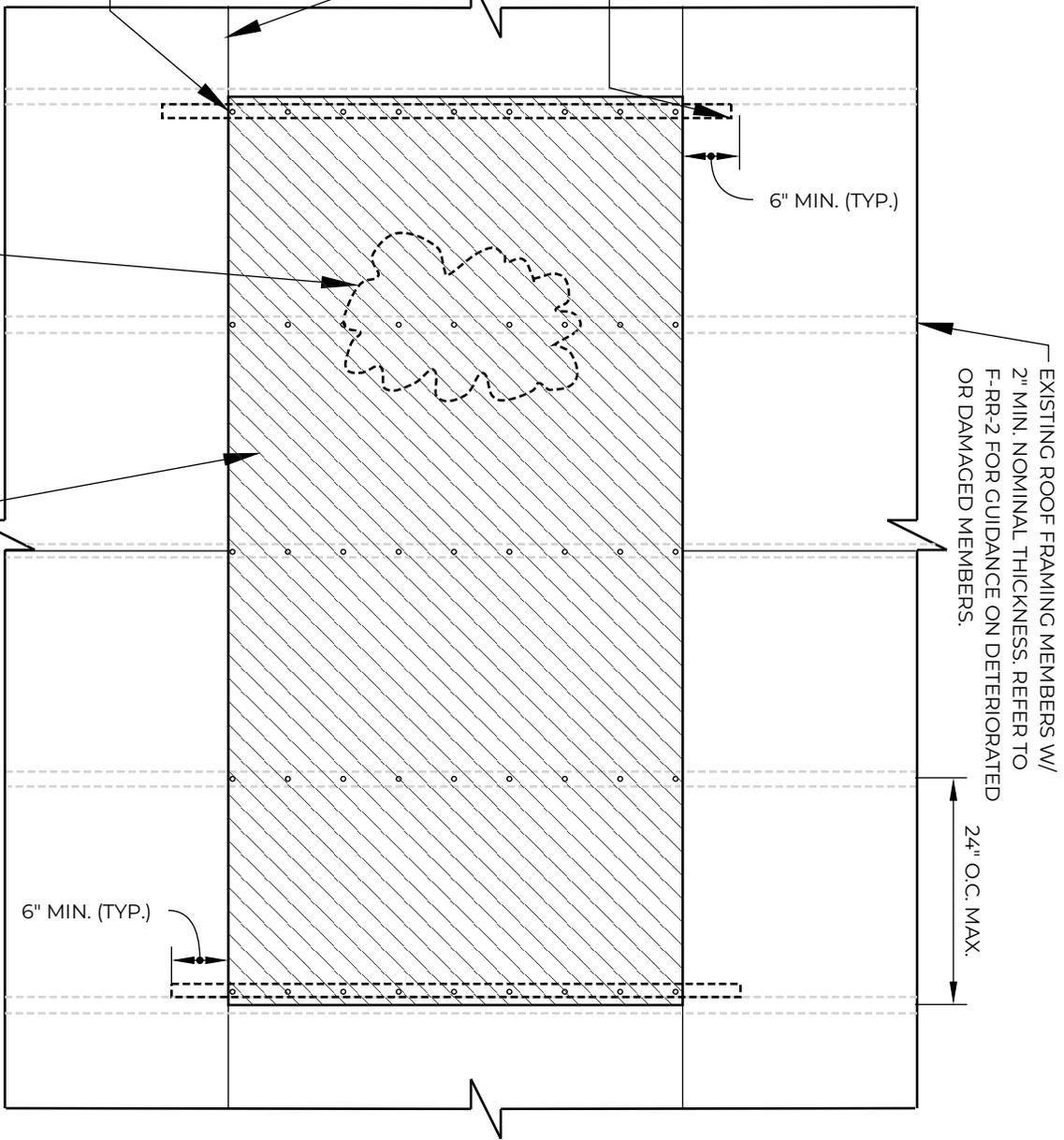
1. GENERAL NOTES:
REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION. WHEN REPLACING AN ENTIRE DAMAGED SHEET WITH A DIMENSION OF LESS THAN 24" IN ANY DIRECTION, PROVIDE 2X4 BLOCKING ALONG ALL UNSUPPORTED EDGES, AND FASTEN SHEATHING IN ACCORDANCE WITH F-RR-3 AND F-RR-4.
2. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
3. AT PANEL ENDS, PROVIDE 2 X 4 SCAB FASTENED TO EXISTING MEMBER W/ 16D NAILS @ 4" O.C. STAGGERED, TYP. OF (2).

EXISTING ROOF SHEATHING BY OTHERS W/ 7/16" MIN. THICKNESS AND NO DAMAGE OR DETERIORATION. REFER TO FORTIFIED STANDARD DETAILS F-RR-3 AND F-RR-4 FOR RE-NAILING SCHEDULE.

REFER TO FORTIFIED STANDARD DETAILS F-RR-3 AND F-RR-4 FOR REQUIRED NAILING. ATTACH NEW ROOF DECK TO SCAB (NOT EXISTING ROOF MEMBER), TYP.

PREVIOUSLY DAMAGED ROOF DECK AREA. INSPECT ROOF SUPPORT MEMBERS BELOW FOR DETERIORATION OR DAMAGE AND REPLACE ENTIRE SHEET.

NEW ROOF DECK REPLACEMENT FASTENED TO SCAB, BLOCKINGS (IF APPLICABLE) AND EXISTING FRAMING IN ACCORDANCE WITH FORTIFIED STANDARD DETAILS F-RR-3 AND F-RR-4.



APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

RE-ROOFING DECK REPLACEMENT
FASTENING DETAIL

DRAWING #:

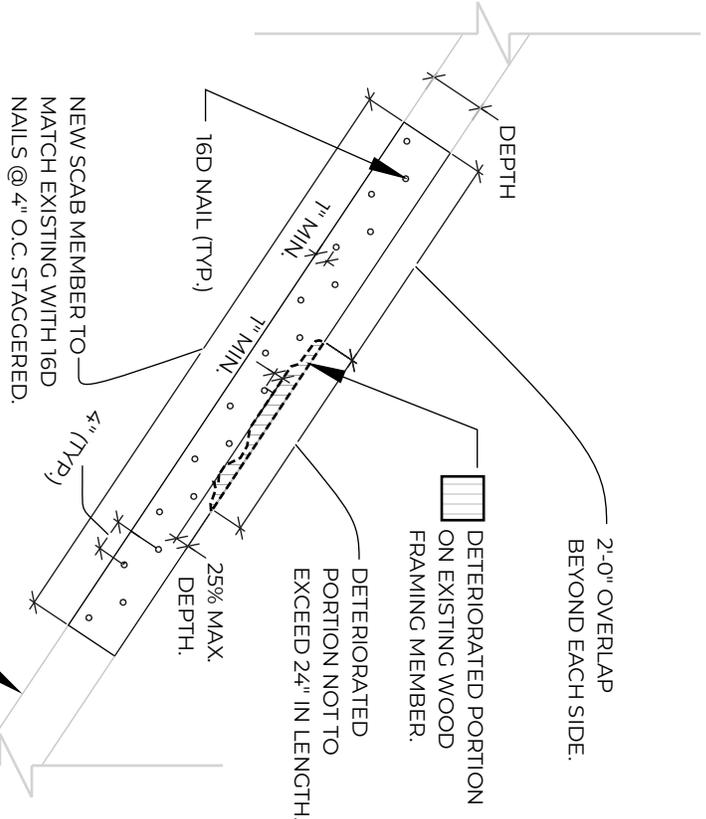
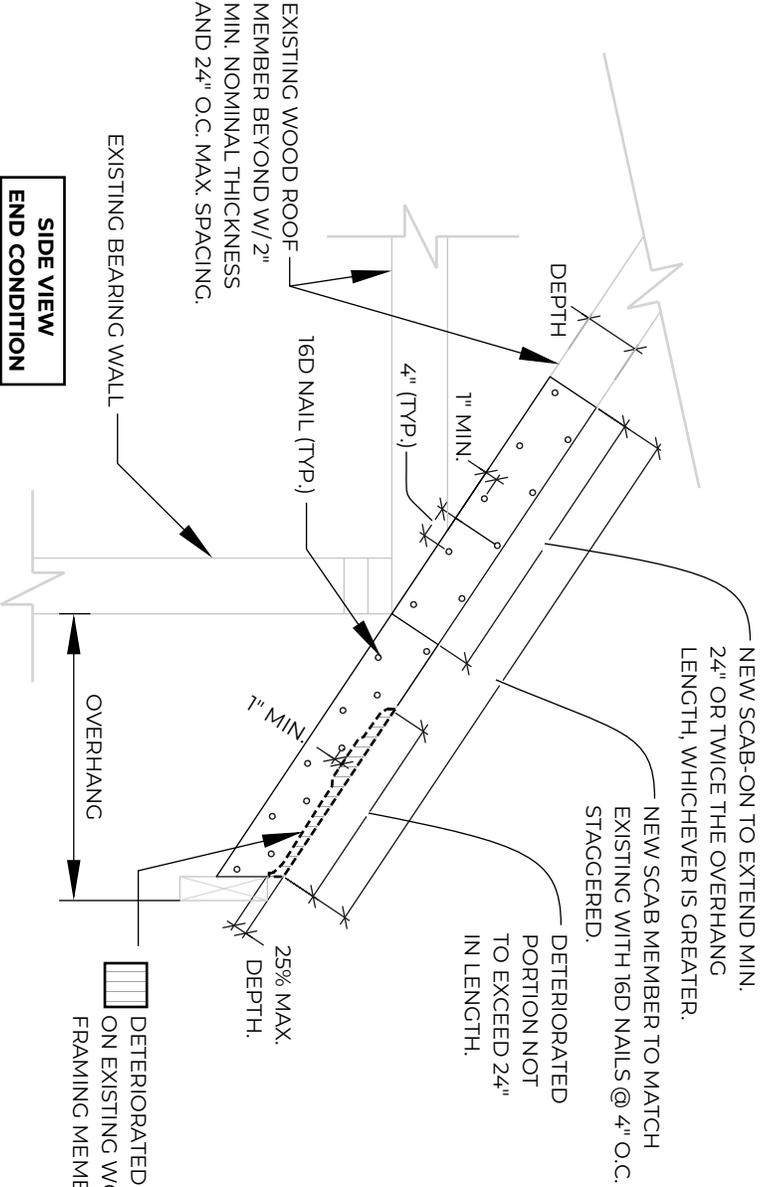
F-RR-1

DATE:

11/18/2019



- GENERAL NOTES:
1. REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION. SCAB WOOD MEMBERS MAY BE TRIMMED UP TO A MAXIMUM OF 1/2" AT THE BOTTOM TO FACILITATE INSTALLATION.
 2. IF DAMAGE IS GREATER THAN THE CONDITIONS SHOWN, CONSULT A LICENSED PROFESSIONAL ENGINEER TO PROVIDE ENGINEERING DETAILS TO REPAIR THE DAMAGE. DAMAGED/DETERIORATED AREA MUST BE A MINIMUM OF 6 IN. AWAY FROM ANY MECHANICAL CONNECTIONS (I.E. TRUSS/RAFTER HANGERS, TRUSS CONNECTOR PLATES, ETC.)
 3. WHEN THE FASCIA OR SUB-FASCIA IS THE ROOF FRAMING MEMBER THAT IS DAMAGED OR DETERIORATED, REMOVE AND REPLACE THE DAMAGED/DETERIORATED SECTION PLUS AT LEAST 2 FT. BEYOND THAT SECTION ON EACH SIDE.
 4. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.



EXISTING WOOD ROOF MEMBER BEYOND W/2" MIN. NOMINAL THICKNESS AND 24" O.C. MAX. SPACING.

EXISTING BEARING WALL

OVERHANG

DETERIORATED PORTION ON EXISTING WOOD FRAMING MEMBER.

SIDE VIEW INTERIOR SPAN CONDITION

EXISTING WOOD ROOF MEMBER BEYOND W/2" MIN. NOMINAL THICKNESS AND 24" O.C. MAX. SPACING.

2'-0" OVERLAP BEYOND EACH SIDE.

DETERIORATED PORTION ON EXISTING WOOD FRAMING MEMBER.

DETERIORATED PORTION NOT TO EXCEED 24" IN LENGTH.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)
 FORTIFIED HOME™ - HIGH WIND (2015)

DESCRIPTION:

RE-ROOFING NEW SCAB MEMBER DETAIL FOR DAMAGED OR DETERIORATED WOOD FRAMING MEMBER

DRAWING #:

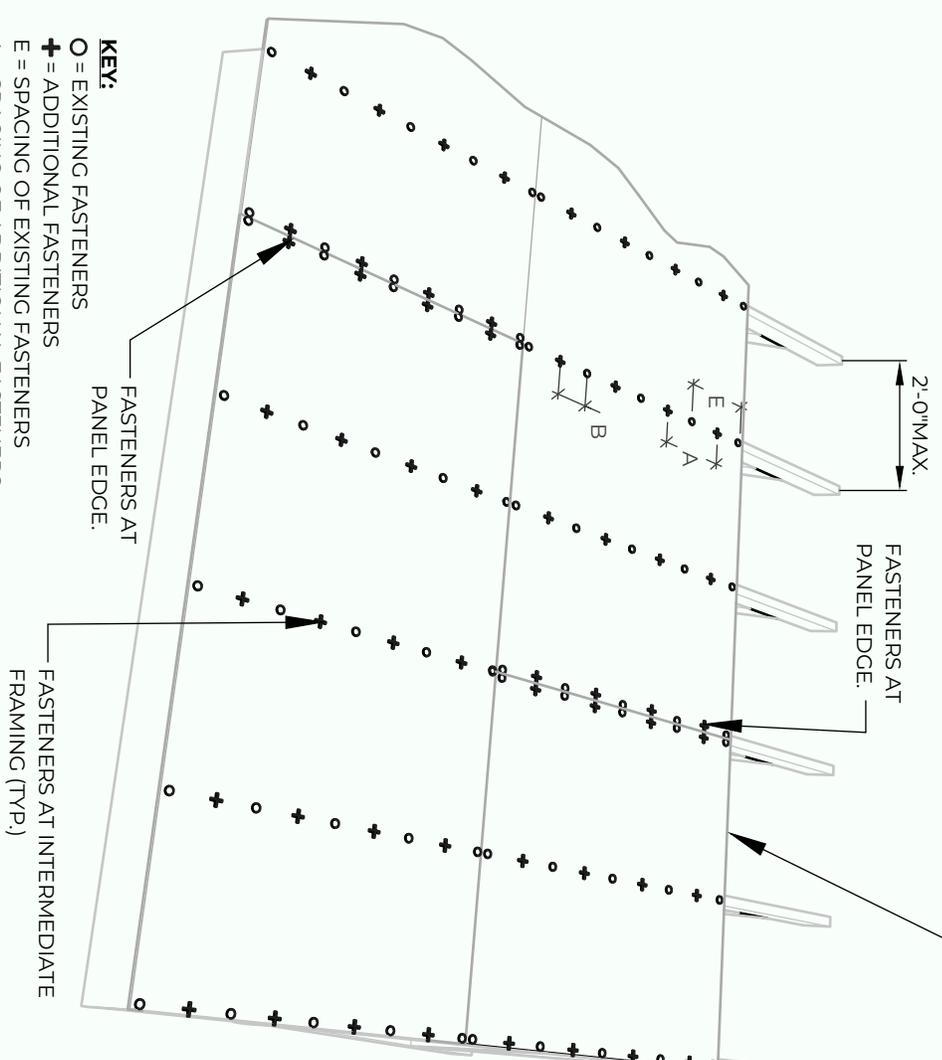
F-RR-2

DATE:

11/18/2019



- GENERAL NOTES:**
 REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
1. APPLICABLE FOR ROOF PITCH 2:12 OR GREATER.
 2. FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.
 - 3.



KEY:
 O = EXISTING FASTENERS
 + = ADDITIONAL FASTENERS
 E = SPACING OF EXISTING FASTENERS
 A = SPACING OF ADDITIONAL FASTENERS
 B = SPACING BETWEEN EXISTING AND ADDITIONAL FASTENER

EXISTING STRUCTURAL WOOD PANEL ROOF SHEATHING (PLYWOOD OR OSB); 7/16" MIN. W/ NO DAMAGE OR DETERIORATION. REFER TO F-RR-1 FOR DAMAGED OR DETERIORATED SHEATHING.

EXISTING ROOF FRAMING MEMBERS W/ 2" MIN. NOMINAL THICKNESS. REFER TO F-RR-2 FOR GUIDANCE ON DETERIORATED OR DAMAGED MEMBERS.

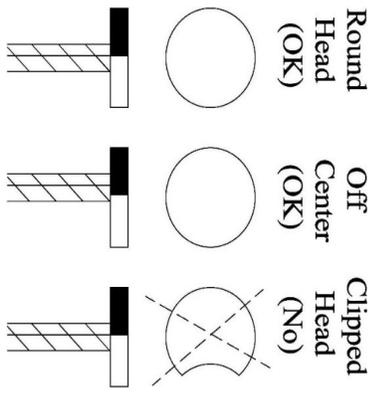


FIGURE 1.

Table F-RR-3: Additional 8d Ring-Shank Nails³ Required for Existing Roof Deck

Wind Speed ⁵	Existing Fastener ²	Existing Spacing ⁴ , E	Required Spacing of Additional 8d Ring-Shank Nails ^{3,4}		
			Roof Zones ¹ 2 and 3	Roof Zone ¹ 1	Intermediate Framing
Up to 100 mph (V_{asd}) / 130 mph (V_{ult})	8d smooth-shank nails	E ≤ 6" O.C.	N/A	A = 6" O.C.	N/A
			B = 6" O.C.	A = 6" O.C.	B = 6" O.C.
Greater than 100 mph (V_{asd}) / 130 mph (V_{ult})	8d smooth-shank nails ²	E ≤ 12" O.C.	B = 6" O.C.		
			A = 4" O.C.		
	Staples or 6d nails	Any	A = 4" O.C.		
			B = 4" O.C.		

- Notes:**
1. Refer to FORTIFIED Standard Detail F-G-2 for identification of Roof Zones
 2. Existing 8d ring-shank nails to be a minimum of 0.131" diameter x 2 1/2" long.
 3. All additional 8d ring-shank nails to be a minimum of 0.113" diameter x 2 3/8" long with full round head. Refer to Figure 1.
 4. Refer to roof figure and Key for description of distances E, A, and B.
 5. V_{asd} corresponds to ASCE 7-05 / V_{ult} corresponds to ASCE 7-10.

APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)

DESCRIPTION:

HURRICANE - RE-NAILING THE ROOF DECK (WOOD STRUCTURAL PANELS)

DRAWING #:

F-RR-3

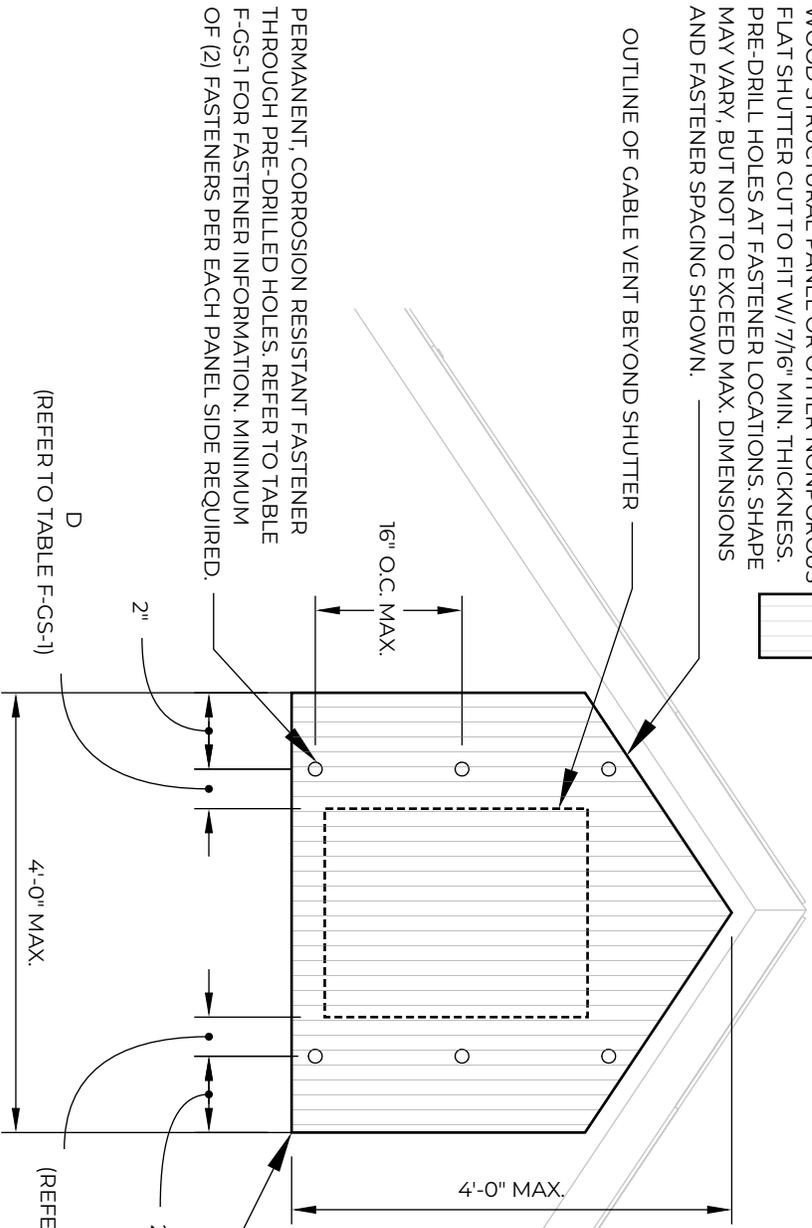
DATE:

11/18/2019



- GENERAL NOTES:**
 REFER TO APPLICABLE FORTIFIED HOME STANDARDS FOR ADDITIONAL INFORMATION.
- REFER TO FORTIFIED STANDARD DETAIL F-G-1 FOR CORROSION PROTECTION REQUIREMENTS.
 - FORTIFIED HOME STANDARDS ARE TO BE APPLIED IN CONJUNCTION WITH FEDERAL, STATE, AND LOCAL CODES, ORDINANCES AND REGULATIONS IN ADDITION TO THE STRUCTURAL DESIGN WHICH IS BY OTHERS. IN CASE OF A CONFLICT BETWEEN PROVISIONS, USE WHICHEVER IS MORE STRINGENT.

WOOD STRUCTURAL PANEL OR OTHER NONPOROUS FLAT SHUTTER CUT TO FIT W/ 7/16" MIN. THICKNESS. PRE-DRILL HOLES AT FASTENER LOCATIONS. SHAPE MAY VARY, BUT NOT TO EXCEED MAX. DIMENSIONS AND FASTENER SPACING SHOWN.



SHUTTER CAN BE INSTALLED FROM OUTSIDE OF HOUSE OR FROM INSIDE OF ATTIC.

TABLE F-GS-1: FASTENING SCHEDULE FOR CABLE VENT COVER.

SUPPORT STRUCTURE TYPE	FASTENER TYPE & SIZE	END DISTANCE, D
WOOD	1/4" Ø LAG SCREWS W/ 2" EMBEDMENT & 1" Ø WASHER	1"
CONCRETE OR GROUTED MASONRY	1/4" Ø FASTENER W/ 2" EMBEDMENT & 1" Ø WASHER	1.5"

NOTES: WHERE SCREWS ARE ATTACHED TO MASONRY OR MASONRY/STUCCO, USE VIBRATION-RESISTANT ANCHORS W/ 1500 LBS MIN. WITHDRAWAL CAPACITY.

PERMANENT, CORROSION RESISTANT FASTENER THROUGH PRE-DRILLED HOLES. REFER TO TABLE F-GS-1 FOR FASTENER INFORMATION. MINIMUM OF (2) FASTENERS PER EACH PANEL SIDE REQUIRED.

SEAL SHUTTER AROUND THE EDGES OF THE CABLE VENT SO THAT WATER DRAINS TO OUTSIDE.



APPLICABLE STANDARDS:

FORTIFIED HOME™ - HURRICANE (2019)

DESCRIPTION:

CABLE VENT SHUTTERING

DRAWING #:

F-GS-1

DATE:

11/18/2019



SOUTH CAROLINA DEPARTMENT OF INSURANCE

SC Safe Home is a grant program established by the state legislature under the Omnibus Coastal Property Insurance Reform Act of 2007. The Omnibus Act was enacted to address issues involving property insurance availability and affordability along South Carolina's coast. It established the South Carolina Comprehensive Hurricane Grant Mitigation Program known as SC Safe Home. The SC Safe Home Program provides grants to South Carolina property owners to assist with the retrofit of their homes to make them more resistant to loss due to hurricane damage.

The State of South Carolina makes no representations, guarantee, or warranty, either express or implied, regarding the performance or effectiveness of the wind resistive devices, installed pursuant to the SC Safe Home Participating Wind Inspectors Manual SC Safe Home Participating Contractor Manual with respect to protecting property, loss prevention, life safety and protection purposes, or fitness for a particular purpose.

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