



2025
FORTIFIED Multifamily
STANDARD

WEATHER HAZARDS



Hurricane



High Wind



Hail

LEVELS





2025 FORTIFIED Multifamily™ Standard

Table of Contents

1	INTRODUCTION	4
2	SITE SPECIFIC REQUIREMENTS	5
2.1	Occupancy and Land Use	5
2.1.1	Use and Occupancy	5
2.1.2	Land Use	5
2.1.3	Height.....	5
2.2	Foundation Qualification Requirements.....	5
2.2.1	Ineligible Foundations	5
2.2.2	Elevated Floor Building-to-Foundation Connections.....	5
2.2.3	All Other Foundations	6
2.3	Flood	6
2.4	Hail Supplement (Optional).....	6
2.5	Corrosion Resistance Requirements.....	7
2.6	Product Substitution Preapproval Requirements.....	10
2.7	Historic Buildings and Local Architectural Restrictions	10
2.8	IBHS Contact Information.....	10
2.9	Definitions.....	11
3	FORTIFIED MULTIFAMILY REQUIREMENTS	13
3.1	FORTIFIED Roof	13
3.1.1	Building Design Overview.....	13
3.1.2	Design Requirements for Low-Sloped Roof Systems ($\leq 10^\circ$, Less Than 2/12)	18
3.1.3	Design Requirements for Steep-Sloped Roofs ($>10^\circ$, 2/12 or Greater)	20
3.1.4	Corrosion Protection—Materials	32
3.1.5	Skylights	33
3.1.6	Roof-Mounted Equipment.....	33
3.1.7	Lightning Protection Systems.....	34
3.1.8	Low-Sloped ($\leq 10^\circ$) Roof-Mounted Safety Rails.....	36
3.1.9	Low-Sloped Roof Equipment Screens	36
3.2	FORTIFIED Silver	36
3.2.1	Openings.....	36
3.2.2	Wall Systems	37
3.2.3	Gable Ends.....	39
3.2.4	Securing Chimneys	39
3.2.5	Electrical and Mechanical Systems and Connections—Flood Protection.....	39
3.3	FORTIFIED Gold	40
3.3.1	Continuous Load Path	40
3.3.2	Structural Members of Cantilever Overhangs.....	40
3.3.3	Attached and Accessory Structures.....	40



4	SUPPORTING DOCUMENTATION	41
5	APPENDIX A: APPROVED AND PERFORMANCE TESTED SYSTEMS.....	42
5.1	Hail-Impact Related Performance Criteria (Optional Supplement).....	42
5.1.1	Low-Sloped Continuous Roof Covers.....	42
5.1.2	Steep-Sloped Roof Covers	42
5.1.3	Hail Resistance of Photovoltaic Systems.....	43
5.2	Fire-Rated Approved Roof Systems.....	43
5.3	Approved Low-Sloped Continuous Roof Covers	43
5.3.1	Florida Product Approval (FPA) Approved Systems.....	43
5.3.2	FM Approved Systems.....	44
5.3.3	Miami-Dade County Approved Systems.....	45
5.3.4	Texas Department of Insurance (TDI) Approved Systems	46
5.3.5	UL Rated and Approved Systems.....	46
5.3.6	Directory of Roof Assemblies	47
5.3.7	Roof Cover Selection Example.....	47
5.4	Approved Structural and Architectural Metal Roof Panel Systems.....	49
5.5	Additional Approved Photovoltaic (PV) Systems.....	50
6	REFERENCES.....	51

Tables

Table 1: Corrosion Protection Requirements for Fasteners & Connectors in Coastal Regions	7
Table 2: Sheathing Fastening.....	21
Table 3: Design Wind Speed and Shingle Testing Standards (h1<60 ft, Exposure C)	30
Table 4: Roof Example Using Wind Design Pressures LRFD and ASD	47
Table 5: FM/FPA/ICC-ES/ Miami-Dade/TDI/UL Roof Selection	49

Figures

Figure 1: Use 8d ring-shank nails when attaching roof sheathing.	22
Figure 2: Installing a sealed roof deck system; taping the seams of roof sheathing.....	24
Figure 3: Installation of 19 in. starter course	26



1 Introduction

The Insurance Institute for Business & Home Safety's (IBHS) FORTIFIED Multifamily™ standard addresses specific natural hazard risks and provides recommendations for reducing damage particular to those risks. The FORTIFIED Multifamily standard helps building owners improve their multifamily structure's ability to resist wind, water, and hail damage from tropical cyclones or convective storms. Incorporating FORTIFIED features when building or re-roofing will transform multifamily buildings and communities into more resilient and durable assets.

FORTIFIED Multifamily uses an incremental approach to make new and existing multifamily buildings more resistant to damage from severe weather. With three levels of FORTIFIED Multifamily designation available—FORTIFIED Roof™, FORTIFIED Silver™, and FORTIFIED Gold™—builders can work with owners to choose a level of protection that best suits their budgets and resilience goals. The following sections outline eligibility requirements for the FORTIFIED Multifamily program for all designation levels.

Note: Some requirements vary depending on whether the location is in a hurricane-prone region or a high-wind-prone region. There are also additional requirements for projects seeking the optional hail supplement. These differences are noted throughout this document.

Designation certificates are issued by IBHS verifying that a multifamily building's design and construction is in accordance with the FORTIFIED Multifamily standards. Designation letters will specify whether the hurricane or high-wind provisions were met, as well as noting if the requirements for the optional hail supplement have been met.

FORTIFIED Multifamily requirements are minimum requirements for FORTIFIED designations and do not take the place of structural design or supersede more restrictive requirements from the structural design, locally adopted building code(s), or product manufacturer's specifications. It is the responsibility of the building designer and contractor to ensure local regulations and building codes are properly accounted for and recognize that many requirements fall outside of the scope of FORTIFIED. In case of a conflict between provisions, use whichever regulation is more stringent. FORTIFIED Multifamily Evaluator services including review and site surveys are provided independent of IBHS and only evaluate the components outlined within this standard.

Re-evaluations (Section 3.1.1.1) address the specific building components included in the standard at the time of evaluation. Re-evaluations do not replace routine building maintenance plans including required structural engineering inspections that report on the building's structural condition, building code inspection requirements, and any other items beyond the scope of these standards.



2 Site Specific Requirements

2.1 Occupancy and Land Use

2.1.1 Use and Occupancy

Building classifications are based on 2018 International Building Code Chapter 3, Section 310 Residential R-2 and R-3 buildings and structures for nontransient sleeping purposes. Examples include but are not limited to apartment buildings, condominiums, and townhomes when the occupants own or lease only the interior, or when operated as commercial properties. For other types of occupancies within R- 2 and R-3, use the FORTIFIED Commercial standard. The FORTIFIED Multifamily Evaluator and IBHS have the discretion, and reserve the right to, determine a building's eligibility for the program based on use and occupancy.

2.1.2 Land Use

FORTIFIED Multifamily does not supersede local and municipal policy concerning land use and locations deemed safe to build commercial structures.

2.1.3 Height

Buildings with height equal to or greater than 250 ft, measured from finished elevation (FFE) to the topmost roof structure will be evaluated for eligibility on a case-by-case basis and may be accepted into the FORTIFIED Multifamily program at the discretion of IBHS.

2.2 Foundation Qualification Requirements

2.2.1 Ineligible Foundations

Buildings on a foundation constructed of unrestrained stacked masonry or stone (a dry-stack foundation) are NOT eligible for a FORTIFIED Multifamily designation.

2.2.2 Elevated Floor Building-to-Foundation Connections

To be eligible for designation or re-designation under the FORTIFIED Multifamily program, buildings with elevated floors (not slab-on-grade construction) must have adequate positive connections from the floor or wall structure to the supporting foundation. For example, buildings on piers or pilings must have connections from the tops of the piers/pilings to the building's floor beams and a building on piers with shallow foundations must have connections that provide a continuous load path to the foundations. All connectors must be free from damage, corrosion resistant (if applicable) in accordance with [Section 3.1.4](#) of this standard and installed per the connector manufacturer's installation instructions. All structural connections must be engineered and specified by the structural engineer of record.



2.2.3 All Other Foundations

2.2.3.1 New Construction

All other new foundation systems must be engineered and specified by the structural engineer of record.

2.2.3.2 Existing Conditions

Existing foundation systems must have adequate positive connections from the floor or wall structure to the supporting foundation. When seeking FORTIFIED Gold, the existing foundation systems must be evaluated by the structural engineer of record. Additional information and on-site testing may be required to verify the structural capacity of the existing conditions.

2.3 Flood

While protecting electrical and mechanical systems from flood is a requirement of FORTIFIED Silver, whole-building protection against the flood hazard is not required under FORTIFIED Multifamily. However, IBHS strongly recommends the following mitigation steps be taken for flood zones designated by the Federal Emergency Management Agency (FEMA) including V, A, B, D, and X-shaded:

- Elevate the building's first finished floor above the 500-year flood level (if known) or 3 ft above the base flood elevation (BFE) for the property.
- If the building is not sufficiently elevated as described above, it is recommended that dry flood protection such as flood gates, walls, or doors be used to prevent water intrusion to the heights described above. Flood depth, duration, velocity, and condition of water should be considered (including floating debris).
- Buildings should have a check valve or similar backflow device installed at the point of entry into the building on the sanitary line to prevent sewage from potentially flowing back into the building during a flood.

Levees Best Practices: This standard allows for a building's design to assume a levee will successfully protect against flood waters. However, buildings in levee-protected areas should be designed as if the levee could fail, providing additional protection against potential flooding from a levee breach.

2.4 Hail Supplement (Optional)

FORTIFIED Multifamily hail hazard requirements are an optional supplement that reduces a building's exposure. To be eligible for a Hail Supplement, a building must first meet all the requirements for either a FORTIFIED Multifamily-Hurricane or a FORTIFIED Multifamily-High Wind designation. Then, to earn a Hail Supplement, all hail requirements, marked as shown, throughout the standard must also be met.



Hail Supplement (Optional):



2.5 Corrosion Resistance Requirements

Table 1: Corrosion Protection Requirements for Fasteners & Connectors in Coastal Regions

Requirements & Best Practices for FORTIFIED Roof™ Designations			
	REQUIREMENTS		BEST PRACTICES
	Distance to saltwater shoreline ¹		Distance to brackish water shoreline
Roof Connections	0–300 ft	300–3,000 ft	0–300 ft
Roofing nails for shingles	Category A	Category B (or better)	Category B (or better)
Concrete and clay roof tile fasteners			
Roof vent fasteners			
Metal roof system including panels and exposed fasteners, clips, etc.	Follow manufacturer's corrosion resistance guidance for coastal areas. If not provided by manufacturer, the following corrosion resistance categories may be accepted for exposed fasteners and clips		
	Category A	Category B (or better)	
Fasteners used for attachment of underlayment to roof deck	Category B (or better)		
Roof mounted equipment curbs, fasteners, and connections	Category A	Category B (or better)	
Photovoltaic unit fasteners and connections			
Skylight curbs, fasteners, and connections			
Other attached roof components fasteners and connections (including equipment screens and roof safety rails)			
Low-slope application – wood nailer fasteners	See Section 3.1.2.3.2 for more information		



Requirements and Best Practices for FORTIFIED Silver™ and FORTIFIED Gold™ Designations			
Exterior Exposed Connections (Including under soffits and elevated foundations)	REQUIREMENTS		BEST PRACTICES
	Distance to saltwater shoreline ¹		Distance to brackish water shoreline
	0–300 ft	300–3,000 ft	0–300 ft
Silver: <ul style="list-style-type: none"> Soffit fasteners Exposed façade system/siding connectors, anchors, fasteners Exposed attached structure connectors, anchors, fasteners 	Category A <i>Aluminum Soffits</i> NOT Allowed	Category B (or better) <i>Aluminum Soffits</i> <i>Allowed</i>	Category B (or better)
Gold: Exposed CLP connectors, anchors, fasteners			
Interior Connections (Including enclosed in attic or within wall cavity)	BEST PRACTICES		BEST PRACTICES
	Distance to saltwater shoreline ¹		Distance to brackish water shoreline
	0–300 ft	300–3,000 ft	0–300 ft
Silver: <ul style="list-style-type: none"> Gable bracing metal connectors and fasteners Gable outlooker hangers, clips, and fasteners Chimney framing metal connectors and fasteners 	Category B (or better)		Category C (or better)
Gold: Enclosed CLP connectors, anchors, fasteners	Category C (or better)		



Corrosion Resistance Categories ^{2,3}	
<p>CATEGORY A: STAINLESS STEEL OR EQUIVALENT</p> <p><u>Metal connectors:</u> Stainless steel per ASTM A316</p> <p><u>Fasteners:</u> Stainless steel per ASTM A304 or A316</p> <p>Proprietary coated fasteners require documentation of equivalent corrosion protection performance to stainless steel, such as equivalence testing per ICC-ES AC257 Exposure Condition 4, or other comparative testing documentation</p>	<p>CATEGORY B: ENHANCED GALVANIZED OR EQUIVALENT</p> <p><u>Metal connectors:</u></p> <ul style="list-style-type: none"> Galvanized per ASTM A653 with G185 coating Hot-dip galvanized per ASTM A123 <p><u>Fasteners with diameters over 3/8 in.:</u> Hot-dip galvanized per ASTM A153 Class C</p> <p><u>Fasteners with diameters up to 3/8 in. shall meet one of the following:</u></p> <ul style="list-style-type: none"> Hot-dip galvanized per ASTM A153 Class D Galvanized per ASTM A641 Class 3 Per ASTM G85, Annex 5, Corrosion resistance exhibiting not more than 5% red rust after the following: <ul style="list-style-type: none"> For nails: 280 hours For roof tile fasteners: 1,000 hours For other carbon steel fasteners: 360 hours <p>In lieu of testing listed above, proprietary coated fasteners require documentation of equivalent or superior corrosion protection performance to the galvanization options listed above, such as equivalence testing per ICC-ES AC257 Exposure Condition 4, or other comparative testing documentation</p> <p>Testing per ASTM B117 with corrosion resistance exhibiting not more than 5% red rust after 1,000 hours exposure may be accepted if no other testing is available</p>
<p>CATEGORY C - STANDARD GALVANIZED</p> <p><u>Metal connectors:</u> Galvanized per ASTM A653 with G90 coating</p> <p><u>Fasteners:</u> Galvanized per ASTM A641 Class 1</p>	
<p>Table Notes:</p> <ol style="list-style-type: none"> For the purposes of FORTIFIED designation, “saltwater shoreline” shall be considered as the ocean or gulf coastline along the mainland United States including seaward island coastlines. This includes the Atlantic, Pacific, and Gulf of Mexico coastlines, as well as the coastline of any Bay or Sound with no land barrier separating it from being completely open to the ocean or Gulf of Mexico. Distances are measured from the closest feature of the subject building to the ocean or gulf coastline. Fastener and connector materials and coatings must be compatible with materials and coatings they come into contact with to prevent galvanic corrosion due to dissimilar materials. Fasteners in contact with chemically treated wood shall be in accordance with the requirements of the IBC or locally adopted code as applicable. 	



2.6 Product Substitution Preapproval Requirements

Failure to obtain written approval for material/product substitutions from the FORTIFIED Multifamily Evaluator may result in costly and avoidable expenses and may also result in a project not achieving the FORTIFIED designation level being sought.

If a product/material substitution is necessary after project plans have been reviewed, the design team is required to communicate the substitution to the FORTIFIED Multifamily Evaluator to confirm the new product meets the necessary criteria. It is critical that this be done as soon as it is determined that a potential substitution may be needed and well in advance of procurement of materials. Substitutions must be installed in a manner that meets the minimum requirements outlined in the FORTIFIED standard and must follow the manufacturer's installation instructions. When new materials/products are selected, it is the responsibility of the design team to provide the FORTIFIED Multifamily Evaluator with proper documentation (See Section 4 Supporting Documentation).

For substitute products or systems that do not have required testing referenced in the FORTIFIED Standard (e.g., impact resistance testing), the FORTIFIED Multifamily Evaluator will determine, at their discretion, alternate acceptance criteria which may include testing at a certified laboratory or in-situ testing.

2.7 Historic Buildings and Local Architectural Restrictions

Historic buildings may have local architectural restrictions that require building components to preserve their character. Restrictions can apply to repairs, alterations, restorations, occupancy changes, or additions.

Areas where these restrictions may conflict with FORTIFIED include:

FORTIFIED Roof

- Verification of sufficient connections between roof deck and walls

FORTIFIED Silver

- Verification of impact-rated windows/doors in hurricane-prone regions
- Verification of impact -resistant siding in hurricane-prone regions
- Elevation of critical utilities

FORTIFIED Gold

- Verification of sufficient load path from roof to foundation

Failure of individual building components often leads to cascading failures, which is why the FORTIFIED Multifamily standards and designation levels focus on mitigating a building's vulnerability through a holistic approach. Each designation level has requirements that enable a building to perform to that level with a building performance expectation. For buildings to perform as designated—and to achieve designation—they must meet the requirements of the designation level sought. No exceptions to the standard will be made.

2.8 IBHS Contact Information

For more detailed information about how to make your multifamily building stronger, please visit <https://fortifiedhome.org/fortified-multifamily/>. You also can submit specific enquiries at: <https://fortifiedhome.org/contact/>.



2.9 Definitions

Ballasted roofing system: a roofing system where the membrane is not anchored or adhered in any way to the decking material; it is kept in place using river-washed stones or paver blocks.

Ballasted roof-mounted equipment: equipment that is not mechanically attached to structural members; it is held down by concrete blocks or similar material.

Continuous load path: an engineering term that refers to a series of connections that allow forces, such as those created by high-wind events, to pass from one part of a structure to another and ultimately to the foundation. A continuous load path allows the building to resist the forces created by high winds as a unit. Without a continuous load path, there are “weak links” in a building’s connections. These weak links are where failures are most likely to occur.

Designation: a certificate issued by IBHS verifying a commercial building’s design and construction is in accordance with the FORTIFIED Multifamily standards (FORTIFIED Roof™, FORTIFIED Silver, or FORTIFIED Gold).

Design pressure rating: the allowable wind pressure rating assigned to a roof, window, door, or opening protection product, expressed as both a positive and negative pressure. The design pressure rating is based on specific testing and a required factor of safety.

Design wind speed: the wind speed specified in the building code for a given location that is used in accordance with code-accepted procedures to establish wind pressures and associated forces which a building or parts of a building must be capable of resisting.

Documentation: evidence that a specific requirement has been met, either in the form of a test report, manufacturer’s installation guidelines, product markings, or other evidence that proves a specific requirement has been met.

Drip edge: metal flashing installed at eaves and along gable rake edges on steep- sloped roofs.

Flashing: components used to weatherproof or seal roof system edges at perimeters, penetrations, walls, expansion joints, valleys, drains, and other places where the roof covering is interrupted or terminated.

FORTIFIED Multifamily Application: an online form filled out and submitted by the building owner or design team. Information collected on this form determines whether the project is eligible to pursue a FORTIFIED designation. An application can be filled out by visiting the IBHS [FORTIFIED Multifamily website](#).

FORTIFIED Multifamily–Wind Low-Sloped Re-Roofing Form: a document that captures the specific existing construction details as well as re-roofing details (qualifications outlined in Section [3.1.1.2.1](#)). This document also captures the items necessary for an applicant to achieve FORTIFIED Silver and FORTIFIED Gold. It is to be filled out by the general contractor/roofing contractor, structural engineer of record, or project architect. It confirms the re-roofing requirements and outlines the required documentation of the existing construction including photo documentation.

FORTIFIED Multifamily–Wind New Construction and New Additions Form: a document that captures the specific construction details for new construction and additions to buildings (qualifications outlined in Section [3.1.1.2.3](#)). It is to be filled out by the project architect, a structural engineer of record, and the general contractor and/or roofing contractor. It confirms the requirements for the selected FORTIFIED level have been included



in the building documents and the general contractor and/or roofing contractor is aware of these requirements.

FORTIFIED Multifamily–Wind Steep-Sloped Re-Roofing Form: a document that captures the specific existing construction details as well as re-roofing details (qualifications outlined in Section [3.1.1.2.2](#)). This document also captures the items necessary for an applicant to achieve FORTIFIED Silver and FORTIFIED Gold. It is to be filled out by the general contractor/roofing contractor, structural engineer of record, or project architect. It confirms the re-roofing requirements and outlines the required documentation of the existing construction including photo documentation.

FORTIFIED Multifamily Evaluator: a member of a third-party company certified by IBHS to complete the necessary reviews and evaluations to verify compliance of commercial buildings as FORTIFIED.

FORTIFIED Multifamily Evaluator consulting agreement: a document that provides the terms and conditions between the FORTIFIED Multifamily Evaluator and the client/building owner.

Gable end: the vertical triangular wall between the sloping ends of a gable roof and the rectangular wall below.

Gable rake edge: the edge of the roof overhang at a gable end.

Glazed openings: any opening in a door or wall that contains glass.

Hail Supplement: Set of optional requirements to reduce a building’s vulnerability to hail. A project must first meet FORTIFIED Commercial Hurricane or High Wind designation. All requirements in the standard marked hail supplement must be met.

High-wind-prone regions: areas NOT located in a hurricane-prone region.

Hurricane-prone regions: areas vulnerable to hurricanes as defined in ASCE.

For ASCE 7-10, ASCE 7-16, and ASCE 7-22, hurricane-prone regions are locations along the Gulf of Mexico and Atlantic coasts where the wind speed for Risk Category II buildings is greater than 115 mph, plus Hawaii, Puerto Rico, the Virgin Islands, Guam, and American Samoa.

Mean Roof Height: the average height of the roof, usually calculated as the average eave and ridge height of the roof.

Re-covering: the application of a new roof cover over an existing system. This is not approved for FORTIFIED Multifamily designations.

Re-roofing: the replacement of a roof cover when an existing roof cover system is completely removed and stripped down to the roof deck.

Impact resistant/rated: products or materials specified in this standard that meet the ASTM E1996 large missile test rating.

Sealed roof deck (SRD): protective measures taken in addition to or as part of the underlayment system installed under the primary roof cover (i.e., shingles, tile, or metal roofing) that are designed to stay in place and keep water from entering the building if the primary roof covering is damaged or lost due to high winds.

Structural Engineer of Record: a licensed and insured professional engineer registered in the state of building’s construction responsible for the structural design of the building’s main force resisting systems and its components and cladding.



3 FORTIFIED Multifamily Requirements

3.1 FORTIFIED Roof

3.1.1 Building Design Overview

Eligible roof cover systems include class A fire-rated covers that are part of new construction or replacement roof covers when an existing roof cover system is completely removed and stripped down to the roof deck (re-roofing). Re-covering applications are not permitted.

See Section [5.5](#) of Appendix A for a list of approved systems. Additionally, roof systems shall meet the wind uplift load requirements specified in Section [3.1.1.3](#).

3.1.1.1 Designation Status and Re-Designation Term Limits

3.1.1.1.1 Maintaining a Designation

After a designation is issued, a building must remain in compliance with the FORTIFIED Multifamily requirements. Any building renovation, modification, or addition, not properly completed with a FORTIFIED Multifamily evaluator or with prior approval from IBHS, can void the building's active designation or compliance.

Prior to any work, building owners must notify IBHS to ensure the work does not adversely affect the FORTIFIED Multifamily designation or re-designation.

All renovations, modifications, or additions must comply with the FORTIFIED standards and may require additional inspections from a FORTIFIED Multifamily evaluator (applicable costs apply). If non-compliant alterations to the building(s) relating to this designation occur, IBHS reserves the right to terminate the designation.

Renovations, modifications, and additions that require prior approval include but are not limited to the following examples:

FORTIFIED Roof

- Any roof modification or renovation (including post-storm damage)
- Any modification to existing roof-mounted equipment
- Installation of new roof-mounted equipment, including but not limited to:
 - Satellite dishes
 - Roof-mounted solar panels
 - Mechanical units
 - Mechanical screens
 - Safety rails

FORTIFIED Silver

- Replacement of windows or exterior doors with materials that differ from the original approved materials.
- Replacement of wall cladding with a new material

FORTIFIED Gold

- Addition or modification to any cantilevered overhangs, chimneys, and attached accessory structures.



3.1.1.1.2 Re-Designation

FORTIFIED Multifamily designations (FORTIFIED Roof, FORTIFIED Silver, and FORTIFIED Gold); are valid for a period of 5 years from the certificate issue date. The re-designation inspection focuses on the design and construction details of each respective level.

To ensure a roof system continues to retain its durability and the building continues to remain eligible for a designation using the IBHS FORTIFIED Multifamily program, a re-evaluation shall occur every 5 years as part of the required re-designation. The evaluation will be similar to an initial inspection that includes a physical inspection of the roof cover, roof edge securement, and any roof-related items that may affect the performance of the cover, as well as a review of roof cover design, installation, and maintenance records, repairs, improvements, etc. The FORTIFIED Multifamily Evaluator may require an in-situ test such as a moisture survey, uplift or similar test, if sufficient documentation of records is not available.

Low-sloped ($\leq 10^\circ$) roof systems can conceal performance issues due to undetected moisture, leaks, and material degradation, and because these issues worsen with age, these roof cover systems may require an in-situ test to maintain their FORTIFIED status.

Additionally, the items outlined in FORTIFIED Silver and FORTIFIED Gold will be re-evaluated if the building is seeking a re-designation at those levels. This will include re-evaluation of items outlined in Section [3.2](#) and/or [3.3](#).

3.1.1.1.3 Term Limitations

On-Time Re-Designations: FORTIFIED designated properties are eligible for an On-Time Re-designation from one year before to one year after the expiration date indicated on the most recent FORTIFIED designation certificate. Re-designation certificates expire five years from the expiration date of the most recent designation certificate. Therefore, certificates issued after the prior expiration date will be valid for less than five years.

Early Re-Designations: Re-designations submitted more than one year before the expiration date of the most recent certificate will be considered Early Re-designations. Certificates issued for Early Re-designations will be valid from the date of approval and will expire five years from that date. Therefore, certificates issued for Early Re-designations shorten the term of the prior certificate and result in a two-certificate term of less than 10 years.

Late Re-Designations: If a re-designation evaluation is submitted after the one-year grace period has elapsed but less than five years after the most recent expiration date, it is considered a Late Re-designation, and the property may be eligible for redesignation. Re-designation certificates expire five years from the expiration date of the most recent designation certificate. Therefore, certificates issued for Late Re-designations will be valid for less than five years.



3.1.1.2 Additions and Re-roofing

Existing buildings with wood frame roofs must be constructed in accordance with the 2000 International Building Code (IBC) or later. If they do not meet this minimum requirement, the structural engineer of record must verify that all existing roof structural framing members (i.e., trusses, wood I-joists, stick framing, etc.) are free of any damage or deterioration. They must also be evaluated to ensure they have sufficient residual capacity to handle the minimum loads and load combinations outlined in Section [3.1.1.3.1](#). All damaged, deteriorated, and/or capacity-insufficient members must be repaired or replaced.

Existing roof-structural-framing-member-to-wall connections (also known as roof-to-wall connections) must meet the minimum loads and load combinations outlined in Section [3.1.1.3.1](#). All damaged, deteriorated, and/or capacity-insufficient connections must be replaced.

Members without an existing roof-to-wall connection should be retrofit with an adequate connection (i.e., hurricane straps) so that capacity meets the minimum loads and load combinations outlined in Section [3.1.1.3.1](#).

For buildings that are replacing all existing structural framing members; roof to wall connections are required and should be designed to meet the minimum loads and load combinations outlined in Section [3.1.1.3.1](#).

3.1.1.2.1 Re-roofing Low-Sloped ($\leq 10^\circ$, less than 2/12) Roof Cover Systems

If re-roofing, all roof decks shall be evaluated for any rust, rotting, or any other condition that may reduce the integrity of the deck. If the deck includes lightweight insulating concrete, gypsum, cementitious wood-fiber or similar materials, the deck also must be evaluated for moisture, cracks, or brittleness, and insulation fastener pull tests shall be conducted.

Structural roof deck must be re-evaluated to verify that its capacity meets the field, perimeter, and corner component and cladding wind pressure requirements of ASCE 7 as outlined in Section [3.1.1.3.1](#).

Structural roof deck attachments must be re-evaluated to verify that their capacity meets the field, perimeter, and corner component and cladding wind pressure requirements of ASCE 7 for the building location with the adjustments in design/allowable pressures outlined in Section [3.1.1.3](#).

An option is to through-fasten, so that fasteners penetrate through the bottom of the structural deck. For example, gypsum and cementitious wood-fiber decks may include through-fastened toggle bolts. Lightweight insulating concrete on steel form may include through-fastened insulation fasteners that penetrate the steel form below the lightweight insulating concrete.

All necessary repairs to the roof deck shall be completed prior to installation of a new roof cover system.

3.1.1.2.2 Re-roofing Steep-Sloped ($> 10^\circ$, 2/12 or Greater) Roofs

Inspect the wood roof deck after the old roofing materials have been removed to identify and replace any damaged or deteriorated decking (damage or deterioration could be from moisture, weathering, or insect infestation). Damaged or deteriorated decking would generally be marked by one or more of the following characteristics: soft or spongy wood, wood swelling or buckling, delaminating (plywood), or crumbling and flaking of the wood. Do not cut or notch supporting wood members when removing damaged/deteriorated decking.



If a section of the roof deck is damaged or deteriorated, remove and replace the entire damaged sheet or board.

If the roof deck is damaged, there is a possibility that the wood roof framing members (rafters or truss top chords) below the damaged deck are damaged as well. Inspect roof framing members below the removed deck. If more than $\frac{1}{4}$ in. of the surface is deteriorated or damaged, the members shall be evaluated by the structural engineer of record to ensure they have sufficient residual capacity to handle all design loads and shall be repaired or replaced per the structural engineer of record.

Where roof deck is removed, the removed portions shall not be reused. New roof deck shall be used and fastened per 3.1.3.2.1.

Structural roof deck must be re-evaluated to verify that its capacity meets the field, perimeter, and corner component and cladding wind pressure requirements of ASCE 7 as outlined in Section [3.1.1.3.1](#).

Structural roof deck attachments (existing and added fasteners) must be evaluated to verify that their capacity meets the field, perimeter, and corner component and cladding wind pressure requirements of ASCE 7 for the building location with the adjustments in design/allowable pressures outlined in Section [3.1.1.3](#).

3.1.1.2.3 Additions to Existing Buildings

Commercial properties constructing additions to an existing building are eligible to pursue a FORTIFIED Multifamily designation under the following conditions:

1. Extension to the Existing Roof
 - a. Connected Roof Structure: a condition where the addition's roof structure has any structural interaction with the existing structure (gravity, lateral, etc.).

Existing structural deck and framing members capacity must meet the requirements of Section [3.1.1.3.1](#), and be verified by the structural engineer of record. Structural deck attachments shall meet the design requirements of Section [3.1.1.3](#). Structural interactions between the addition and existing structure shall be engineered (i.e., diaphragm action).
 - b. Expansion Joint: a condition where the addition's roof structure is separated by an expansion joint and there is no structural interaction between the existing roof and the new roof.

Existing structural deck and framing members capacity must meet the requirements of Section [3.1.1.3.1](#), and be verified by the structural engineer of record. Structural deck attachments shall meet the design requirements of [Section 3.1.1.3](#).
2. Addition Roof at a Different Elevation: a condition where the addition's roof is at a different elevation than the existing roof. The existing roof and the new roof have no structural interaction.

Existing structural deck and framing members capacity must meet the requirements of Section [3.1.1.3.1](#), and be verified by the structural engineer of record. Structural deck attachments shall meet the design requirements of [Section 3.1.1.3](#).



If seeking a FORTIFIED Silver or FORTIFIED Gold designation, the addition and the existing building must both follow the standards outlined in Section 3. All existing conditions' compliance with the standards shall be verified and may require additional on-site testing (invasive/noninvasive) to verify capacity as requested by the FORTIFIED Multifamily Evaluator.

3.1.1.3 Design Load Requirements

3.1.1.3.1 Design Parameters

- For ASCE 7-10, ASCE 7-16, and ASCE 7-22, based design, the appropriate Risk Category design wind speed shall be used, with a minimum Risk Category II.
- Exposure Category must be a minimum “C” or “D” as defined by ASCE 7.
- **NOTE:** For new construction, the entire building shall be designed to Exposure Category C or D. This is applicable for FORTIFIED Roof, Silver, and Gold levels. For commercial buildings, it is not uncommon for development to occur around the property which could change the buildings exposure category subjecting it to higher wind pressures not originally considered. In efforts to ensure building resilience, IBHS requires design professionals to account for such modifications during construction. For new construction, Exposure Category must be documented on the structural drawings of the construction document (CD) set. Structural drawings with exposure category indicated must be provided on the application.
- In the case of existing properties, IBHS understands it may not be possible to bring the entire building to Exposure Category C or D. For Roof, Silver, and Gold designation levels, the applicable building components specified in this standard within the designation level being sought must meet Exposure Category C or D. For existing buildings, the “Exposure Category” must be included in existing construction compliance forms.

3.1.1.3.2 Factor of Safety

The minimum required factor of safety must be applied for the specific building components outlined in the standard. A minimum factor of safety required is 2 for ASCE 7-10, and 1.67 for ASCE 7-16 and ASCE 7-22 based on allowable stress design (ASD) loads, unless a higher factor of safety is required for a particular assembly, system, element, fastener, or connection. The ultimate strength of the building assembly, element, fastener, or connection shall meet or exceed the load on that assembly, element, fastener, or connection using one of the following calculated wind loads:

1. ASCE 7-10 ASD Method: Calculated ASD wind load x 2 (minimum required factor of safety)
2. ASCE 7-10 LRFD Method: Calculated LRFD wind load x 0.6 x 2 (minimum required factor of safety)
3. ASCE 7-16 and ASCE 7-22 ASD Method: Calculated ASD wind load x 1.67 (minimum required factor of safety)
4. ASCE 7-16 and ASCE 7-22 LRFD Method: Calculated LRFD wind load



3.1.1.3.3 Effective Wind Area

The structural engineer or record may determine the appropriate effective wind area for structural system components such as roof trusses. For all other building components, an effective wind area of 10sft shall be used. This includes but is not limited to:

- Doors
- Flashing
- Gutter Systems
- Roof cover systems
- Roof deck fastening
- Roof mounted equipment and their attachments
- Roof to wall connections
- Windows

3.1.2 Design Requirements for Low-Sloped Roof Systems ($\leq 10^\circ$, Less Than 2/12)

Low-sloped roof applications with continuous-type membrane roof assemblies such as built-up roof, modified bitumen, single-ply, hybrids, and metal panel roofs, must be designed for the appropriate wind pressures of ASCE 7 for the field, perimeter, and corners with the adjustments outlined under the “Design Load Requirements” in Section [3.1.1.3](#).

3.1.2.1 Low-sloped Continuous Roof Covers

Low-sloped continuous roof covers with an approved product approval found in Section [5.3](#) of Appendix A are permitted, provided the adjustments are made in design/allowable pressures outlined under “Design Load Requirements” in Section [3.1.1.3](#).



Hail Supplement (Optional): Low-sloped continuous roof covers must meet the minimum requirements outlined in Section [5.1](#) of Appendix A.

3.1.2.1.1 Single-ply Membrane (SPM)

- Peel-Stop: Single-ply roof covers shall include a perimeter peel-stop with a termination bar or similar, located 1–2 ft from the roof edge. Mechanically attached systems with fasteners 1–2 ft from the roof edge do not require an additional peel-stop.
- Mechanically Attached - SPM On Steel Decks: Mechanically attached membranes shall have their sheets and fasteners installed perpendicular to the steel deck ribs.
- Ballasted, Roof Pavers, and Pedestal Systems:
Stone ballast, roof pavers for ballast applications, plaza decks or terrace pavers shall NOT be permitted. This includes loosely laid, interlocked, mechanically connected, and all pedestal systems.

3.1.2.1.2 Structural and Architectural Metal Roof Panel Systems

Structural metal panel roof systems on open framing members and nonstructural architectural metal roof panels on solid wood sheathing with any of the product approvals found in Section [5.18](#) of Appendix A are permitted, provided adjustments are made in design/allowable pressures as outlined in Section [3.1.1.3](#).



3.1.2.1.3 Vegetative Roof Systems

Vegetative roof systems shall NOT be permitted in **hurricane-prone regions**. This includes intensive, simple intensive (semi-intensive), and extensive green roof systems.

In **high-wind-prone regions**, only extensive and simple intensive (semi-intensive) vegetative roof systems with an active FM RoofNav number or Miami-Dade County Notice of Acceptance (NOA) are permitted. Extensive vegetative roofs have growth less than 6 in. in depth and simple intensive (semi-intensive) vegetative roofs have growth from 6 to 8 in. in depth. Structural calculations, uplift tests and/or additional documentation may be requested by the FORTIFIED Multifamily Evaluator.

3.1.2.1.4 Built-up Roofing Systems

Built-up roofing systems with pea-size, loosely laid gravel are NOT permitted.. Built-up roofing systems with pea-size gravel that is fully embedded in asphalt are permitted.

3.1.2.2 Structural Roof Deck

Structural roof deck shall be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).

Structural roof deck attachments shall be designed for field, perimeter, and corner component and cladding wind pressures requirements of ASCE 7 for the building location with the adjustments in design/allowable pressures outlined in Section [3.1.1.3](#).

3.1.2.3 Roof edge Flashing, Coping, and Counter-Flashing

Roof edge flashing, coping, and counter-flashing shall be designed and tested in accordance with ANSI/SPRI/FM 4435/ES-1 for ASCE 7 design wind pressures as outlined in Section [3.1.1.3](#).

3.1.2.3.1 Wood Nailers

Wood nailers shall comply with the design guidance in Section 2.2.2 of the FM Data Sheet 1-49.

Provide wood nailers when recommended by the manufacturer or when required for fastening of flashing or the edge of the roof assembly. When roofs meet at parapets or vertical walls, it is acceptable to secure the roof assembly, when required, to the deck without a wood nailer.

Use minimum 1½-in. by 5½-in. (40-mm by 140-mm) wood nailers of pressure-treated or untreated Douglas Fir, Southern Yellow Pine, or wood having similar decay- resistant properties. The maximum unsupported overhang is 2 in. (50 mm), in which case minimum 1½-in. by 7¼-in. (38-mm by 185-mm) nailers are needed, secured with two rows of staggered fasteners.

3.1.2.3.2 Wood Nailer Securement

Securement of wood nailers shall comply with the design guidance in Section 2.2.2 of the FM Data Sheet 1-49. Use corrosion-resistant fasteners compatible with the wood nailer. When the wood nailer is treated wood, use stainless steel, hot-dipped galvanized steel complying with ASTM A153 (or equivalent) or fasteners with appropriate coatings recommended by the manufacturer for use in the specific type of treated wood. Bolts should be of sufficient length for all threads in the nuts to be fully engaged.



3.1.2.4 Gutter Systems

Gutter systems consisting of gutters, gutter straps, gutter brackets, joints, fasteners, and roof flanges shall be designed in accordance with ANSI/SPRI GD-1 (2010) or ANSI/SPRI GT-1 (2016) with the adjustments in design/allowable pressures outlined in Section [3.1.1.3](#).

Notes:

- A. ANSI-SPRI GD-1 document includes a minimum factor of safety of 1.67 (see Section 2.0 of ANSI-SPRI GD-1). A minimum 2.0 factor of safety as outlined in Section [3.1.1.3](#) shall be applied.
- B. ANSI-SPRI GT-1 document does not include a minimum factor of safety. A minimum 2.0 factor of safety as outlined in Section [3.1.1.3](#) shall be applied to the maximum test loads obtained.

3.1.3 Design Requirements for Steep-Sloped Roofs (>10°, 2/12 or Greater)

3.1.3.1 Structural Roof Deck

3.1.3.1.1 Plywood and OSB

Roof sheathing must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#). The bending and shear capacity requirements shall be calculated using accepted engineering practice and the resistance shall be based on established minimum wood structural panel capacities. Wood structural panel thickness shall not be less than $\frac{7}{16}$ in.

Minimum sheathing requirement for new clay or concrete tile roofs must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#). The minimum thickness is $\frac{15}{32}$ -in. plywood. However, manufacturer installation guidelines, evaluation reports, and site-specific design requirements may require a roof deck material greater than $\frac{15}{32}$ -in. plywood.

Engineering calculations verifying the structural capacity of the deck may be required by the FORTIFIED Multifamily Evaluator.

3.1.3.1.2 Sawn Lumber or Wood Boards

Sawn lumber or wood board roof deck must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).

Sawn lumber or wood boards gaps must not exceed 1/8 in. unless otherwise specified in manufacturer's written guidance.

3.1.3.1.3 Steel Decks

Steel deck must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).

3.1.3.2 Structural Roof Deck Attachments

3.1.3.2.1 Structural Wood Panel Roof Sheathing (Plywood or OSB)

Table [2](#) describes the fastening requirements for OSB and plywood sheathing on steep-sloped (>10°) wood framing members. Engineering calculations are required for roofs with a peak height over 30 ft. Roof zones and dimension "a" shall be in accordance with ASCE 7.

Table 2: Sheathing Fastening

Mean Roof Height ^A	Max Roof Member Spacing	Roof Square Footage	Sheathing Thickness	Fastener Type	Fastener Spacing Along Structural Members		
					Field	Perimeter	Corner
H ≤ 30 ft	24 in. o.c.	Less than or equal to 5,000 sq ft	7/16 – 5/8 in.	8d ring-shank nails	4 in.		
		Greater than 5,000 sq ft	Shall be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section 3.1.1.3.1 . ^C	Fasteners selected by structural engineer of record ^B	Shall be designed for component and cladding wind pressures requirements of ASCE 7 for the building location with the adjustments in design/allowable pressures outlined in Section 3.1.1.3 . ^C		
H > 30 ft	Member spacing designed by structural engineer of record						

NOTES:

A. Mean Roof Height refers to the dimension of the average height of the roof, usually calculated as the average eave and ridge height of the roof.

B. All fasteners shall be ring-shank nails or screws unless otherwise noted and approved by IBHS. The following restrictions shall be used in determining fastener size and spacing:

- a. Size and spacing shall be based on loads calculated for the largest tributary area assigned to any of the panel fasteners.
- b. No increase in allowable withdrawal values for load duration effects is allowed.

C. Calculations for uplift and lateral loads (diaphragm action) for sheathing and fasteners required.

3.1.3.2.2 Structural Wood Panel Roof Sheathing Ring Shank Nails

Structural Wood Panel Roof Sheathing nails must be a minimum of 8d (0.113-in diameter x 2 3/8-in long roof sheathing ring shank.

Ring-shank nails shall either meet or exceed the length and diameter dimensions provided below or meet the Roof Sheathing Ring Shank (RSRS-01) nail specifications in ASTM F1667 (nails identified as “F1667 NLRSSRS”). Note that RSRS-02 through RSRS- 05 nail sizes included in ASTM F1667 have larger diameters and lengths than RSRS-01 fasteners and consequently will have greater withdrawal capacities. The increased withdrawal capacity may be limited by head pull-through for thinner sheathing, such as $\frac{7}{16}$ in. versus $\frac{19}{32}$ in.

Clipped-head ring-shank nails are not acceptable for attachment of structural wood roof sheathing panels. The specific minimum required dimensions and characteristics for the ring-shank nails ([Figure 1](#)) to be used for roof sheathing attachment are:

- Full round head diameter (no clipped head nails allowed)
- 2 3/8 in. minimum nail length
- 0.113 in. diameter

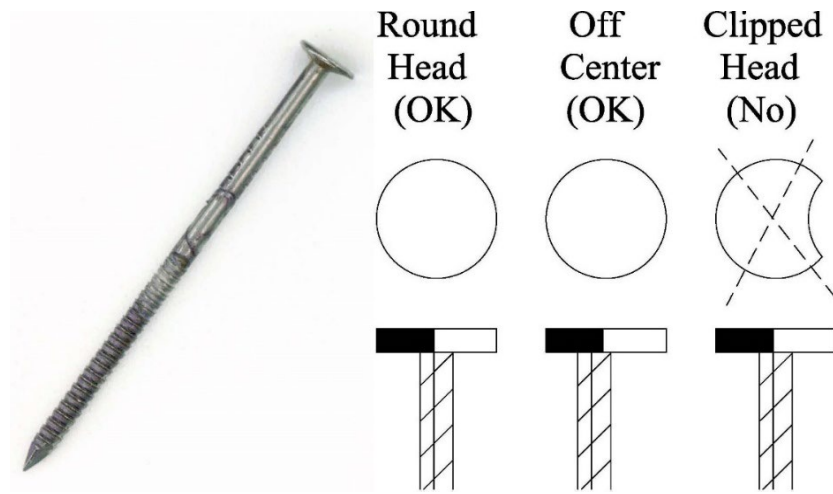


Figure 1: Use 8d ring-shank nails when attaching roof sheathing.

Research shows that panels attached with ring-shank nails have about twice the uplift capacity compared to panels attached with the same size smooth-shank nails.

3.1.3.2.3 Sawn Lumber or Wood Board Roof Deck

Attachments shall be designed in accordance with the uplift requirements outlined in Section [3.1.1.3](#).

3.1.3.2.4 Steel Decks

Attachments shall be designed in accordance with the uplift requirements outlined in Section [3.1.1.3](#).

3.1.3.3 Sealed Roof Deck

Steep-sloped roof cover installations require a sealed roof deck system that keeps water out of the attic and the interior of the building in the event the roof covering is damaged during a hurricane.

3.1.3.3.1 Options for Shingle or Metal Roof Covers

Sealed Roof Deck Option 1- Flashing Tape and Underlayment: Tape the seams between roof sheathing that forms the roof deck and add an approved underlayment. There are two material options for taping the seams on the roof deck:

Material Option 1: Apply an ASTM D1970 compliant self-adhering polymer-modified bitumen flashing tape, at least 4 in. wide, directly to the roof deck to seal the horizontal and vertical joints in the roof deck.

Material Option 2: Apply an American Architectural Manufacturers Association (AAMA) 711-13, Level 3 (for exposure up to 80°C/176°F) compliant self-adhering flexible flashing tape at least 3¾ in. wide directly to the roof deck to seal the horizontal and vertical joints in the roof deck.

Any flashing tape used to achieve a sealed roof deck must be fully adhered without voids (e.g., wrinkles) in order to be accepted. In some instances, the ability of self-adhered flashing tapes to adhere to oriented strand board (OSB) sheathing may be compromised by the level of surface texture or wax used in fabricating the OSB panels. In applications where flashing tape adhesion to OSB is marginal, apply a manufacturer-specified compatible primer to the



OSB panels where the tape will be applied to ensure the proper attachment of the self-adhering tape to the sheathing. Do not nail or staple the tape to the roof sheathing. Refer to the manufacturer's recommendations for installation and primer requirements (if applicable).

Next, apply one of the following code-compliant underlayment options over the self-adhering tape:

1. ASTM D226 Type II (#30)
2. ASTM D4869 Type III or Type IV (#30)
3. ASTM D6757 (for asphalt shingle roof covers)
4. As an alternative, apply a reinforced synthetic roof underlayment which has an ICC approval as an alternate to ASTM D226 Type II felt paper. The synthetic underlayment must have a minimum tear strength of 15 lbf in accordance with ASTM D4533 and a minimum tensile strength of 20 lbf/in. in accordance with ASTM D5035.

Notes:

- Be sure to check product labelling carefully. Not all products are labeled ASTM D4869 Type III and IV. Look for ASTM D4869 felt that is labeled Type III and IV. ASTM D4869 Type I, or Type II will NOT be accepted.
- An AC266-rated system consisting of wood structural panel sheathing with integrated water resistive barrier such as Huber Zip™ roof sheathing used in combination with approved or proprietary tape to seal the roof deck seams as described above and in compliance with manufacturers installation instructions, is deemed to comply as an approved FORTIFIED sealed roof deck without any additional underlayments required.

Installation Notes:

- Underlayment must be attached using annular-ring or deformed-shank roofing nails (0.083 in. minimum diameter and sufficient length to penetrate through the roof sheathing or not less than 3 / 4 in. into the roof sheathing) with minimum 1-in.-diameter caps (metal or plastic button cap nails). Metal caps and nail or metal cap-nails are required for ultimate design wind speed of 160 mph or greater. Fasteners shall meet the corrosion protection requirements outlined in Section [2.5](#).
- Space fasteners at 6 in. o.c. spacing along all laps and at 12 in. o.c. vertically and horizontally in the field or a more stringent fastener schedule if required by the manufacturer for high-wind and prolonged exposure installations. Horizontal laps must be a minimum of 4 in. and end laps must be a minimum of 6 in.
- Drip edge installation at eaves: Install the drip edge on top of the underlayment at the eaves. 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 shingle roof installations, seal the drip edge, underlayment, and starter strip at the eave by either using a self-adhering starter strip or applying an 8-in.-wide layer of compatible flashing cement, maximum thickness 1/8 in., over the drip edge and adjacent underlayment.
 - 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.

See Section [3.1.3.4](#) for further drip edge installation requirements.

- Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.



Figure 2: Installing a sealed roof deck system; taping the seams of roof sheathing.

Sealed Roof Deck Option 2- Self Adhered Membrane: Cover the entire roof deck with a full layer of self- adhering polymer-modified bitumen membrane meeting ASTM D1970 requirements. This approach provides a waterproof membrane over the entire roof and can greatly diminish the potential for leaks. In some instances, the ability of the self-adhered membranes to adhere to oriented strand board (OSB) sheathing may be compromised by the level of surface texture or wax used in fabricating the OSB panels. In applications where membrane adhesion to OSB is marginal, apply a manufacturer-specified compatible primer to the OSB panels to ensure the proper attachment of the self-adhering membrane to the sheathing.

Notes:

- It has been reported that shingles are bonding to many of these self-adhered membranes and this could lead to damage of the sheathing when replacing the shingles. Consequently, the membrane should be covered with a bond break such as a #15 ASTM D226, Type I underlayment. On shingle roofs, it is best guidance that the underlayment be fastened well enough to keep it on the roof surface and provide safety to the roofers until the shingles are applied.
- For asphalt shingle installations, hold bond break material back 8 in. from roof edges to allow mastic and starter strip or self-adhered starter strip to be applied directly to drip edge.

Installation Notes:

- Install drip edge on top of the underlayment. Make sure the top surface of the drip edge is cleaned, free of oil and, if required by the starter strip manufacturer, primed with ASTM D41 primer.



- For shingle roof installations, seal the drip edge, underlayment, and starter strip at the eave by either using a self-adhering starter strip or applying an 8-in.-wide layer of compatible flashing cement, maximum thickness $\frac{1}{8}$ in., over the drip edge and adjacent underlayment.
- 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. See Section [3.1.3.4](#) for further drip edge installation requirements.
- Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.
- **CAUTION:** Manufacturers emphasize the need for adequate attic ventilation when self-adhered membrane is applied over the entire roof. This is particularly important north of the North Carolina/ South Carolina border. Also, some local building departments prohibit the use of this system. Check with the local building department for restrictions and refer to underlayment and primary roof system manufacturer’s installation instructions for ventilation limitations.

Sealed Roof Deck Option 3- Two Layers Felt Underlayment: Install two (2) layers of one of the following code-compliant underlayment options:

1. ASTM D226 Type II (#30)
2. ASTM D4869 Type III or Type IV (#30)
3. ASTM D6757 (for asphalt shingle roof covers)

CAUTION: Be sure to check product labelling carefully. Not all products labelled ASTM D4869 are Type III or Type IV. Look for ASTM D4869 felt that is labeled Type III or Type IV. ASTM D4869 Type I or Type II will NOT be accepted.

Installation Notes:

Two layers of underlayment shall be installed in a shingle-fashion, lapped 19 in. on horizontal seams (36-in. roll), and 6 in. on vertical seams, in the following manner and as shown in [Figure 3](#).

1. Cut 17 in. off one side of the roll and install the remaining 19-in.-wide strip of underlayment along the eave. Safely Tack in place.
2. Carefully install a 36-in.-wide roll of underlayment over the 19-in.-wide course of underlayment along the eave.
3. Follow the same procedure for each course, overlapping the sheets 19 in. (leaving a 17 in. exposure).

Underlayment must be attached using annular-ring or deformed-shank roofing nails (0.083 in. minimum diameter and sufficient length to penetrate through the roof sheathing or not less than $\frac{3}{4}$ in. into the roof sheathing) with minimum 1-in.-diameter caps (metal or plastic button cap nails). Metal caps and nail or metal cap-nails are required for ultimate design wind speed of 160 mph or greater. Fasteners shall meet the corrosion protection requirements outlined in Section [2.5](#).

Fasten the bottom edge of the roll (horizontal lap) with fasteners at 6 in. o.c. Since the bottom edge (horizontal lap) of the next layer of underlayment will be fastened

approximately 19 in. above the horizontal lap below, install a row of nails with 12 in. o.c. horizontal spacing about 10 in. above the bottom lap. When the installation is completed, the resulting fastening of the two (2) layers of felt should consist of the same fasteners at approximately 6 in. o.c. along all laps and at not more than 12 in. o.c. in the field of the sheet between the side laps. Add fasteners along any exposed vertical laps so that the maximum spacing between fasteners is 6 in. o.c.

Installation Notes:

- Install the drip edge on top of the double layer of underlayment at the eaves. 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 shingle roofs, seal the drip edge, underlayment, and starter strip at the eave by using a self-adhering starter strip or applying an 8-in.-wide layer of compatible flashing cement, maximum thickness $\frac{1}{8}$ in., over the drip edge and adjacent underlayment.
- 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.
- Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

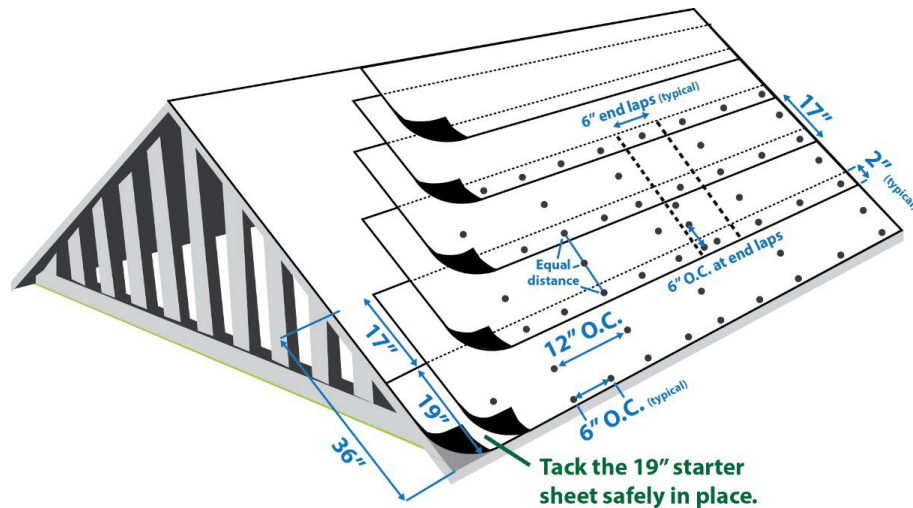


Figure 3: Installation of 19 in. starter course

Sealed Roof Deck Option 4- 2-ply Synthetic Underlayment:

Apply two layers of one of the following code-compliant synthetic underlayment options:

- ASTM D8257 – Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing.
- Reinforced synthetic roof underlayment which has a current ICC, AC 188 approval as an alternate to ASTM D226 Type II felt paper. The synthetic underlayment must have a minimum tear strength of 15 lbf in accordance with ASTM D4533, a minimum tensile strength of 20 lbf/in. in accordance with ASTM D5035 and pass the ASTM D4869 liquid water transmission test.



Installation Notes:

Two layers of a FORTIFIED-compliant reinforced synthetic underlayment shall be installed in a shingle fashion, in the following manner.

For 40-in.-wide Rolls

1. Cut 20 in. off one side of the roll and install the remaining 20-in.-wide strip of underlayment along the eave. Safely tack in place.
2. Carefully install a 40-in.-wide roll of underlayment over the 20-in.-wide course of underlayment along the eave.
3. For the succeeding courses follow the same procedure for each, overlapping the sheets 22 in. (leaving an 18-in. exposure). Fasten with one row in the center of the sheet at 12 in. o.c. and one row at the overlaps fastened 6 in. o.c.

For 48-in.-wide Rolls:

1. Cut 24 in. off one side of the roll and install the remaining 24-in.-wide strip of underlayment along the eave. Safely tack in place.
2. Carefully install a 48-in.-wide roll of underlayment over the 24-in.-wide course of underlayment along the eave.
3. For the succeeding courses follow the same procedure for each, overlapping the sheets 26 in. (leaving a 22-in. exposure). Fasten with one row in the center of the sheet at 12 in. o.c. and one row at the overlaps fastened 6 in. o.c.

For 60-in.-wide Rolls:

1. Cut 30 in. off one side of the roll and install the remaining 30-in.-wide strip of underlayment along the eave. Safely tack in place.
2. Carefully install a 60-in.-wide roll of underlayment over the 30-in.-wide course of underlayment along the eave.
3. For the succeeding courses follow the same procedure for each, overlapping the sheets 32 in. (leaving a 28-in. exposure). Fasten with two equally spaced rows in the center of the sheet at 12 in. o.c. and one row at the overlaps fastened 6 in. o.c.

In all cases, fasten underlayment a maximum 6 in. o.c. along the side and end laps and a maximum 12 in. o.c. in the middle of the sheet between the side laps.

For ultimate design wind speeds less than 170 mph, secure underlayment using annular-ring or deformed-shank nails with 1-in.-diameter caps (button cap nails).

For ultimate design wind speeds 170 mph or greater, secure underlayment using annular-ring or deformed-shank nails with thin metal disks ("tincaps").

3.1.3.3.2 Options for Concrete and Clay Tile Roof Covers

The following options qualify as sealed roof decks under clay and concrete roof tiles. In option 1, the self-adhering tape provides a required barrier against water intrusion in case the roofing felt begins to lift.

Sealed Roof Deck Option 1- Flashing Tape and Underlayment: Tape seams between roof sheathing that forms the roof deck and add an approved underlayment. There are two material options for taping the seams on the roof deck.



Material Option 1: Apply an ASTM D1970 compliant self-adhering polymer-modified bitumen flashing tape, at least 4 in. wide, directly to the roof deck to seal the horizontal and vertical joints in the roof deck.

Material Option 2: Apply an AAMA 711-13, Level 3 (for exposure up to 80°C/176°F) compliant self-adhering flexible flashing tape at least 3¾ in. wide directly to the roof deck to seal the horizontal and vertical joints in the roof deck.

Any flashing tape used to achieve a sealed roof deck must be fully adhered without voids (e.g., wrinkles) to be accepted. In some instances, the ability of self-adhered flashing tapes to adhere to oriented strand board (OSB) sheathing may be compromised by the level of surface texture or wax used in fabricating the OSB panels. In applications where flashing tape adhesion to OSB is marginal, apply a manufacturer-specified compatible primer to the OSB panels where the tape will be applied to ensure the proper attachment of the self-adhering tape to the sheathing. Do not nail or staple the tape to the roof sheathing. Refer to the manufacturer's recommendations for installation and primer requirements (if applicable).

Next, apply a #30 ASTM D226 Type II underlayment/anchor sheet over the self-adhering tape. Attach the underlayment/anchor sheet using annular-ring or deformed-shank roofing fasteners with minimum 1-in.-diameter metal caps at 6 in. o.c. spacing along all laps and at (2) rows in between side laps at a maximum of 12 in. o.c., or a more stringent fastener schedule if required by the manufacturer for high-wind use as an anchor sheet. Horizontal laps must be a minimum of 4 in. and end laps must be a minimum of 6 in.

Finally, apply an approved self-adhering polymer-modified bitumen roof tile cap sheet that complies with ASTM D1970 and meets the site design wind speeds over this underlayment - **OR** - hot-mop an approved tile underlayment over the underlayment/anchor sheet using hot asphalt.

Installation Notes:

- Install the drip edge on top of the ASTM D226 Type II underlayment but under the self-adhering ASTM D1970 cap sheet. 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 so that the self-adhering cap sheet adheres to the top of the drip edge. See Section [3.1.3.4](#) for further drip edge requirements.
- Lap underlayment with minimum 6-in. leg "turned up" at wall intersections; lap wall weather barrier over turned-up roof underlayment.

Sealed Roof Deck Option 2- Self Adhered Membrane: Cover the entire roof deck with an approved self-adhering polymer-modified bitumen underlayment complying with ASTM D1970 installed in accordance with both the underlayment manufacturer's and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure for the roof covering to be installed. In some instances, the ability of the self-adhered membranes to adhere to oriented strand board (OSB) sheathing may be compromised by the level of surface texture or wax used in fabricating the OSB panels. In applications where membrane adhesion to OSB is marginal, apply a manufacturer-specified compatible primer to the OSB panels to ensure the proper attachment of the self-adhering membrane to the sheathing.

Note: Some local building departments prohibit the use of this system. Check with the local building department for restrictions. Manufacturers emphasize the need for adequate attic ventilation when this type of membrane is applied over the entire roof.



Installation Notes:

- Install the self-adhered underlayment over the drip edge. Before installing the drip edge, prime the roof deck with a compatible primer or install a separator sheet that extends 2 in. past the deck flange of the drip edge. 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 so that the self-adhering membrane adheres to the top of the drip edge. See Section [3.1.3.4](#) for further drip edge requirements.
- Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

3.1.3.4 Drip Edge (Edge Flashing)

Provide a minimum 26-gauge galvanized metal drip edge along all eaves and gable rake edges. Drip edge shall be installed **OVER** the underlayment along gable rake edges and at eaves unless stated otherwise. Overlap drip edge at joints a minimum of 3 in. Eave drip edges shall extend ½ in. below the bottom of the sheathing and extend back on the roof a minimum of 2 in. Drip edges must be mechanically fastened to the roof deck at maximum of 4 in o.c. Mechanical fasteners should be applied in an alternating (staggered) pattern along the length of the drip edge with adjacent fasteners placed near opposite edges of the leg/flange of drip edge on the roof.

3.1.3.5 Flashing (All Non-Edge Flashing Application)

Steep-sloped flashings are used to weatherproof or seal roof system edges at perimeters, penetrations, walls, expansion joints, valleys, drains, and other places where the roof covering is interrupted or terminated. New condition flashings shall be installed in a manner that will prevent moisture from entering the wall or roof, or through moisture-permeable materials at intersections or other penetrations through the roof plane.

The non-edge flashing installation shall meet the requirements found in the 2018 or more recent edition of the IBC and the product manufacturer’s installation instructions.

3.1.3.6 Steep Sloped Gutters and Leaf Guards

For existing conditions where the gutters are not being replaced, a new drip edge must be installed over the existing gutter. New drip edge installed over existing gutters may be notched as closely as possible around gutter brackets, provided that only the vertical drip edge leg is notched, and notches do not exceed 2 in. wide in any case.

Leaf guards are not to be installed under the shingle or starter strip because this interrupts the load path of the roof cover and the sealed roof deck at the edges.

3.1.3.7 Steep Slope Rain Diverters

Installing rain diverters on asphalt shing roofs can break the manufacturer’s shingle seam making the area vulnerable to wind damage. All rain diverters shall be installed per the manufacturer’s approved water diverter installation detail. The detail, including authorized approval of installation on asphalt shingle manufacturer’s letterhead, must be provided with photographic documentation of installation and all associated materials to the FORTIFIED Multifamily Evaluator.

3.1.3.8 Approved Steep-Sloped Roof Covering

Roof coverings and their attachment shall be rated for the design wind speeds and parameters outlined in Section [3.1.1.3](#) and installed in accordance with the manufacturer's recommendations for high-wind regions.



Hail Supplement (Optional): Steep-sloped roof covers must meet the minimum requirements outlined in Section [5.1.2](#) of Appendix A.

3.1.3.8.1 Asphalt Shingles

Asphalt shingles, including hip and ridge materials, shall meet the shingle testing standard for the appropriate site design wind speed as shown in Table [3](#).

Table 3: Design Wind Speed and Shingle Testing Standards ($h_1 < 60$ ft, Exposure C)

Wind Speed (vasd)	Wind Speed (vult)	Shingle Wind Testing Standard/Classification
100 MPH	129 MPH	ASTM D3161 (Class F) or ASTM D7158 (Class G or H) ²
110 MPH	142 MPH	
120 MPH	155 MPH	
140 MPH	180 MPH	
150 MPH	194 MPH	
<u>NOTES:</u> 1. Mean roof height 2. Buildings with an Exposure Category D or Mean Roof Height 60’ or greater must use ASTM D 3161 (Class F) shingles.		

Shingles must be installed using the number of fasteners required by the manufacturer for high-wind fastening. In areas where the local building code requires more fasteners than required by the manufacturer, fasteners shall comply with the 2018 or more recent edition of the IBC.

Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12-gage [0.105 inch (3 mm)] shank with a minimum 3/8-inch-diameter (9.5 mm) head, complying with ASTM F1667, of a length to penetrate through the roofing materials and not less than 3/4 inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than 3/4 inch (19.1 mm) thick, the fasteners shall penetrate through the sheathing.

Installation of Starter Strips at Eaves: Manufacturer-approved starter strips at eaves shall be installed on an approved sealed roof deck with the drip edge conforming to the requirements of Section [3.1.3.3](#) and [3.1.3.4](#). The starter strip shall be either:

1. Set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be 1/8 in. Fasten starter strips parallel to the eaves along a line above the eave line according to the manufacturer's specifications. Position fasteners to ensure they will not be exposed under the cutouts in the first course. Starter strips and shingles must not extend more than 1/4 in. beyond the drip edge.
2. Shingle manufacturer-approved ASTM D1970 fully adhered (peel-and-stick) starter strip with asphaltic adhesive strip at eave—installed so that starter strip adheres to and covers the drip edge top surface.

Installation of Shingles at Gable Rakes (Drip Edge Installed Over Underlayment): Shingles installed at gable rake edges shall be installed according to one of the following three options:

1. Shingles at rakes shall be set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing shall be $\frac{1}{8}$ in. Fasten shingles at rakes according to the manufacturer's specifications.
2. Manufacturer-approved starter strips at rakes shall be set in an 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be $\frac{1}{8}$ in. Fasten starter strips parallel to the rakes according to the manufacturer's specifications. Position fasteners to ensure they will not be exposed. Starter strips and shingles must not extend more than $\frac{1}{4}$ in. beyond the drip edge.
3. Shingle manufacturer-approved ASTM D1970 fully adhered (peel-and-stick) starter strip with asphaltic adhesive strip at rake—installed so that starter strip adheres to and covers the drip edge top surface. Starter strips and shingles must not extend more than $\frac{1}{4}$ in. beyond the drip edge.

Attachment of Shingles at Intersections and Valleys: Shingles installed at all intersections and both sides of open valleys shall be set in a minimum 8-in.-wide strip of flashing cement. Maximum thickness of flashing cement shall be $\frac{1}{8}$ in. Cut side of closed valleys shall be set in a minimum 2-in.-wide, $\frac{1}{8}$ -in.-thick strip of flashing cement. Woven valleys to be according to the manufacturer's specifications.



Hail Supplement (Optional): Asphalt shingles must meet the minimum requirements outlined in Section [5.1.2.1](#) of Appendix A.

3.1.3.8.2 Clay and Concrete tiles

Clay and concrete roof tile systems and their attachment must meet the requirements of the site design wind speed and exposure category. Clay and concrete roof tiles must be installed in accordance with the manufacturer's product approval for the site design wind speed, roof height, and Exposure Category.

Roof tiles may be installed with roof tile adhesives that are recognized and installed in accordance with an ICC-ES Evaluation Report, a Florida Product Approval, a Miami-Dade County NOA, or a Texas Department of Insurance (TDI) Evaluation Report. Mortar set tile or mortar set hip and ridge tiles are not permitted. Hip and ridge boards or metal must be attached to the roof framing to resist the uplift pressure for the site design wind speed and exposure or in accordance with the tile manufacturer's product approval. Hip and ridge tiles must be secured to the hip and ridge boards or metal with mechanical fasteners and/or an approved roof tile adhesive.

The clay and concrete tiles must be installed over minimum $\frac{15}{32}$ -in.-thick plywood and one of the acceptable sealed roof deck underlayment options in Section [3.1.3.3.2](#).



Hail Supplement (Optional): Clay and concrete tiles must meet the minimum requirements outlined in Section [5.1.2.2](#) of Appendix A.

3.1.3.8.3 Architectural Metal Panels

Structural metal panel roof systems on open framing members and nonstructural architectural metal roof panels on solid wood sheathing with any of the product approvals found in Section [5.18](#) of Appendix A are permitted, provided adjustments are made in design/allowable pressures as outlined in Section [3.1.1.3](#).

Architectural metal panels shall be installed over continuous decking and one of the acceptable sealed roof deck underlayment options from Section [3.1.3.3.1](#).



Hail Supplement (Optional): Architectural metal panels must meet the minimum requirements outlined in Section [5.1.2.3](#) of Appendix A.

3.1.3.8.4 Other Steep-Sloped Roof Coverings

For all other roof coverings, the designer must provide documentation showing that the roof covering was designed to meet the ASCE 7 building-specific parameters outlined in Section [3.1.1.3.1](#). The attachments shall be designed for the component and cladding wind pressures in accordance with Section [3.1.1.3](#).



Hail Supplement (Optional): Other steep-sloped roof covers must meet the minimum requirements outlined in Section [5.1.2.4](#) of Appendix A.

3.1.3.9 Attic Ventilation System Resistance to Wind-Driven Water Intrusion

The following requirements address additional vulnerabilities to wind-driven water intrusion.

3.1.3.9.1 Ridge and Off-Ridge Vents

Ridge vents, off-ridge vents, and turbines must be TAS 100(A) rated for resisting water intrusion in high winds and must be properly attached to the roof following the manufacturer's recommended installation for high winds.

3.1.3.9.2 Gable End Vents

IBHS does not recommend gable-end vents in new commercial buildings built in hurricane-prone regions. Research indicates that gable-end vents are more susceptible to water intrusion than vents at other locations.

If gable-end vents must be used to meet code required attic ventilation requirements, they shall be TAS 100(A) approved products installed according to the manufacturer's guidance as documented in the TAS 100(A) product approval.

3.1.4 Corrosion Protection—Materials

Fasteners and connectors shall have corrosion protection based on the building's proximity to salt water. Table [1](#) in Section [2.5](#) provides approved guidance.

Best Practice: While it may not be required, IBHS recommends the use of stainless steel as corrosion protection in all locations.

3.1.5 Skylights

Skylights and their attachments shall be designed for the ASCE 7 wind parameters as defined in Section [3.1.1.3.1](#). Skylights must be tested and approved at a minimum, in accordance with one of the following:

- AAMA/WDMA/CSA 101/ CSA 101/ A440, ASTM E330
- The Florida Building Code Testing Application Standard TAS 202

Installation shall meet the air and water infiltration requirements of ASTM E330 and ASTM E331.

The curb installation shall be confirmed by the structural engineer of record that it will meet the required uplift minimum factor as described in Section [3.1.1.3](#).

For **hurricane-prone regions**, the skylights shall meet AAMA 520-12 and shall meet one of the following:

- ASTM E1886 cyclic pressure test requirements and ASTM E1996 large missile impact rated "C" or "D".
- FM Approved per ANSI FM 4431 and FM 4350 with large missile impact rating.
- Miami-Dade County Approved (TAS 201 and TAS203), with large missile impact rating.



Hail Supplement (Optional): For protection against hail, skylights shall meet at least one of the following rating requirements:

- ASTM E1886 cyclic pressure test requirements and be ASTM E1996 missile impact rated B, C, D, or E.
- FM Approved per ANSI/FM 4431, with Severe Hail Rating.
- Current Miami-Dade County Approved Notice of Acceptance including impact resistance.

3.1.6 Roof-Mounted Equipment

All roof-mounted equipment and accessories must be mechanically attached to the building's structural system. Ballasted systems are not permitted in both hurricane and high wind prone regions.

3.1.6.1 Roof-Mounted Structures and Equipment

Roof-mounted structures and equipment and their attachments shall be designed in accordance with ASCE 7-10 Section 29.5.1 "Rooftop Structures and Equipment for Buildings with $h \leq 60$ ft" or ASCE 7-16 Section 29.4 "Rooftop Structures and Equipment for Buildings." A minimum factor of safety as described in Section [3.1.1.3](#) is required.



Hail Supplement (Optional): Hail guards shall be provided for air conditioner condenser fins, air intakes such as fans, and any other vulnerable component that, if struck by hail, can impair the operation of the unit.



3.1.6.2 Photovoltaic (PV) Systems

Photovoltaic systems and their attachments shall be designed using wind loads in accordance with ASCE 7-16, ASCE 7-22, SEAOC PV2, or a model-scale wind tunnel study that meets the requirements of ASCE 49-12. A minimum factor of safety as described in Section [3.1.1.3](#) is required. The roof deck shall be designed to support the increased PV array loads with appropriate load combinations, including live loads, wind, rain, and snow (including drifts).

For additional approved systems, see Section [5.3.7](#) of Appendix A.

See ASCE 7-16 or ASCE 7-22, C29.4 for more information regarding the risk category and additional design guidance for roof-mounted PV systems.



Hail Supplement (Optional): PV systems shall meet the minimum requirements outlined in Section [5.1.3](#) of Appendix A.

3.1.6.2.1 Recommendations for Additional Building Risks

While this document focuses on wind loads and hail risks for PV systems, IBHS strongly recommends that all additional building risks be addressed including:

- Increased combustibility from above the deck, which may lead to re- classification of the exterior fire rating of the roof cover system
- Snow, hail, seismic, electrical, and fire hazards
- Firefighting hazards

Periodic inspection, maintenance, and repair should include the prevention of roof cover puncturing, debris accumulation, and proper water-shedding of the roof cover to allow drainage which will prevent overloading of the roof. The use of a cover board is recommended in new roof cover systems to increase puncture resistance.

Best Practice: *When installing PV panels on a low-sloped roof, ensure the row spacing between the panels is wide enough for maintenance crews to service damaged panels. If the panels are installed too close together, perimeter panels may need to be removed to access interior ones.*

3.1.6.3 Roof-Mounted Antennas, Satellite Dishes and Communication Equipment

All roof-mounted antennas, satellite dishes, and other communication equipment and their connections must be designed for the design load requirements defined in Section [3.1.1.3](#).

Ballasted roof-mounted antennas, satellite dishes, and communication equipment are not permitted for hurricane- and high-wind-prone regions.

3.1.7 Lightning Protection Systems

Roof-mounted lightning protection systems shall be designed and installed for wind resistance in accordance with FEMA guidance on rooftop attached lightning protection systems in high-wind regions. The information outlined in this section highlights the key components of the FEMA document. Refer to the FEMA Advisory (see "[References](#)" on page 51) for more information and additional guidance.



3.1.7.1 Parapet Attachment

For parapets greater than 12 in. tall, all air terminal base plates and conductor connectors must be mechanically attached with 12-in. screws that have a minimum 1.25-in. embedment into the inside face of the parapet nailer and are properly sealed for watertight protection.

In lieu of conductor connectors that have prongs, mechanically attached looped connectors are required.

3.1.7.2 Adhered Single-Ply Membranes, Built-up, and Modified Bitumen

For adhered single-ply membranes, air terminal base plates must be attached with pourable sealer (type recommended by the manufacturer).

For built-up and modified bitumen roofs, air terminal base plates must be attached with asphalt roof cement.

Option 1: Instead of conductor connector clips, 9-in.-wide minimum by 3-ft-long strips of modified bitumen cap sheet should be placed over the conductor and attached to the membrane. If the strips are torch-applied, do not overheat the conductors. Start the strips 3 in. from either side of the air terminal base. Follow the next strip with a 3-in.-wide break in between strips along the conductor.

Option 2: Adhesive-applied conductor connectors that do not rely on prongs must be spaced no more than 6 in. o.c. in the corner zones of the roof and shall be spaced no more than 12 in. o.c. in the field and perimeter (zones designated by ASCE 7).

3.1.7.3 Mechanically Attached Single-Ply Membranes

Conductor and conductor connectors must be placed parallel with, and within 8 in. of, the membrane fastener row. When a conductor falls between or is perpendicular to membrane fastener rows, install an additional row of membrane fasteners where the conductor will be located. Install a cover strip over the membrane fasteners. Place the conductor over the cover strip and secure using one of the following methods:

Note: Air terminal base plates must be attached with pourable sealer (type recommended by the manufacturer).

Option 1: Instead of conductor connector clips, 9-in.-wide (minimum) by 3-ft-long strips of modified bitumen cap sheet should be placed over the conductor and attached to the membrane. If the strips are torch-applied, do not overheat the conductors. Start the strips 3 in. from either side of the air terminal base. Follow the next strip with a 3-in.-wide break in between strips along the conductor.

Option 2: Adhesive-applied closed (looped) conductor connectors that do not rely on prongs must be spaced no more than 6 in. o.c. in the corner zones of the roof and shall be spaced no more than 12 in. o.c. in the field and perimeter (zones designated by ASCE 7).

3.1.7.4 Standing Seam Metal Roofs

Pre-manufactured mechanically attached clips (panel clips) shall be used and anchored to the roof panel ribs. The air terminal base plates and closed (looped) connectors shall be attached to the panel clips. These connections shall be spaced no more than 6 in. o.c. in the corners and 12 in. o.c. in the perimeter and field (zones designated by ASCE 7).



3.1.7.5 Conductor Splice Connectors

Bolted splice connectors are required in lieu of pronged connectors. If strips of flashing membrane are used to connect the terminal to the membrane, the strip must start 3 in. from the splice to minimize the conductor movement. If closed connectors are used, they shall be placed 3 in. from the splice.

3.1.8 Low-Sloped ($\leq 10^\circ$) Roof-Mounted Safety Rails

All low-sloped roof-mounted safety rails and their connections must be designed in accordance with IBC 2015/2018 and ASCE 7-10/7-16.

A calculation set must be submitted to the FORTIFIED Multifamily Evaluator including all wind design parameters, member selection and design, connection details, and capacity verification, and the supporting structural member calculations. Shop drawings must be submitted. The FORTIFIED Multifamily Evaluator may request more information to determine the safety rail system compliance with the standards.

3.1.9 Low-Sloped Roof Equipment Screens

Low-sloped roof equipment screens and their connections shall be designed to meet the ASCE 7 building-specific parameters outlined in Section [3.1.1.3.1](#).

3.2 FORTIFIED Silver

All FORTIFIED Roof requirements shall be satisfied. The following sections specify the additional requirements.

3.2.1 Openings

3.2.1.1 Windows, Curtain Walls, Exterior/Personnel Doors, Sliding Doors, and Large Commercial Doors

Hurricane Prone Region Pressure Design:

In hurricane-prone regions, windows, curtain walls, exterior/personnel doors, and sliding doors, and commercial doors including roll-up, sectional doors, and entrance doors must be pressure rated for pressures associated with the ASCE 7 design wind speed and exposure category "C" or "D" to match the walls below. wind parameters as defined in Section [3.1.1.3.1](#).

Windows, curtain walls, exterior/personnel doors, and sliding doors must be tested and approved at a minimum, in accordance with one of the following:

- AAMA/WDMA/CSA 101/ CSA 101/ A440, ASTM E330
- The Florida Building Code Testing Application Standard TAS 202

Large commercial doors including roll-up, overhead, and sectional (garage doors), must be pressure rated for pressures associated with the ASCE 7 wind parameters as defined in Section [3.1.1.3.1](#). Commercial doors must be tested and approved at a minimum in accordance with one of the following:

- AAMA/WDMA/CSA 101/ CSA 101/ A440, ASTM E330
- ANSIDASMA 108
- The Florida Building Code Testing Application Standard TAS 202



Hurricane Prone Region Impact Protection:

In hurricane-prone regions, all windows, curtain walls, exterior/personnel doors, and sliding doors located within 30 ft of grade shall be impact rated or protected with an impact-rated protection system that, at a minimum, meets ASTM E1886 cyclic pressure and one of the following:

- Large Missile Level D (9 lb 2x4 impacting end on at 50 ft/sec) as defined in ASTM E1996 and ASTM E1886 and AAMA 506 E1996 large missile impact requirements.
- The Florida Building Code Testing Application Standards TAS 201 and TAS 203

Glazing 30 ft or higher above grade shall meet ASTM E1886 cyclic pressure and be rated for the design pressure and Small Missile Level A as defined in ASTM E1996, ASTM E1886 and AAMA 506.

Large commercial doors including roll-up, overhead, and sectionals (garage door) must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#). Commercial doors, at a minimum, shall also meet one of the following:

- Large Missile D (9 lb 2x4 impacting end on at 50 ft/sec) as defined in ASTM E1996 and ASTM E1886 and AAMA 506
- ANSI/DASMA 115 Standard Method for Testing Sectional Doors, Rolling Doors, and Flexible Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure AND/OR
- The Florida Building Code TAS 201 (Impact Test Procedures), 202 (Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure), and 203 (Criteria for Testing Products Subject to Cyclic Wind Pressure Loading)

High-wind-prone Region Pressure Design:

In high-wind-prone regions, windows, curtain walls, exterior/personnel doors, sliding doors, and large commercial doors including roll-up, overhead, and sectional (garage door) windows, curtain walls, and doors including roll-up, sectional doors, and entrance doors must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#). **Impact resistance is not required in high-wind-prone regions.**

3.2.2 Wall Systems

Wall systems shall be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).

3.2.2.1 Exterior Walls

Exterior walls shall be capable of resisting ASCE 7 wind loads for the appropriate wall wind pressure zone.



3.2.2.2 Wall Impact Resistance

In **hurricane-prone regions**, wall impact resistance shall be adequate to meet the requirements of ASTM E1886 and ASTM E1996 for the impact of a 9-lb nominal 2-in. x 4-in. lumber missile impacting end-on at 34 mph (50 ft/s) [large missile impact level D]. Systems that meet the intent of this requirement include but are not limited to:

- Reinforced concrete block masonry
- Precast concrete
- Cast-in-place concrete
- Solid insulated concrete forms
- Reinforced brick
- Brick with concrete block backing
- Insulated metal panels
- $\frac{3}{4}$ -in. plywood \geq
- $\frac{7}{16}$ -in. wood structural panel sheathing with one of the following finishes:
 - Brick veneer
 - $\frac{1}{2}$ -in. stucco
 - $\frac{1}{2}$ -in.-thick wood
 - $\frac{1}{2}$ -in. fiber-cement-based planking
 - $\geq \frac{5}{8}$ -in.-thick wood structural panel sheathing with vinyl or aluminum siding.

In **high-wind-prone regions**, the exterior wall system shall, at a minimum, provide the resistance to wind pressures and debris impact of a $\frac{7}{16}$ -in. OSB wood structural panel attached to wood wall framing

3.2.2.3 Exterior Insulating Finishing Systems (EIFS)

In **hurricane-prone regions**, exterior insulating finishing systems (EIFS) installed on a metal or wood frame shall not be permitted unless they are a **Miami-Dade County Approved** system. EIFS installed over masonry are acceptable.

In **high-wind-prone regions**, EIFS are permitted.

For all new construction applications, EIFS systems shall be installed by a qualified professional with an active Association of the Wall and Ceiling Industry (AWCI)- EIFS Mechanics certification.

For all existing EIFS that meet these criteria, a qualified professional with an active AWCI- EIFS Inspectors certification shall inspect the EIFS and provide supporting documentation regarding its condition. EIFS that are not visibly damaged, deteriorated, chipped or cracked, that have structurally sound horizontal and vertical seals including around windows and penetrations, are free of leaks, and have at least 5 years of useful life remaining are eligible for a FORTIFIED Silver designation. EIFS that do not meet these conditions and/or do not have at least 5 years of useful life remaining will require repairs or replacement to be eligible for a FORTIFIED Silver designation.

For a national registry of AWCI certified professionals visit

<https://www.awci.org/education/doing-it-right/eifs-doing-it-right#registry>.



3.2.2.4 Parapets

Parapets and false fronts shall be designed for the ASCE 7 wind pressures as outlined in Section [3.1.1.3.1](#). Parapets and false fronts greater than 3 ft in height shall include internal or external bracing with supporting documentation.

3.2.3 Gable Ends

3.2.3.1 Gable End Wall Strength

Gable end walls shall be designed in accordance with ASCE 7 as outlined in Section [3.1.1.3.1](#).

3.2.3.2 Gable End Wall Sheathing

Gable end wall sheathing shall have sufficient strength and fastening to resist wall design wind pressures specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).

The wall system shall, at a minimum, provide the resistance to wind pressures and debris impact of a $\frac{7}{16}$ -in. OSB wood structural panel attached to wood wall framing.

3.2.3.3 Gable End Bracing

Gable end bracing must be designed by the structural engineer of record to meet the minimum design wind pressures specified in ASCE 7 as outlined in Section [3.1.1.3.1](#), and shall address the bending capacity of the gable wall, bracing of the gable wall at its top and bottom, and connection of the bottom of the gable wall to the wall below.

3.2.3.4 Gable End Overhangs

Gable end overhangs must be constructed and attached to gable framing to resist the site-specific wind pressures specified in ASCE 7 as outlined in Section [3.1.1.3.1](#). Gable end overhangs greater than 12 in. should be designed as an outlooker by the structural engineer of record and calculations must be provided to the FORTIFIED Multifamily Evaluator.

3.2.3.5 Gable End Rake Soffits

Gable end rake soffits shall be unvented in **Hurricane Prone Regions**.

3.2.4 Securing Chimneys

Other attached structures such as chimneys shall have adequate load path members and connections and must be capable of resisting the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).

3.2.5 Electrical and Mechanical Systems and Connections—Flood Protection

All electrical and mechanical equipment and connections necessary to operate critical systems shall be elevated at minimum above the 500-year flood level, if known, or 3 ft above the base flood elevation (BFE) for the property. If the equipment cannot be sufficiently elevated as described above, permanent dry flood protection such as flood gates, walls, doors, or similar devices shall be used to prevent water intrusion to the heights described above. Flood depth, duration, velocity, and condition of water shall be considered (including floating debris).



3.3 FORTIFIED Gold

All FORTIFIED Roof and FORTIFIED Silver requirements shall be satisfied. The following sections specify the additional requirements.

3.3.1 Continuous Load Path

A continuous and adequate load path from the roof to the foundation of the building shall be provided to resist loads specified in ASCE 7 as outlined in Section [3.1.1.3.1](#). The building shall have positive connections from the roof to foundation to transmit wind uplift and lateral loads safely to the ground. This includes providing a continuous load path through the wall to the foundation on inter-story connections in multi-story structures.

The load path shall be designed by the structural engineer of record and installed per design with supporting documentation verifying the installation.

3.3.2 Structural Members of Cantilever Overhangs

Structural members of cantilever overhangs must be adequately anchored and designed for the ASCE 7 design wind pressures as outlined in Section [3.1.1.3.1](#).

3.3.3 Attached and Accessory Structures

Canopies, car ports, porte cocheres, or any other vehicle-type drive-through structures shall have adequate load path members and connections to resist the loads and load combinations specified in ASCE 7 as outlined in Section [3.1.1.3.1](#).



4 Supporting Documentation

Supporting documentation to be reviewed by the FORTIFIED Multifamily Evaluator is needed for each FORTIFIED Multifamily requirement and may include any one or a combination of the following:

- Design/development building drawing
- 100% construction drawings signed and sealed by a licensed professional architect and the structural engineer of record
- A confirmation letter with supporting documentation from the structural engineer or record stating that the installation meets a specific requirement. The structural engineer of record should have a license from the state where the referenced building is located.
- Photographs
- Building material submittals including but not limited to structural decks and roofing components
- Roof cover attachment details provided by manufacturer or contractor
- Any requested structural engineering calculations
- FORTIFIED Multifamily Compliance Forms (including the New Construction Form, Low-Sloped Re-Roofing, and Steep-Sloped Re-Roofing forms) completed by a licensed architect or the structural engineer of record
- Any other documents requested by the FORTIFIED Multifamily Evaluator or IBHS



5 Appendix A: Approved and Performance Tested Systems

5.1 Hail-Impact Related Performance Criteria (Optional Supplement)

5.1.1 Low-Sloped Continuous Roof Covers

Low-sloped ($\leq 10^\circ$) continuous roof covers must meet one of the following test standards:

- FM Approval Standard 4470 with a Class 1-SH or 1-VSH
- UL 2218 Class 4

5.1.2 Steep-Sloped Roof Covers

5.1.2.1 Asphalt Shingles

Asphalt shingles must meet a minimum rating of Good or Excellent on the [IBHS Roof Shingle Hail Impact Rating Scale](#).

The [IBHS Impact Resistance Test Protocol for Asphalt Shingles](#) is a test standard that is used to evaluate the hail performance of new asphalt shingle roof products. The test method uses state-of-the-art hailstone characteristics, kinetic energies, and damage assessment technology to evaluate new shingle performance against hail. IBHS has published, and will periodically refresh, the performance ratings for the most widely sold, basic impact-resistant shingles when subjected to 2-in. impacts according to the test protocol.

5.1.2.2 Clay and Concrete Roof Tiles

All clay and concrete roof tiles must meet FM 4473 Class 4 impact rating.

FM 4473 is a test standard administered by Factory Mutual Research that uses pure water frozen ice balls to evaluate impact resistance of new rigid roof covering materials (like concrete tile, clay tile, or slate). It involves firing the ice balls from a sling or air cannon at the roof-covering product. A Class 4 rating requires the product to still be functional following two impacts in the same spot with 2-in. ice balls.

5.1.2.3 Metal Panels

All metal panels must meet UL2218 Class 4 impact rating.

UL 2218 is a test standard developed by Underwriters Laboratories for assessing the impact resistance of new flexible roofing products (like metal panels or metal shingles). It involves dropping steel balls of varying sizes from heights designed to simulate the energy of falling hailstones. Class 4 indicates that the product was still functional after being struck twice in the same spot by 2-in. steel balls.

Although impact-resistant metal roofs have good impact resistance and are likely to survive most hailstone sizes without functional damage, metal roofs can be vulnerable to aesthetic damage since hail can cause permanent indentations in the roofing panels. Use of metal roofing products with granular coatings may reduce the visibility of small indentations.



5.1.2.4 Other Roof Coverings

For all other roof coverings, documentation must indicate that the roof cover has either a UL 2218 Class 4 rating or FM 4473 Class 4 rating to be eligible for a FORTIFIED Multifamily hail designation.

5.1.3 Hail Resistance of Photovoltaic Systems

For hail resistance, the PV system must meet one of the following:

- Flexible PV modules that are FM Approved for hail or meet FM Approval Standard 4476 that includes a Severe Hail rating.
- Rigid PV modules that are FM Approved for hail or meet FM Approval Standard 4478 that includes a Class 4 rating.

5.2 Fire-Rated Approved Roof Systems

Eligible tested and approved roof covers include those that are class A fire-rated by:

- ASTM
- FM
- UL

5.3 Approved Low-Sloped Continuous Roof Covers

Eligible tested and approved roof cover systems include those that are:

- Florida Product Approval (FPA) approved
- FM Approved
- ICC-Evaluation Services (ICC-ES) approved
- Miami-Dade Approved
- Texas Department of Insurance (TDI) approved
- UL Rated

Engineering extrapolation of test data (outside of the parameters set by the report/approval) to achieve greater design pressure ratings or larger connection spacings than listed in the certified report is not permitted.

Search tools are listed below in each of the following approved system.

5.3.1 Florida Product Approval (FPA) Approved Systems

- Multiple Systems: Select separate FPA-approved systems rated for each area: field, perimeter, and the corner.
- Single System: Select an FPA-approved system rated for the corner area uplift pressures and use it for the entire roof.
- Single System—Enhanced Fastening: In some instances, FPA does permit edge (perimeter/corner) enhancements. Enhancements must follow provisions stated in corresponding active FPA Evaluation Report.

Please refer to the roof selection example in Section [5.3.7](#) of Appendix A.



The design team shall document the following information regarding all current and active FPA-approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (field/perimeter/corner)
2. FL number
3. Uplift resistance
4. All material and securement details
5. Perimeter and corner enhancements
6. Enhancements calculations

The design team must submit a copy of the FPA Evaluation Report for each approved system to the FORTIFIED Multifamily Evaluator. FPA Evaluation Reports can be found by using the search tool located at www.floridabuilding.org/pr/pr_app_srch.aspx.

5.3.2 FM Approved Systems

FM Approval Standard 4470 or 4474 with a **current and active** RoofNav number.

- Multiple Systems: Select separate FM approved systems rated for each area: field, perimeter, and the corner.
- Single System: Select an FM approved system rated for the corner area uplift pressures and use it for the entire roof.
- **Note:** For hurricane-prone areas, FM does not permit edge (perimeter/corner) enhancements.

Please refer to the roof selection example in Section [5.3.7](#) of Appendix A.

The design team shall document the following information regarding all current and active FM-Approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (field/perimeter/corner)
2. FM assembly number
3. Roof system type
4. Uplift resistance
5. All material and securement details

The design team must submit a copy of the FM Assembly Report highlighting the selected assembly details for each approved system to the FORTIFIED Multifamily Evaluator. FM Approved roof assemblies can be found by using the RoofNav® search tool located at www.roofnav.com.

5.3.2.1 ICC Evaluation Service (ICC-ES) Approved Systems

- Multiple Systems: Select separate ICC-ES–approved systems rated for each area: field, perimeter, and the corner.
- Single System: Select an ICC-ES–approved system rated for the corner area uplift pressures and use it for the entire roof.
- Single System - Enhanced Fastening: ICC-ES does not permit edge (perimeter/corner) enhancements.



Please refer to the roof selection example in Section [5.3.7](#) of Appendix A.

The design team shall document the following information regarding all current and active ICC-ES–approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (field/perimeter/corner)
2. ESR report number
3. Division number
4. Section number
5. Table and system number
6. Uplift resistance
7. All material and securement details

The design team must also submit a copy of the ICC-ES Report for each approved system to the FORTIFIED Multifamily Evaluator. ICC-ES Approved roof assemblies can be found by using the search tool located at www.icc-es.org/evaluation-report-program/reports-directory.

5.3.3 Miami-Dade County Approved Systems

Must have a **current and active** Notice of Acceptance (NOA). Please refer to [Miami- Dade Product Control Search](#).

Multiple Systems: Select separate Miami-Dade County approved systems rated for each area: field, perimeter, and the corner.

Single System: Select a Miami-Dade County system rated for the corner area uplift pressures and use it for the entire roof.

Edge (Perimeter/Corner) Enhancements: Select a system rated for the field. Perimeter and corner enhancements can be made in accordance with the Miami-Dade County Notice of Acceptance.

Please refer to the roof selection example in Section [5.3.7](#) of Appendix A.

The design team shall document the following information regarding all current and active Miami-Dade Approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (field/perimeter/corner)
2. NOA number
3. Uplift resistance
4. All material and securement details

The design team must also submit a copy of the NOA Report for each approved system to the FORTIFIED Multifamily Evaluator. Miami-Dade Approved roof assemblies can be found by using the search tool located at www.miamidade.gov/building/pc-search_app.asp.



5.3.4 Texas Department of Insurance (TDI) Approved Systems

- Multiple Systems: Select separate TDI-approved systems rated for each area: field, perimeter, and the corner.
- Single System: Select a TDI-approved system rated for the corner area uplift pressures and use it for the entire roof.
- **Note:** TDI does not permit edge (perimeter/corner) enhancements. Please refer to the roof selection example in Section [5.3.7](#) of Appendix A.

The design team shall document the following information regarding all current and active TDI-approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (field/perimeter/corner)
2. TDI Evaluation ID (RC-xxx)
3. Assembly number
4. Uplift resistance range
5. All materials and securement details

The design team must also submit a copy of the TDI Product Evaluation Report for each approved system to the FORTIFIED Multifamily Evaluator. TDI Approved roof assemblies can be found by using the search tool located at www.tdi.texas.gov/wind/prod/indexrc.html.

5.3.5 UL Rated and Approved Systems

Tested and approved UL systems must meet the testing procedures outlined in either *UL 580 – Tests for Uplift Resistance of Roof Assemblies* or *UL 1897 – Uplift Tests for Roof Covering Systems*. Per UL, the appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the UL Mark on the product.

- Multiple Systems: Select separate UL-approved systems rated for each area: field, perimeter, and the corner.
- Single System: Select a UL-approved system rated for the corner area uplift pressures and use it for the entire roof.
- **Note:** UL-rated systems do not permit edge (perimeter/corner) enhancements. Please refer to the roof selection example in Section [5.3.7](#) of Appendix A.

The design team shall document the following information regarding all current and active TDI-approved roof systems on the Project Construction Form & Compliance Checklist.

- Location (field/perimeter/corner)
- UL product number (found on the top right of the product specification report)
- Option number (each report includes several assembly options with corresponding uplift capacities)
- Uplift resistance
- All materials and securement details

The design team must submit a copy of the UL Product Specification Report for each approved system to the FORTIFIED Multifamily Evaluator. Product Specification Reports can be found by using the UL search tool located: <http://productspec.ul.com/index.php>



5.3.6 Directory of Roof Assemblies

As an option to search for roofing systems, Single Ply Roofing Industry (SPRI) has created [Directory of Roof Assemblies](#) (DORA). DORA is a web application database of roof systems tested in accordance with standards referenced in Chapter 15 of the International Building Code. This service lists tested ultimate wind uplift load capacities on single-ply and modified bitumen roof systems. Assemblies may be searched, viewed, saved, and printed.

It is important to note that the uplift capacities within DORA are ultimate pressures and must be divided by 2 for the design uplift pressures required by Section [3.11.3](#).

5.3.7 Roof Cover Selection Example

The following example, along with Table [4](#) and Table [5](#), can be used to help the system needed based on uplift values.

- Building Parameters:
- Width: 100 ft
- Length: 100 ft
- Height: 60 ft
- Roof Slope: $\geq 7^\circ$ (Low-sloped roof)
- Wind Velocity: 160 mph
- Wind Exposure Category: D
- Risk Category: III
- Escarpment: Flat

Note: Although this is an example of a low-sloped roof without overhangs, roof peaks for roofs with a steep slope ($>10^\circ$) and overhangs must be addressed when applicable.

Use the ASCE 7-10 Figure 30.5-1 (net design wind pressures) to obtain the components and cladding wind pressures for Zone 1, Zone 2, and Zone 3. Use the adjustment factor (λ) from the same figure to account for building height and exposure category. Results are listed in Table [4](#).

Table 4: Roof Example Using Wind Design Pressures LRFD and ASD

Zone	Ultimate (LRFD) Pressure (psf) from Figure 30.5-1 @ 10 sq ft	Adjustment Factor (h=60 ft and Exposure=D)	Adjusted Ultimate (LRFD) ASCE 7-10 Design Pressures (psf)	Adjusted Allowable (ASD) ASCE 7-10 Design Pressures (psf) [Ultimate x 0.6]
Zone 1	18.7/-46.1	1.87	35.0/-86.2	21.0/-51.7
Zone 2	18.7/-77.3	1.87	35.0/-144.6	21.0/-86.8
Zone 3	18.7/-116.3	1.87	35.0/-217.5	21.0/-130.5
Zone 4	46.1/-50.0	1.87	86.2/-93.5	51.7/-51.6
Zone 5	46.1/-61.7	1.87	86.2/-115.4	51.7/-69.2

Using Table [5](#) as a guide, use the newly calculated ASD values to select an appropriate FM or Miami-Dade system.



5.3.7.1 Multiple Systems

Using multiple FM approved systems, Zone 1 ($51.7 < 60$) shall be a minimum of FM 1-105 rated, Zone 2 ($86.8 < 90$) shall be a minimum of FM 1-180, and Zone 3 ($130.5 < 135$) shall be a minimum of FM 1-270.

Using multiple UL approved systems, Zone 1 ($51.7 < 60$) shall be a minimum of 105 rated, Zone 2 ($86.8 < 90$) shall be a minimum of 180, and Zone 3 ($130.5 < 135$) shall be a minimum of 270.

Using multiple FPA/ ICC-ES/Miami-Dade/TDI approved systems (see Section [3.1.2.1](#) for more information), Zone 1 shall be a minimum of 51.7 rated, Zone 2 shall be a minimum of Miami-Dade 86.8 rated, and Zone 3 shall be a minimum of 130.5 rated.

5.3.7.2 Single System

Using a single, select a roof cover that is sufficient for the corner (Zone 3 [$130.5 < 135$]) wind uplift pressures. Use an FM 1-270, a UL 270 rating, or an FPA/ ICC-ES/ Miami-Dade/ TDI 135 for all zones of the roof.

5.3.7.3 Edge (Perimeter/Corner) Enhancements

In some cases, FPA does permit edge (perimeter/corner) enhancements. Enhancements must follow provisions stated in corresponding active FPA Evaluation Report.

FM edge (perimeter/corner) enhancements are not permitted.

ICC-ES/ TDI/ UL does not permit edge (perimeter/corner) enhancements.

Using a Miami-Dade approved system, select a roofing system rated for the field. If permitted by the NOA, edge enhancements may be provided. To calculate these enhancements, refer to the specific system NOA.



Table 5: FM/FPA/ICC-ES/ Miami-Dade/TDI/UL Roof Selection

ASCE 7-10 Uplift Values (LRFD) (psf)	ASCE 7-10 Uplift Values (ASD) (psf)	Minimum FM Rated	UL Approved	Minimum FPA/ ICC-ES/ Miami-Dade/TDI Rated
≤50	≤30	1–60	60	30
≤62.5	≤37.5	1–75	75	37.5
≤75	≤45	1–90	90	45
≤87.5	≤52.5	1–105	105	52.5
≤100	≤60	1–120	120	60
≤112.5	≤67.5	1–135	135	67.5
≤125	≤75	1–150	150	75
≤137.5	≤82.5	1–165	165	82.5
≤150	≤90	1–180	180	90
≤170.8	≤102.5	1–205	205	102.5
≤175	≤105	1–210	210	105
≤195.8	≤117.5	1–235	235	117.5
≤200	≤120	1–240	240	120
≤212.5	≤127.5	1–255	255	127.5
≤225	≤135	1–270	270	135
≤237.5	≤142.5	1–285	285	142.5
≤250	≤150	1–300	300	150
≤262.5	≤157.5	1–315	315	157.5
≤275	≤165	1–330	330	165
≤287.5	≤172.5	1–345	345	172.5
≤300	≤180	1–360	360	180
≤312.5	≤187.5	1–375	375	187.5
≤325	≤195	1–390	390	195
≤337.5	≤202.5	1–405	405	202.5
Note: Available uplift values and approvals may exceed the values included in this table.				

5.4 Approved Structural and Architectural Metal Roof Panel Systems

Approved structural metal panel roof systems on spaced supports and nonstructural architectural metal roof panels on solid wood sheathing include those approved by the following:

- Florida Product Approval (FPA)
- FM Approved
- ICC-Evaluation Services (ICC-ES)
- Miami-Dade Approved
- Texas Department of Insurance (TDI)



- UL Rated

5.5 Additional Approved Photovoltaic (PV) Systems

The following are additional approved PV systems:

- Rigid PV modules that are FM Approved or meet FM Approval Standard 4478 (wind uplift, combustibility from above the deck).
- Flexible PV modules that are FM Approved or meet FM Approval Standard 4476.
- PV system with an ICC AC 428 Evaluation Report



6 References

[American Architectural Manufacturers Association](#) (AAMA)

[American Society for Civil Engineers](#) – Minimum Design Loads for Buildings and Other Structures

American Wood Council – [National Design Specifications \(NDS\) for Wood Construction](#)

Federal Emergency Management Agency – [Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report; Building Performance Observations, Recommendations, and Technical Guidance, FEMA 549 / July 2006](#). Rooftop Attached Lightning Protection Systems in High-Wind Regions; Hurricane Katrina Recovery Advisory, pg. 479.

Federal Emergency Management Agency – [Flood Map Service Center](#)

[Florida Building Code](#)

[Florida Department of Business & Professional Regulation – Florida Product Approvals](#) (FPA)

TRI/FRSA [Florida High Wind Concrete and Clay Tile Installation Manual; Sixth Edition](#)

[FM Approvals](#)

[FM Global Data Sheets](#)

[ICC Evaluation Services](#)

Miami-Dade County Approvals – Regulatory & Economic Resources

[National Fire Protection Agency \(NFPA\) 780](#) – *Standard for Installation of Lightning Protection Systems*

[Single Ply Roofing Industry \(SPRI\)](#)

[Texas Department of Insurance \(TDI\)](#)

[Underwriters Laboratories](#)