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Hurricane Resistance Bronze Designation

Objective

Minimize damage and loss resulting from a Category 1 hurricane by:

1) improving roof sheathing attachment and providing a sealed roof deck;
2) installing sheathing on gable end wall, if necessary;
3) improving the attachment of outlookers at gable ends; and,
4) reducing chances of attic ventilation system failure.

Designation Term Limit

The FORTIFIED Home™ Hurricane Resistance Bronze Designation is valid for a period of five years. Designations expire on March 31 in the year following the fifth anniversary of designation.

Definitions

Certified FORTIFIED Evaluator: an individual who has met the professional requirements for certification by IBHS, and who has achieved a passing score on the FORTIFIED Home™ Hurricane Designation certification exam.

Damaged or deteriorated lumber: generally, lumber that is 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.

Outlooker: usually 2x framing that extend out over the top of the gable to support the sheathing on the overhang. They are typically required when the gable overhang is greater than 12 inches.

Qualified roof: a roof covering meeting the following criteria by type:

Shingle roof: A roof that has either asphalt or wood shingles as a primary roof covering material. A roof that is not visibly damaged or deteriorated, and has at least five years of useful life remaining is eligible for inclusion in bronze1 designation without roof covering replacement. An IBHS Certified FORTIFIED Evaluator must inspect the roof to determine the condition and remaining useful life of the roof covering. Roof coverings that are damaged or deteriorated, or have less than five years remaining useful life as determined by the evaluator are not eligible for bronze1 designation without roof covering replacement and must be re-roofed in accordance with bronze2 designation with roof covering replacement.

Tile roof: A roof that has either concrete or clay tile as a primary roof covering material. A roof that is not visibly damaged or deteriorated, and has at least five years of useful life remaining is eligible for inclusion in bronze designation without roof covering replacement. An IBHS Certified FORTIFIED Evaluator must inspect the roof to determine
the condition and remaining useful life of the roof covering. Roof coverings that are damaged or deteriorated, or with less than five years remaining useful life as determined by the evaluator are not eligible for bronze1 designation without roof covering replacement and must be re-roofed in accordance with bronze2 designation with roof covering replacement.

**Metal roof:** A metal roof that is not visibly damaged or deteriorated, and has at least five years of useful life remaining is eligible for inclusion in Bronze designation without roof covering replacement. A Certified FORTIFIED Evaluator must inspect the roof to determine the condition and remaining useful life of the roof covering. Roof coverings that are damaged or deteriorated, or with less than five years remaining useful life as determined by the IBHS certified evaluator are not eligible for Bronze1 designation without roof covering replacement and must be re-roofed in accordance with Bronze2 designation with roof covering replacement.

**Qualified Sealed Roof Deck (SRD):** A roof covering underlayment installed under the primary roof covering (ie. shingles or metal roofing) and attached to the top of the roof deck. A qualified sealed roof decks is an underlayment that is designed to stay in place and keep water from entering the home if the primary roof covering is damaged or lost due to high winds.

Underlayment that may qualify as a sealed roof deck under FORTIFIED include:

- A “peel & stick” membrane applied over the entire roof deck
- A 4” wide “peel & stick” membrane tape applied over all joints in the roof deck, topped by a roofing felt
- A properly attached synthetic underlayment with all seams taped
- A closed cell foam applied to all joints in the roof deck from the attic

**Underlayment:** a material applied to the surface of the roof deck or roof sheathing prior to the installation of the primary roof covering material.

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**Hurricane Resistance Bronze¹ Designation without Roof Cover Replacement**

**Introduction**

The FORTIFIED Home™ Hurricane Resistance Bronze¹ Designation provides prescriptive methods to retrofit a qualified roof without requiring roof covering replacement. This approach shall be used when roof covering replacement is determined by IBHS to be unnecessary because the following conditions are met: 1) The existing roof cover does not show visible signs of damage or deterioration; and, 2) The existing roof cover has at least five years of useful life remaining.

**Strengthening of roof sheathing attachment and providing a sealed roof deck for the roof from within the attic**

Strengthening the attachment of roof sheathing and installation of a sealed roof deck shall be achieved by applying acceptable spray polyurethane foam adhesive to the underside of the roof deck as shown in Figure 1.

The minimum requirements for spray adhesives are:
1) Product must be tested and evaluated in accordance with TAS 202-94, Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure. The minimum allowable design uplift pressure must be greater than or equal to 110 psf. (Note: the test pressure must be 1.5 times the design pressure to meet the TAS 202-94 test protocol.)

2) Two-component spray polyurethane foam system with a minimum core density of 1.5-3.0 pcf in accordance with ASTM D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

3) Spray polyurethane foam adhesive system must be installed by a properly trained and qualified applicator in accordance with the manufacturer’s maintenance and installation guidelines.

4) Documentation from the installing contractor identifying the manufacturer and product used for the improved roof sheathing attachment/sealed roof deck must be provided to the Certified FORTIFIED Evaluator to be included with final designation checklist. Documentation should also state that the installation meets the manufacturer’s requirements for an allowable design uplift pressure of at least 110 PSF.

Retrofit Requirements:
To provide enhanced roof sheathing attachment and a sealed roof deck, apply the spray polyurethane foam adhesive over all joints between sheathing and along all intersections between roof sheathing and all roof framing members in the manner prescribed by the manufacturer to meet the minimum design uplift pressure of 110 psf.

Improving the attachment of drip edges
Dabs of adhesive caulk must be applied under the bottom flange of the drip edge (see Figure 2) to improve the anchorage.

Improving the attachment/replacing ridge vents and off-ridge vents
Ridge vents and off-ridge vents must be rated for high winds and properly anchored to the roof. Ridge vents and off-ridge vents must be checked to determine whether they are rated for high winds according to TAS 100(A) and to check their attachment. If they are not rated units or not properly anchored, they are to be replaced/reattached as appropriate.
Hurricane Resistance Bronze\(^2\) Designation with Roof Cover Replacement

**Roof deck attachment (re-nail the roof decking)**

**Sawn Lumber or Wood Board Roof Decking:**

- Add fasteners as required to ensure that roof decking consisting of sawn lumber or wood boards up to 1 inch thick are secured with at least two nails, having a minimum diameter of 0.131 inches and a minimum length of 2-1/2 inches, (three nails if the board is wider than 8 inches) to each roof framing member it crosses. Framing members must be spaced no more than 24 inches apart. Clipped-head, D-head or round-head nails shall be acceptable provided they have the required minimum diameter and length.

- For wood boards greater than 1 inches thick and up to 2 inches thick, add fasteners as required to ensure that the decking is secured with at least two nails, having a minimum diameter of 0.131 inches and sufficient length to penetrate a minimum of 1-5/8 inches into the roof framing, (three nails if the board is wider than 8 inches) to each framing member it crosses. Framing members must be spaced no more than 24 inches apart. Clipped-head, D-head or round-head nails shall be acceptable provided they have the required minimum diameter and length.

**Structural Wood Panel (Plywood or Oriented Strand Board-OSB) Roof Sheathing:**

The number and spacing of additional fasteners needed to adequately strengthen the connection of structural wood panel roof sheathing depends on the size, type and spacing of the existing fasteners. With these considerations in mind, the re-nailing solutions outlined below are based on using ring-shank nails with full round heads as the additional nails. The specific required minimum dimensions and characteristics for the additional ring-shank nails to be used to strengthen the roof deck attachment [Figure 3] are:

- full round head diameter (no clipped head nails allowed)
- 2-3/8 inch minimum nail length
- 0.113 inches in diameter
Table 2: Additional Fasteners at Panel Edges and Intermediate Framing for Roof Deck

<table>
<thead>
<tr>
<th>Wind Speed</th>
<th>Existing Fasteners</th>
<th>Existing Spacing</th>
<th>Required Additional Fastening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6d nails</td>
<td>Any</td>
<td>6 inches o.c. spacing between additional fasteners along panel edges and intermediate framing</td>
</tr>
<tr>
<td>120 mph or less</td>
<td>8d smooth shank nails</td>
<td>6 inches o.c. or less along panel edges and intermediate framing</td>
<td>No additional fasteners required along panel edges, 6 inches o.c. spacing between additional fasteners along intermediate framing</td>
</tr>
<tr>
<td></td>
<td>8d smooth shank nails</td>
<td>Greater than 6 inches o.c.</td>
<td>6 inches o.c. spacing between existing and additional fasteners along panel edges, 6 inches o.c. spacing between additional fasteners along intermediate framing</td>
</tr>
<tr>
<td></td>
<td>8d ring shank nails</td>
<td>12 inches o.c. or less</td>
<td>6 inches o.c. spacing between existing and additional fasteners along panel edges and intermediate framing</td>
</tr>
<tr>
<td>Greater than 120 mph</td>
<td>Staples or 6d nails</td>
<td>Any</td>
<td>6 inches o.c. spacing between existing and additional fasteners along panel edges and intermediate framing</td>
</tr>
<tr>
<td></td>
<td>8d smooth shank nails</td>
<td>Less than 6 inches o.c.</td>
<td>4 inches o.c. spacing between existing and additional fasteners along panel edges and 6 inches o.c. between additional fasteners along intermediate framing</td>
</tr>
<tr>
<td></td>
<td>8d smooth shank nails</td>
<td>6 inches o.c. or greater</td>
<td>4 inches o.c. spacing between existing and additional fasteners along panel edges and along intermediate framing</td>
</tr>
<tr>
<td></td>
<td>8d ring shank nails</td>
<td>12 inches o.c. or less</td>
<td>4 inches o.c. spacing between existing and additional fasteners along panel edges and along intermediate framing</td>
</tr>
</tbody>
</table>

Note:
1. Roof sheathing panels must be minimum of 7/16 inches thick
2. Roof framing members must be spaced at maximum of 24 inches o.c. and have a minimum 2 inches nominal thickness
3. Existing 8d nails to be a minimum of 0.131 inches in diameter and 2-1/2 inches long
4. All additional fasteners are to be 8d ring shank nails (0.113 inches x 2-3/8 inches with full round head – Figure 3)
5. Roof pitch must be 2/12 or greater
Deteriorated or damaged roof deck:
Inspect the 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 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.

Requirements for replacement of roof decking:
1. If a section of the roof deck is damaged or deteriorated, remove and replace the entire damaged sheet or board.
2. Inspect the roof framing members below the removed decking. If more than $\frac{1}{4}$ inch of the surface is deteriorated or damaged, follow the “Requirements for deteriorated or damaged wood roof framing members.
3. Add a minimum 2x4 scab, (A), to the side of existing roof framing member along the edges of new decking such that the new decking can be fastened to the added 2x4 scab instead of the existing roof framing member (to prevent the additional roof deck fasteners from damaging the existing framing members). Fasten the new 2x4 scab to existing framing member with 16d nails (or 3 inches long, No. 8 wood screws) at 4 inches o.c. See Figure 5.
4. Fasten the new decking to the supporting roof framing members and the newly added 2x4 scab, (A), in accordance with Table 1 (boards) or Table 2 (sheathing) as appropriate.

Deteriorated or damaged wood roof framing member:
If the roof deck is damaged, there is a possibility that the wood roof framing members below the damaged decking are deteriorated or damaged as well. The guidelines listed below provide guidance for repairing wood roof framing members with relatively minor damage/deterioration as described. If the damage is greater than the conditions listed, consult a licensed professional engineer to provide engineering details to repair the damage.

Requirements for repairing damaged or deteriorated wood roof framing members
1. The damaged or deteriorated portion of a roof framing member must meet all of the following conditions in order to be repaired instead of replaced:
   a. The roof framing member must be a nominal 2 inches thick and be spaced no more than 24 inches o.c.
   b. Damaged/deteriorated area must be less than 25 percent of roof framing member depth.
   c. Damaged/deteriorated area must not exceed 25 percent of member length up to an absolute maximum length of 2 feet.
   d. Damaged/deteriorated area must be a minimum of 6 inches away from any mechanical connections (truss/ rafter hangers, truss connector plates, etc.)
Figure 5: Roof Deck Replacement Detail
2. If all conditions in Section 1 are met, a scab can be used to repair the damaged roof framing member. The scab should match the size of the damaged roof framing member. For example, a 2x4 roof truss top chord with damage meeting the conditions listed would require a 2x4 scab; a 2x10 rafter with damage meeting the conditions would require a 2x10 scab. Each scab member must be a continuous piece, extend beyond the damaged portion, as shown in Figure 6, and be fastened to the existing roof framing member with (2) rows of 16d nails (or 3-inch, No. 8 wood screws) at 4 inches o.c. The scab may be trimmed up to ½ inch to facilitate installation.

3. The roof decking should be fastened to the new scab as indicated in Table 1 (boards) or Table 2 (sheathing) as appropriate.

**Provide underlayment and secondary water resistance at roof deck (sealed roof deck installed)**

A sealed roof deck that keeps water out of the house and stays on the roof in the event of roof covering damage shall be installed using one of the following methods when replacing the roof covering to achieve a Bronze designation:

**Options for shingle or metal roofs:**

1. The entire roof deck shall be covered with a full layer of self-adhering polymer modified bitumen membrane meeting ASTM D1970 requirements. 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, the amount of wax added to the OSB panel, and the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels to ensure the proper attachment of the self-adhering membrane to the sheathing. Roofers are finding that shingles are bonding to many of these membranes and this could lead to damage of the sheathing when it comes time to replace the shingles. Consequently, the membrane should be covered with a bond break such as a 15-pound ASTM D226, Type I underlayment. This underlayment for the shingles only needs to be fastened sufficiently to keep it on the roof surface and provide safety to the roofers until the shingles are applied. Note: Some local building departments (e.g. Miami-Dade and Broward Counties) prohibit the use of this system. Check with the local building department.

2. Apply a self adhering polymer modified bitumen flashing tape at least 4 inches wide directly to the roof deck to seal the horizontal and vertical joints in the roof deck. 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, the amount of wax added to the OSB panel, and the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels 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. Next apply a code compliant 30-pound ASTM D226, Type II underlayment over the self-adhering tape. This underlayment must be attached using annular ring or deformed shank roofing fasteners with minimum 1-inch diameter caps at 6 inches o.c. spacing along all laps and at 12 inches o.c. in the field or a more stringent...
Figure 6: New Scab Member Fastening Detail
fastener schedule if required by the manufacturer for high-wind installations. Horizontal laps shall be a minimum of 2 inches and end laps shall be a minimum of 6 inches. Nails with plastic or metal caps are allowed in areas where the design wind speed is less than 140 mph. Metal caps are required for areas where the design wind speed is greater than or equal to 140 mph. A self adhering polymer modified bitumen membrane complying with ASTM D1970 may be installed over this underlayment in order to comply with FEMA technical fact sheet No. 19, Option 1 which is recommended for areas with design wind speeds greater than 120 mph.

3. Apply reinforced synthetic roof underlayment which has an ICC approval as an alternate to ASTM D226 Type II felt paper. The synthetic underlayment must have minimum tear strength of 20 lbs. per ASTM D1970 or ASTM D4533. This underlayment must be attached using annular ring or deformed shank roofing fasteners with minimum 1-inch diameter caps at 6 inches o.c. spacing along all laps and at 12 inches o.c. in the field or a more stringent fastener schedule if required by the manufacturer for high-wind installations. Metal caps are required for areas where the design wind speed is greater than or equal to 140 mph. Horizontal laps shall be a minimum of 2 inches unless larger overlap is required to avoid sealing horizontal seams and end laps shall be 6 inches. All seams must be sealed with a compatible adhesive or a compatible 4-inch wide tape except for steep slope roofs with a 12/12 roof pitch (45 degrees) or greater. Horizontal seams on steep slope roofs with a 12/12 pitch (45 degrees) or greater do not have to be sealed with adhesive or tape provided the overlap for horizontal seams is at least 18 inches. A self adhering polymer modified bitumen membrane complying with ASTM D1970 may be installed over this underlayment in order to comply with FEMA technical fact sheet No. 19, Option 1 which is recommended for areas with design wind speeds greater than 120 mph.

**Options for Concrete and Clay tile roofs:**

1. The entire roof deck shall be covered with a full layer of self-adhering polymer modified bitumen membrane cap sheet meeting ASTM D1970 requirements. 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, the amount of wax added to the OSB panel, and the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels to ensure the proper attachment of the self-adhering membrane to the sheathing. Note: Some local building departments (e.g. Miami-Dade and Broward Counties) prohibit the use of this system. Check with the local building department.

2. Apply a self adhering polymer modified bitumen flashing tape at least 4-inch wide directly to the roof deck to seal the horizontal and vertical joints in the roof deck. 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, the amount of wax added to the OSB panel, and the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels 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. Next apply a code compliant 30# ASTM D226, Type II underlayment over the self-adhering tape. This underlayment must be attached using annular ring or deformed shank roofing fasteners with minimum 1-inch diameter caps at 6 inches o.c. spacing along all laps and at 12 inches o.c. in the field or a more stringent fastener schedule if required by the manufacturer for high-wind installa-
Horizontal laps shall be a minimum of 2 inches and end laps shall be a minimum of 6 inches. Nails with plastic or metal caps are allowed in areas where the design wind speed is less than 140 mph. Metal caps are required for areas where the design wind speed is greater than or equal to 140 mph. Finally, apply a self adhering polymer modified bitumen cap sheet complying with ASTM D1970 over this underlayment.

3. Apply a self adhering polymer modified bitumen flashing tape at least 4-inch wide directly to the roof deck to seal the horizontal and vertical joints in the roof deck. 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, the amount of wax added to the OSB panel, and the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels 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. Next apply a code compliant 30# ASTM D226, Type II underlayment over the self-adhering tape. This underlayment must be attached using annular ring or deformed shank roofing fasteners with minimum 1-inch diameter caps at 6 inches o.c. spacing along all laps and at 12 inches o.c. in the field or a more stringent fastener schedule if required by the manufacturer for high-wind installations. Horizontal laps shall be a minimum of 2 inches and end laps shall be a minimum of 6 inches. Nails with plastic or metal caps are allowed in areas where the design wind speed is less than 140 mph. Metal caps are required for areas where the design wind speed is greater than or equal to 140 mph. Finally, hot mop the underlayment using hot asphalt and apply a 90# mineral surface cap sheet.

Drip edge requirements:

Provide drip edge at eaves and gables. Overlap to be a minimum of 3 inches. Eave drip edges shall extend ½ inches below sheathing and extend back on the roof a minimum of 2 inches. Drip edge at eaves shall be permitted to be installed either over or under the underlayment. The drip edge shall be mechanically fastened to the roof deck at maximum of 4 inches o.c. Mechanical fasteners shall 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.

Flashing requirements:

Roof membranes shall be taped and sealed around all roof penetrations. For flashing at roof penetrations, changes in roof slope and intersections with walls or building features, follow the recommendations given in the NRCA Roofing and waterproofing manual or the FRSA guide. Lap underlayment with a minimum of a 6-inch turned up leg at all wall intersections. Lap wall weather barrier over turned up roof underlayment.

Roof covering replaced with high-wind rated product

Roof coverings and their attachment must be rated for the ASCE 7 design wind speed for the site location of the building and must be installed in accordance with the manufacturer’s recommendations for high-wind regions.

Asphalt Shingles:

ASTM is a standards organization that publishes technical standards for a wide range of materials and products, including test standards for the wind resistance of asphalt shingles. The ASTM shingle testing standards and classification system, not the advertised warranty period and warranty wind speed, will determine which class of high-wind
rated shingles meet the technical requirements for a specific wind speed. Make sure the shingles chosen meet these test standards and classification and that the installation is in accordance with the manufacturer’s recommendation for high-wind installations. Asphalt shingles, including hip and ridge materials, must meet the shingle testing standard for the appropriate site design wind speed as shown in Table 5:

Table 5: Design Wind Speed and Shingle Testing Standards

<table>
<thead>
<tr>
<th>Wind Speed</th>
<th>Shingle Testing Standard/ Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 mph</td>
<td>ASTM D3161 (Class F) or ASTM D7158 Class G, or H</td>
</tr>
<tr>
<td>120 mph</td>
<td>ASTM D7158 Class G or H</td>
</tr>
<tr>
<td>130 mph</td>
<td>ASTM D7158 Class H</td>
</tr>
<tr>
<td>140 mph</td>
<td>ASTM D7158 Class H</td>
</tr>
<tr>
<td>150 mph</td>
<td></td>
</tr>
</tbody>
</table>

**Shingle Attachment:**

Shingles shall 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 local building code.

**Attachment at eaves, rakes, valleys, gable ends, and starter strips:**

Shingles and starter strips at all intersections, eaves, valleys, and gable ends shall be set in a minimum 8-inch wide strip of flashing cement. Maximum thickness of flashing cement shall be 1/8 inch. Shingles shall not extend more than ¼ inch beyond the drip edge.

**Clay and Concrete Roof Tiles:**

Clay and concrete roof tile systems and their attachment shall meet the requirements of the site design wind speed and exposure category. Clay and concrete roof tiles shall be installed in accordance with FRSA/Tile Roofing Institute installation guidelines, “Concrete and Clay Roof Tile Installation Manual Fourth Edition, FRSA/TRI 07320/08-05” for the site design wind speed and exposure category. Mortar set tile or mortar set hip and ridge tiles (Systems Three and Four B, as listed in FRSA/TRI Manual) are not permitted. Hip and ridge boards shall be attached to the roof framing to resist the uplift pressure for the site design wind speed and exposure or in accordance with Table 11 of the FRSA/TRI Manual. Hip and ridge tiles shall be secured to the hip and ridge boards with mechanical fasteners and/or an approved roof tile adhesive. Note: FRSA/ Tile Roofing Institute installation guidelines, “Concrete and Clay Roof Tile Installation Manual Fourth Edition, FRSA/TRI 07320/08-05” are available for purchase from the Tile Roofing Institute or the Florida Roofing, Sheet Metal and Air Conditioning Contractor’s Association.
Metal Panels:

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

Other roof coverings:

For all other roof coverings, the designer must provide documentation showing the roof covering and the attachments were designed for the component and cladding wind pressures corresponding to the site design wind speed (up to 150 mph). All roof coverings, regardless of type, must be installed in accordance with the manufacturer’s installation guidelines for the appropriate design wind speed.

Improved anchorage of roof deck/outlookers at gable ends

Outlookers are usually 2x framing members that extend out past the top of the gable end wall to support the roof deck overhang. They are typically required when the gable end wall roof overhang is greater than 12 inches. Wind pressures on outlookers at the edge of gable end roofs are some of the highest pressures the structure experiences during high-wind events. It’s important to be sure that the outlookers are adequately attached to the supports to prevent a failure of the outlooker connection leading to loss of roof sheathing at the edge of the roof. Figure 8 shows gable end roof sheathing damage after a hurricane; this damage was a result of the failure of outlooker connections to the top of the gable end wall.

Gable end overhangs:

The prescriptive retrofit requirements are only applicable for the following gable end conditions:

Gable ends with outlookers

- Outlookers shall be a minimum of 2x4 framing at 24 inches o.c.
- Outlookers and/or gable end wall or truss must not be notched.

Retrofit requirements continued:

- Outlooker overhangs not to exceed 26 inches as shown in Figure 9 and Figure 10.
- The gable end wall must be sheathed with a structural panel (minimum 7/16 inch structural wood sheathing).

Note: For gable end conditions that do not meet the conditions above, a licensed professional engineer must be consulted to provide instruction and details for strengthening the gable end, gable end wall sheathing, outlookers, and outlooker connections to meet the appropriate design loads (live, dead, and wind load) for the site and framing conditions. The licensed professional engineer must provide engineered details that demonstrate compliance with performance standards. Signed and sealed copies of engineering details to be supplied included with designation inspection results by a Certified FORTIFIED Evaluator. A designation cannot be issued without these supporting documents.
Figure 9: Typical outlooker anchorage improvement at framed gable end wall.
Retrofit requirements for gable end overhangs meeting the criteria above:

Gable ends with outlookers:

1) Add saddle type hurricane clip to connect outlooker to gable end wall/truss as shown in Figures 9 and 10.

2) Add 2x4 joist hanger as shown in Figures 9 and 10.

3) Strengthen connection between roof framing members and roof sheathing.
   - If replacing roof covering, then:
     - Re-nail the roof sheathing as shown in Table 2.
   - When not replacing roof covering, then:
     - Apply acceptable spray polyurethane foam adhesive to all roof framing members in contact with roof sheathing as described on pages 6 and 7.

Figure 10: Typical gable end trusses and outlookers anchorage improvement.
Reduce chances of attic ventilation system failure:

Recent damage assessments conducted after hurricanes now make it clear that wind driven water intrusion causes catastrophic damage to the interior of buildings. The following information is intended to help minimize water intrusion through new and existing attic ventilation systems. With the exception of the plugging of gable rake vents, all other shuttering of openings or plugging of vents should be done on a temporary basis and removed once the storm threat is over so that the attic is once again properly ventilated.

Vinyl and Aluminum Horizontal Soffit Vents:

Properly installed vinyl and aluminum soffits should stay in place under most conditions; however it is not uncommon for vinyl and aluminum soffits to be installed in tracks that are poorly connected to the roof framing and walls. When these poorly anchored soffits blow off during a hurricane, water blows into the home.

Retrofit Requirements:

Note/Opportunity: When the soffit material is being removed and replaced (Options 1) or reinstalled (Option 2), this frequently provides the best opportunity to improve the connection between the roof and wall structure. In fact, for many homes this opportunity allows the roof-to-wall retrofit to be accomplished at a relatively low cost. Improving the connection between the roof and wall structure will accomplish part of the gold designation retrofits and maximize the engagement of whatever existing uplift resistance exists in the wall and the connection to the foundations.

Existing soffit panels and supporting channels shall be inspected by a Certified FORTIFIED Evaluator and verified to be in good condition in order to be retrofitted without replacement. To be in good condition, soffit materials must not appear to be brittle, deteriorated, cracked, torn or damaged. If soffit material is not in good condition or if aluminum soffit material is used within 3,000 feet of the coast, it must be removed and a new soffit system installed in order to meet the appropriate design wind pressures for soffit panels in accordance with Table 3.

The two most important elements for installing vinyl or aluminum soffits to resist high wind pressures are:

1) Limiting the span between the attachment points of the soffit panel to wood members along the overhang to a maximum of 12 inches o.c.

2) Attaching the soffit panel to the wood members along the building length.
RETROFIT OPTIONS

Option 1–Replacing soffit materials:

One option, that is always available, is to remove all of the existing soffit material, install backup framing that may have been omitted in the original installation, and make sure that the new installation of soffit materials meets the manufacturer’s recommendations for high-wind installations that correspond to the wall design pressures for the building and specific site exposure.

Option 2 – Remove and reinstall soffit materials:

In the following outline of actions to be taken, the letters in parentheses refer to the letters in Figure 12.

A. If the soffit manufacturer is not known:
   1. Remove the existing soffit panels (A) and label them so that they can be reinstalled in the same locations–Note: Lengths of soffits may vary around the house so it may be difficult to install some of the panels in a different location. Furthermore, it is likely that some or all of the material will need to be replaced, so make sure that it can be matched before it is removed. Any damaged soffit material should be replaced.

   2. If required, install wood support (D). Make sure all wood supports are attached with 16d nails or ¼ inch diameter screws that have a minimum length of 2-3/4 inches (1-1/4 inch embedment) and maximum spacing of 16 inches as listed in Figure 12.

   3. Install intermediate support (B) and/or end support (C). Note: the end support for the soffit may be provided by the sub-fascia (depending on the configuration) in lieu of installing (C) at the end of the overhang.

   4. Attach new soffit panels (A) with fasteners to wood support members (B) and (C) as specified in Figure 12.

B. If the soffit manufacturer is known; refer to the manufacturer’s documentation for installation details and requirements for soffit support and panel attachment for the appropriate design wind pressure and product model.
   • One source for this information is the Florida Building Code Product Approval website (http://www.floridabuilding.org/c/default.aspx), which provides information on soffit manufacturer’s installation guidelines for specific design wind pressures.

Option 3 – Strengthen anchorage of existing soffit materials:

A. When the existing vinyl or aluminum soffit system is in good condition and the wood support members (B) and (C) are not more than 12 inches apart (See Figure 12), provide attachment for soffit panels (A) to supports (B) and (C) as shown in Figure 12.

   or

B. When the length of the soffit perpendicular to the wall is less than or equal to 12 inches apply a combination of screws and polyurethane sealants to anchor the soffit material and tracks to the walls and fascia boards as outlined below:

   1. Install powder coated color matched or stainless steel sheet-metal
screws that will penetrate through both legs of the J or F channel supporting the fascia panels at the wall such that they create a pin connection through the fascia panels as shown in Figure 13. Install the screws at 12 inches spacing along the channel supporting the fascia panels.

2. Install powder coated color matched or stainless steel sharp pointed screws through the sub-fascia and soffit panel and embedded at least ¾ inch into the wood sub-fascia at the edge of the eave as shown in Figure 14. Install these screws at 12 inches spacing around the perimeter of the eave.

3. Apply a bead of polyurethane sealant (match to color of the wall or soffit or paint, as desired) along the joint between the wall and the track holding the soffit panels as shown in Figure 15.

4. Apply dollops of polyurethane sealant in the grooves where the fascia panels butt up against the wall channel and the sub-fascia as shown in Figures 16 and 17.

Required wind pressure (+/-) in pounds per square foot (psf) for the appropriate wind speed (MPH) in corresponding soffit height (FT). Listed design wind pressures are for Exposure C in end/corner zones. For Exposure B design pressures, multiply the listed design pressures by 0.83 for 15 foot height, 0.78 for 20 foot height, 0.75 for 25 foot height, 0.72 for 30 foot height, and 0.69 for 35 foot height.
Gable Rake Soffit Vents:

Gable rake soffit vents become a problem when porous soffit panels or screen vents are installed on the bottom surface of the roof overhang at the gable end and there is nothing to block the wind driven rain. This usually happens when the gable overhang is supported by outlookers (usually 2x framing that extends out over the top of the gable to support the sheathing on the overhang. They are typically required when the gable overhang is greater than 12 inches.)

Retrofit Requirements:

If the gable rake soffit vents are required to comply with roof ventilation requirements, the mitigation measures described here will not apply. That condition is beyond the scope of this retrofit program and IBHS requires that a design professional be contacted to provide appropriate mitigation measures.

If the gable rake soffit vents are not required to comply with roof ventilation requirements, there are two options:

1. Remove the vented soffit material and reinstall a non-porous soffit material to the bottom of the outlookers in accordance with the manufacturer’s installation guidelines for high-wind areas.

2. Plug the gaps from the inside with metal flashing and sealant. The flashing should be well attached and completely seal the openings. Use sealant around the edges. See the Figure 19 for an illustration of this technique. An alternative would be to use wood blocking with caulk adhesive all around in lieu of the metal flashing.

Gable end vents:

Gable end vents (Figure 20) are not designed to keep out water driven by hurricane force winds.

Retrofit Requirements

There are two options offered here to meet the intent of the program. While there may be other means available to satisfy the intent of the program, in order for these alternatives to be accepted they must they must be approved in advance of the final designation inspection using the Program Action Request (PAR) protocol.
Option 1:

Gable vents must be covered from the outside with plywood or a nonporous type of shutter that will prevent water from entering through the gable end vent. Wood structural panels with a minimum thickness of 7/16 inch and a maximum span of 4 feet is permitted as a gable end cover. Panels must be pre-cut so that they can be attached to the framing surrounding the gable vent. Panels shall be pre-drilled as required for the anchorage method and all required hardware shall be provided. Permanent corrosion-resistant attachment hardware with anchors permanently installed on the building shall be provided. Attachment schedule must be, at a minimum, in accordance with Table 4. Seal the shutters to the trim boards around the edges of the gable end vent. Self-adhesive weather stripping can be used to produce the desired seal.

Option 2:

If installation of shutters from the outside is difficult because of the height or other considerations, but there is access through the attic, the gable vent opening can be shuttered from the inside (Figure 22). Follow the requirements for size and anchorage of wood structural panels indicated in Option 1. Note that careful attention needs to be paid to sealing around the shutter and making sure that any water that accumulates in the cavity can drain to the outside of the house and not into the wall below.

Roof vents:

Many roofing manufacturers now make roof vents (ridge vents, static vents, turbines or powered vents) that have passed wind-driven water tests. They are identified as having passed the Florida Building Code’s Testing Application Standard, TAS 100(A). All roof vents must meet the requirements of TAS 100 (A) and be installed per the manufacturer’s instructions.

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Table 4: Fastening schedule for wood structural panel gable end vent cover

<table>
<thead>
<tr>
<th>FASTENER TYPE</th>
<th>FASTENER SPACING (inches)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 8 Wood Screw based anchor with 2-inch embedment length²</td>
<td>16</td>
</tr>
<tr>
<td>No. 10 Wood Screw based anchor with 2-inch embedment length²</td>
<td>16</td>
</tr>
<tr>
<td>1/4 Lag screw based anchor with 2-inch embedment length²</td>
<td>16</td>
</tr>
</tbody>
</table>

Notes for Table 4:

1. Fasteners shall be installed at opposing ends of the wood structural panel.
2. Where screws are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum withdrawal capacity of 1500 lb.
Is it possible to improve the attachment of roof sheathing and provide a secondary moisture barrier without roof covering replacement?

Yes. There are acceptable polyurethane foam adhesives that can be applied in the attic along the joints between the roof sheathing and the rafters or trusses that strengthen the attachment of the roof sheathing to the rafters or trusses. If sprayed over the joints between the sheathing, these foam adhesives also provide a sealed roof deck to help to keep water out if the roof covering is damaged. These closed cell foam adhesives are different from insulating open or closed cell foam products. These systems use special chemicals that are mixed on site and require professional installation.

Why is it important to improve the attachment of outlookers at gable ends?

Wind pressures on outlookers at the edge of gable end roofs are some of the highest pressures the structure will experience during high-wind events. It’s important to be sure that the outlookers are adequately attached to the supports to prevent a failure of the outlooker connection leading to loss of roof sheathing at the edge of the roof. Figure 23 shows gable end roof sheathing damage after a hurricane; this damage was a result of the failure of outlooker connections.

Why is it important to improve the performance of attic ventilation systems?

Recent experience with hurricanes has made it clear that wind driven water intrusion can cause catastrophic damage to the interior of a building.

What types of ventilation systems need to be addressed?

Any active or passive system intended to ventilate unconditioned attic space needs to be inspected to determine if mitigation is required. Several types of attic ventilation are used throughout the country, including but not limited to: horizontal soffit vents, gable rake soffit vents, gable end vents, and roof vents including ridge vents, goose neck vents, off-ridge vents and turbines.

Can an attic be changed from ventilated to unventilated to achieve the desired results?

Under certain circumstances an unventilated attic can be an effective way to prevent water intrusion and this type of attic is gaining popularity for energy efficiency reasons, provided the air conditioning system is sized appropriately. However, an unventilated attic is best accomplished when the home is specifically designed for it as new construction or during a major renovation when all of the appropriate details can be handled properly. There are a number of changes that have to be made to produce a successful transition from a ventilated to an unventilated attic. Under most circumstances, when seeking to achieve a bronze or silver designation, changing a ventilated attic to an unventilated attic is not recommended. On an existing house, any attempt to change to an unventilated attic configuration needs to be done very carefully with the advice of knowledgeable experts.

Why are soffit vents likely to be susceptible to failure during a high-wind event?

Plywood or wood soffits are generally adequately anchored to roof framing and walls and have not experienced as high a failure rate during storms as vinyl and aluminum soffits. Adequately designed and properly installed vinyl and aluminum soffits should stay in place under most conditions; however it is not uncommon for vinyl and aluminum soffits to be installed in tracks that are not designed to resist hurricane force winds and commonly are poorly connected to the roof framing and walls. When these poorly anchored soffits fail during a hurricane, that failure can lead to substantial water intrusion.

Will vented gable rakes require mitigation?

Yes. Soffit vents located at gable rakes become a problem when porous soffit panels or screen vents are installed on the bottom surface of the roof overhang at the gable end and there is nothing to block wind driven rain. This typically happens when the gable overhang is supported by outlookers, which are usually 2x framing that extend out over the top of the gable to support the sheathing on the overhang. They are typically required when the gable overhang is greater than 12 inches.
How can it be determined if gable rake is ventilated?

You can tell if the roof has gable rake vents by looking in the attic on a sunny day to see if light is visible in the gaps between the sheathing and the top edge of the gable. If you can see daylight, you need to block the gaps that will allow wind driven rain to enter the attic space by following the retrofit requirements below.

If a vent is present in the vertical face of a gable end, does it require remediation?

Yes. Gable end vents located in the vertical face are not designed to keep out water driven by hurricane force winds.

Are ridge vents on the main roof vulnerable to high winds?

Yes. Ridge vents are frequently fastened down using ordinary roofing nails since these are normally handy. It is pretty common to find ridge vents dislodged or blown off during a hurricane. Even a partially dislodged ridge vent can begin to act like a scoop that collects wind-driven rain and directs it into the attic. When they are used, ridge vents are the last part of the roof to be installed.

Do off-ridge vents on the main roof require mitigation?

All off-ridge vents require inspection and may require mitigation. Poorly anchored off-ridge vents can flip up and become scoops that direct wind driven rain into the attic. Some off-ridge vents are also prone to leaking when winds blow from certain directions.

Do other types of vents located on the roof need to be mitigated to withstand hurricane conditions?

Yes. Goose-neck vents and a variety of roof vents that work in ordinary wind are not likely designed to keep out water in a hurricane. Goose-neck vents are another form of off-ridge vent, and they are also frequently used for venting of bathrooms.

Do active vents, such as turbines, require inspection and retrofitting?

Yes. The rotating top portion of many turbines is not designed to withstand high-wind conditions and they are frequently installed with a friction fit to the short standpipe that provides the venting of the attic. The flange on the standpipe that provides the connection of the pipe to the roof sheathing may be poorly anchored to the roof sheathing and not designed to withstand high winds. A weak attachment of this type of vent can lead to it being blown off creating a large void in the roof making it susceptible to damage from high winds and large volumes of water intrusion.
Objectives

Minimize damage and loss resulting from a Category 2 hurricane by:

1) Protecting all openings
   a. Glazed openings
   b. Entry doors
   c. Garage doors
2) Strengthening gable ends over 4’ in height
3) Improving the anchorage of attached structures (porches and carports)

Designation Term Limit

The FORTIFIED Home™ Hurricane Resistance Silver Designation is valid for a period of five years. Designations expire on March 31 in the year following the fifth anniversary of designation.

Definitions

Carport: An attached carport is a structure whose roof is attached to the building or the roof structure of the dwelling and at least one side of the structure is open. A built-in carport has the roof of the house extending over the area used for parking cars, boats or other storage.

Design pressure rating: The allowable wind pressure rating assigned to an 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.

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 that a specific requirement has been met.

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

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

Impact-rated products: Impact-rated products include permanently installed products like doors, windows, sliding glass doors, and skylights that have been tested and approved in accordance with, at a minimum, International Residential Code (IRC) accepted impact resistance and design pressure test standards.

IRC: The International Residential Code developed by the International Code Council (ICC).

Opening protection products: Opening protection products must be tested and approved
with, at a minimum, International Residential Code (IRC) accepted test standards for impact resistance and design pressure. Opening protection products include permanently or temporarily installed shutter systems like roll shutters, accordion shutters, colonial shutters, Bahama-style shutters, storm panels, and fabric and screen products.

**Out of plane wind loads:** When associated with gable ends, out of plane wind loads are wind loads that are perpendicular to the face of the gable end.

**Porch:** A porch is an outdoor or semi-outdoor space with a solid roof directly above it where the roof is attached to or part of the roof of the primary structure. It may have one or more sides that are or once were open or screened. Screen pool enclosures are not considered porches for the purpose of this program.

**Wind loads:** Pressure exerted on a building due to wind. Wind loads are determined by applicable wind load provisions of ASCE 7 "Minimum Design Loads for Buildings and Other Structures."

**Introduction**

Protecting openings from windborne debris and the substantial forces generated by hurricane winds, strengthening gables over 4 foot tall, and improving the anchorage of attached, covered structures to better resist wind generated uplift loads are important steps to protect a home and its contents.

A home is particularly vulnerable to having unprotected windows being broken by windborne debris if:

1. The design wind speed from the area is 130 mph or greater, regardless of tree covering or the surroundings.
2. The design wind speed for the area is 120 mph or greater and the home is located in an area with moderate tree covering.
3. The home is in a neighborhood with few trees and the design wind speed for the area is 110 mph or greater.
4. The vulnerability goes up significantly if the home has a tile roof or if one or more of the neighbors has a tile roof, a flat roof with gravel ballast or, old shingles that are starting to curl.

If the home does not have hurricane clips, straps or anchors tying the roof structure of attached porches or carports to the supporting structure and the foundation, strong winds can damage these attached structures and they can become windborne debris, which ultimately can cause damage to the main structure.

Inadequately braced and improperly anchored tall gable end walls are vulnerable to failure during hurricanes. If the house has a gable end wall that is 4 feet tall or taller, and it is not properly braced and anchored, its failure can cause significant damage to the home.

The Hurricane Resistance Silver Designation addresses all of these concerns, in an effort to strengthen the entire building envelope. This holistic approach is what enables the FORTIFIED program to deliver meaningful risk reduction.

A prerequisite to a FORTIFIED Home™ Hurricane Resistance Silver Designation is completion of bronze designation retrofits (either without roof covering replacement or with roof covering replacement). This series of retrofits leading to the Silver designation provide prescriptive methods for protecting glazed openings, protecting entry doors and garage doors from windborne debris, strengthening gable ends that are over 4’ tall, and improving the anchorage of attached structures.
Opening Protection

Glazed Openings

Retrofit Requirements

All glazed openings (windows, patio doors, skylights, etc.) must be protected from wind-borne debris.

There are two solutions for glazed opening protection:

1. Installation of impact-rated products; or,
2. Installation of opening protection products.

Impact-rated products include permanently installed items, such as entry doors, windows, sliding glass doors, and skylights, that have been tested in accordance with, at a minimum, International Residential Code (IRC) accepted impact resistance and design pressure test standards (or with locally adopted standards, if they are more restrictive).

Opening protection products also must be tested with, at a minimum, International Residential Code (IRC) accepted test standards for impact resistance and design pressure (or with locally adopted standards, if they are more restrictive). Opening protection products include permanently or temporarily installed shutter systems, such as roll, accordion, colonial and Bahama-style shutters; storm panels, and fabric and screen products.

Note: While opening protection products are commercially available for most openings, there are no universally available opening protection products for skylights. Replacement or removal of existing skylights that do not meet approved impact protection requirements of the International Residential Code (IRC) are the only options to provide wind-borne debris protection. Skylight replacement units must meet, at a minimum, the International Residential Code (IRC) accepted test standards for impact resistance and design wind pressure (or with locally adopted standards, if they are more restrictive).

All glazed opening protection (Impact-rated products and opening protection products) must meet two criteria:

1. Design pressure rating: Glazed opening protection must be rated for the design pressures appropriate for the exposure category, wind speed, window size, and window location on the building. Products must be tested, at a minimum, in accordance with International Residential Code (IRC) accepted standards (or with locally adopted standards, if they are more restrictive) and installed in accordance with the manufacturer’s instructions. Acceptable International Residential Code (IRC) design pressure test standards for windows and glass doors include AAMA/WDMA/CSA 101/I.S.2/A440, ASTM E330 (products must be tested to 1.5 times design pressure). The Florida Building Code Testing Application Standard, TAS 202 is also acceptable for the FORTIFIED Home™ program. See Appendix C for wind design pressures for windows, doors, and garage doors.

2. Impact rating: International Residential Code (IRC) accepted test standards for impact resistance include the Large Missile Test of ASTM E 1996 and ASTM E 1886 and AAMA 506. The Florida Building Code Testing Application Standards, TAS 201 and TAS 203 are also acceptable for the FORTIFIED Home™ program.

All installations must be in accordance with the manufacturer’s instructions.

Note: Documentation of glazed opening protection design pressure rating and impact rating is required to validate that these criteria are met and must be provided to the Certified FORTIFIED Evaluator to be included with the final designation checklist.
For additional information about opening protection systems, The Institute for Business & Home Safety’s “Guide to Shutter Installation” provides a comprehensive list of shutter materials, cost estimates, and the pros and cons to consider when choosing opening protection products.

NOTE: The 2006 IRC provides an exception to wind-borne debris impact protection standards for windows by allowing the use of wood structural panels as opening protection for windows. For the FORTIFIED Home™ Program, wood structural panels with a minimum thickness of 7/16 inch and a maximum span of 8 feet are permitted to be used for opening protection in locations with a design wind speed less than 120 mph.

Panels must be pre-cut and pre-drilled as required for the anchorage method and all required hardware shall be provided. Permanent corrosion-resistant attachment hardware with anchors permanently installed on the building must be provided. The attachment schedule must be, at a minimum, in accordance with Table 1.

### TABLE 1: Windborne Debris Protection Fastening Schedule for Wood Structural

<table>
<thead>
<tr>
<th>FASTENER TYPE</th>
<th>FASTENER SPACING (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Panel span ≤ 4 feet</td>
</tr>
<tr>
<td>No. 8 wood screw based anchor with 2-inch embedment length</td>
<td>16</td>
</tr>
<tr>
<td>No. 10 wood screw based anchor with 2-inch embedment length</td>
<td>16</td>
</tr>
<tr>
<td>¼ inch lag screw based anchor with 2-inch embedment length</td>
<td>16</td>
</tr>
</tbody>
</table>

a. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located a minimum of 1 inch from the edge of the panel.

b. Fasteners shall be long enough to penetrate through the exterior wall covering and a minimum of 2 inches into wood wall framing, a minimum of 2 inches into concrete block or concrete, and extend far enough through steel framing such that a minimum of 3 threads are exposed. Fasteners shall be located a minimum of 2.5 inches from the edge of concrete block or concrete.

c. Where screws are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

### Entry doors

#### Retrofit Requirements

All exterior entry doors must be protected from windborne debris. At least one exterior entry door must be operable from inside the living space when opening protection is in place.
There are two options for entry door protection:

1. Install an entry door that is impact rated and meets the appropriate design wind pressure (see Appendix C for design wind pressures); or,

2. Entry doors that are not impact rated must be protected by a wind pressure and impact-rated protective system.

Impact-rated doors and impact-rated protective systems used to protect non-impact-rated doors must be tested and approved in accordance with, at a minimum, International Residential Code (IRC) accepted impact resistance and design pressure test standards (or with locally adopted standards, if they are more restrictive). Acceptable IRC design pressure test standards include AAMA/WDMA/CSA 101/I.S.2/A440 and ASTM E 330 (products must be tested to 1.5 times design pressure). The Florida Building Code Testing Application Standard, TAS 202 is also acceptable for the FORTIFIED Home™ program.

Acceptable IRC impact resistance standards include the large missile test of ASTM E 1996 and ASTM E 1886. The Florida Building Code Testing Application Standards, TAS 201 and TAS 203 are also acceptable. All installations must be in accordance with the manufacturer’s instructions.

Note: Documentation of opening protection design pressure rating and impact rating is required to validate that these criteria are met and must be provided to the Certified FORTIFIED Evaluator to be included with the final designation checklist.

Garage doors

Retrofit Requirements

All garage doors must be protected from wind pressure damage. In addition, garage doors with glazed openings that exceed a total window area of 1-square-foot for a one-car wide garage door or 1.8 square feet for a two-car wide garage door must also be protected from windborne debris.

1. For garage doors without glazed openings (windows): Provide a garage door assembly (door and all associated hardware and components) that meets the design wind pressure for the site or protect the garage door with an impact-rated shutter/screen product that meets the design wind pressure for the site.

2. For garage doors with glazed openings (windows): If the garage door has windows where the total window area on the door is less than or equal to 1.0 square feet for a one car wide garage door or 1.8 square feet for two car wide garage door, then the garage door is only required to meet the design wind pressure requirements for the site. If the garage door has window areas that exceed these total window areas, the door must be rated for the design pressure and the glazing must be rated for both pressure and impact or the garage door shall be protected with an impact rated shutter/screen product that meets the design wind pressure for the site.

Note: See Appendix C for design wind pressures requirements for garage doors.

Garage doors and garage door shutter or screen products must be tested and approved in accordance with, at a minimum, International Residential Code (IRC) accepted impact resistance and design pressure test standards (or with locally adopted standards, if they are more restrictive). Acceptable IRC impact resistance test standards include the Large Missile Test of ASTM E 1996 and ASTM E 1886. The Florida Building Code Testing Application Standards TAS 201 and TAS 203, and ANSI/ DASMA 115 (garage doors only) are also acceptable. Acceptable IRC design pressure test standards include ANSI/ DASMA 108 (garage doors only) or ASTM E 330 (products must be tested to 1.5 times design pressure). The Florida Building Code Testing Application Standard, TAS 202 is also acceptable. All installations must be in accordance with the manufacturer’s instructions.
Note: Documentation of opening protection design pressure rating and impact rating is required to validate that these criteria are met and must be provided to the Certified FORTIFIED Evaluator to be included with the final designation checklist.

**Gable end more than 4 feet tall**

**Retrofit Requirements**

Prescriptive methods for retrofitting gables 4 feet tall and taller are detailed in Appendix A. These methods are intended for applications where the gable end wall framing is provided by a wood gable end truss or a conventionally framed rafter system. These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end construction to out of plane wind loads.

Four issues are addressed:

1. Strengthening the vertical framing members of the gable end with the use of retrofit studs;
2. Bracing the top and bottom of the gable end so the lateral loads are transmitted into the roof and ceiling diaphragms through horizontal braces;
3. Making connections between horizontal braces and retrofit studs using metal straps and fasteners; and,
4. Connecting the bottom of the gable end to the wall below using metal bracket connectors.

*Note: Performing the retrofits required for strengthening gable ends may be easier and provide easier access to the gable end, if combined with the retrofits for strengthening outlooker connections to the gable end or adding gable wall sheathing, when required for the Hurricane Resistance Bronze Designation.*

Minimum requirements for use of prescriptive methods detailed in Appendix A:

1. Minimum ceiling diaphragm must be ½-inch drywall, 3/8-inch thick plywood, or plaster installed over wood lath.
2. Minimum roof diaphragm must be 7/16-inch plywood or OSB.
3. Gable ends must have structural wall sheathing (minimum of 7/16-inch plywood or OSB or equivalent).

Cases that are not covered in this retrofit guidance require that a licensed professional engineer design a gable end bracing system that will meet wind forces appropriate for the location.

*Note: Gable ends that are not covered in this retrofit guidance include:*

1. Gable end walls on rooms with vaulted or cathedral ceilings
2. Gable ends taller than 16 feet and/or have irregular shape.

For instructions and specifications for strengthening and bracing gable ends, see Appendix A, “Gable End Wall Bracing Retrofit.”
Attached structures (porches and carports)

Required Retrofits

These covered, attached structures are usually supported by horizontal beam members sitting on vertical columns, which are then connected to foundation systems.

Improving the anchorage of these structures requires three steps:

1. Provide metal connectors between the supporting roof members and the horizontal beams. It may be necessary to remove soffit/ceiling material in order to reinforce the connection. The uplift load on this connection can be determined by completing the Uplift Worksheet.
   a. Wood to Wood connections: The saddle-type hurricane clip (e.g. H10 or HS10 type clips) may be installed on either side of the beam when the determined uplift force is less than 800 lbs and must be installed on both sides of the beam when the determined uplift is greater than 800 lbs.

2. Provide a metal connector at the top of each beam to column connection. The uplift load required for this connection can be determined by completing the Uplift Worksheet. Select one of the connections shown in Figure VI-2. The determined uplift force must be smaller than the stated allowable uplift capacity corresponding to the selected connection.
   a. The metal connector must be rated for exterior weather exposure and the installation must be in accordance with the manufacturer’s recommendations.

3. Provide a metal connector at each column to foundation connection. The uplift load required for this connection can be determined by completing Uplift Worksheet. Select one of the connections shown in Figure VI-3 so the determined uplift force is less than the corresponding allowable uplift capacity.
   a. The metal connector must be rated for exterior weather exposure and the installation must be in accordance with the manufacturer’s recommendations. Provide a moisture barrier between the bottom of metal connector and the concrete.
Figure VI-1 Connection retrofit typical roof member to beam.

Figure VI-2 Typical beam to column connection retrofit.
Figure VI-3: Typical column to footing retrofit connection.
Uplift Worksheet

Use the following guidelines to determine how much uplift resistance is required to retrofit the existing carport/porch column connection at both the top and bottom. A continuous load path must be achieved from the roof framing members to the supporting beam, from the beam to the column, then from the column to the foundation.

I. Measure how far the porch roof sticks out from the wall, \( D = \) _______ ft.
II. Measure the width of the porch parallel to the house wall, \( W = \) ______ ft.
III. Measure the roof member spacing, \( S = \) ______ ft.
IV. Measure the roof overhang distance, \( OH = \) _____ ft.
V. Count the number of columns supporting the roof _____ (whole number = N) (Count each end wall as a post that supports the roof instead of a post, maximum 2.)

VI. Column support area can be calculated as following:
Inside Column Area \( A = \frac{D}{2} \times \frac{W}{(N-1)} \)
Corner Column Area \( A = \frac{D}{2} \times \frac{W}{2(N-1)} \)

VII. Select the appropriate net uplift pressure (wind pressure minus weight) for the design wind speed at your house from the Uplift Pressure Table below, \( P = \) __________ psf.

VIII. The roof member uplift force can be calculated as follows:
\( P_{up} = P \times (D/2 + OH) \times S = \) __________ lbs.

IX. The uplift force on the beam to column and column to foundation can be calculated by Multiplying the net uplift pressure times the typical area, \( P \times A = \) __________ lbs.

This is the uplift on each column, on the connection at the top of the column, and also on the connection at the bottom of the column. If the column is heavy (e.g. concrete or masonry) then you can reduce the force on the connection at the bottom of the column by the weight of the column.
Example Calculation and Observations: A porch is 8 feet deep and 25 feet wide with four columns along the outside edge of the porch. Consequently; D = 8 ft.; W = 25 ft.; N = 4; S = 2 ft.; OH = 1.5 ft. inside column area (A) = (8/2) x [25/ (4-1)] = 33.4 square feet; corner column area (A) = (8/2) x [25/(2(4-1))] = 16.7 square feet. If the design wind speed is 130 mph, the net uplift pressure on the roof (P) is 45 psf.

Then P*A is 1503 pounds for inside columns and 752 pounds for corner columns. The uplift force at the roof member and beam intersection is: P_{up} = 45 * (8/2 + 1.5) * 2 = 495 pounds.

The supporting foundation may be required to be verified to sufficiently resist the uplift forces.

![Figure 25](image-url)
Hurricane Resistance Gold Designation

**Objective**

Minimize damage and loss resulting from a Category 3 hurricane by:

1) Completing all FORTIFIED Hurricane Resistance Bronze and Silver Designation requirements.

2) Provide a continuous uplift, connection between roof support members, exterior bearing walls, multi-story floors, down to the foundation.

3) Adequately secure chimneys to the structure.

4) Ensure that windows and doors meet appropriate design pressures in addition to being protected from windborne debris.

**Designation Term Limit**

The FORTIFIED Home™ Hurricane Resistance Gold Designation is valid for a period of five years. Designations expire on March 31 in the year following the fifth anniversary of designation.

**Definitions**

- **Aspect ratio:** the ratio between the length and width of a home determined by dividing the length by the width.

- **Bearing point:** the top of a wall that provides vertical support for the roof structure.

- **Continuous load path:** an engineering term that refers to a series of connections, which allow forces, such as those created by high wind events, to pass from one part of a structure to another and which allow 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.

- **Design wind speed:** the wind speed used in the building code to establish wind forces (pressures), which a building or parts of a building must be capable of resisting, in accordance with code-accepted procedures.

- **Living area:** conditioned space in a home that is protected from the elements by walls, windows, doors, and the roof structure.

- **Mean roof height (MRH):** the average height of the roof, usually calculated as the average of the eave and ridge height of the roof.

- **Prescriptive retrofit measure:** a detailed retrofit measure provided in this guide, which does not require analysis by an engineer. These measures can be used to strengthen a home, which meets the requirements provided in this guide, in a manner so that it is likely to have sufficient strength to resist the expected design loads as described for a typical home in a specific region.
**Roof ridge:** the intersection of two roof planes at the peak of the roof.

**Roof span:** the maximum distance perpendicular to the ridge between outside bearing walls providing vertical support for the roof structure. For relatively simple buildings, this is usually the maximum distance (perpendicular to the ridge) between the outer walls that run parallel to the roof ridge.

**Shear walls:** a wall composed of braced panels (also known as shear panels) to counter the effects of lateral load acting on a structure. Wind and earthquake loads are the most common loads that braced wall lines are designed to counteract.

**Simple homes:** rectangular homes, which have either a simple gable or hip roof shape and which do not have significant variations (more that 4-foot offsets) in the exterior wall lines.

**Wall openings:** windows and all doors, including entry doors, sliding glass doors and garage doors.

### Introduction

A Tier II, FORTIFIED Hurricane Resistance Gold Designation level evaluation can be conducted simultaneously with a Tier I evaluation. However, it is more likely that the Tier II evaluation would follow the Tier I evaluation, after it has been determined that the home is a good candidate for a Gold Designation or if the homeowner specifically requests to pursue the Gold designation.

In any case, the home must be evaluated for compliance with all the Bronze and Silver requirements, which are the focus of the Tier I evaluation, and must meet these requirements before being considered for a Gold Designation. The Tier II evaluation adds to the inspection of the home’s foundation, structural components above grade, and structural connections comprising the load path. Depending upon the home and its construction type, the Tier II evaluation process may require limited amounts of invasive investigation (unless plans and documentation are available to show how the structure was designed and built) to gather the necessary information to provide an appropriate retrofit action plan.

### Continuous Load Path Development

#### A. Prescriptive load path retrofit measures

For small, simple homes a prescriptive solution is provided.

To be eligible for these prescriptive solutions, the home must meet the following criteria:

- The width of building shall not exceed 36 feet.
- The span of roof support members shall not exceed 36 feet from bearing point to bearing point.
- Wall openings shall not be greater than 5 foot wide within 8 feet of any corner of the building along walls parallel to roof ridge.
- The aspect ratio, L/W, shall be greater than 1.00 and less than or equal to 2.25.
- Single-story.
- The living area shall not exceed 2,000 square feet.
The roof slope shall not exceed 6/12.

The wall height shall not exceed 10 feet.

The mean roof height (MRH) of the building shall not exceed 20 feet.

No building dimension (length or width) shall be less than the building's mean roof height (MRH).

The building shall be rectangular in shape; walls shall not be offset more than 4 feet on any side of building.

Chimney structure, if applicable, must extend less than 5 feet above the roof deck and have a minimum width of 2 feet and maximum length of 4 feet. (See the chimney retrofits section.)

Bearing walls supporting roof members must rest on continuous footing or continuous stem wall foundations.

Existing stem walls must be CMU, with grouted cells at anchor bolt and vertical rebar locations, or poured concrete walls, with reinforcement resting on continuous poured concrete footing.

Design wind speed for the property as determined by using ASCE 7-05 wind speed maps must not exceed 130 mph for exposure C and 140 mph for Exposure B.

### B. Engineered load path solution

When the home does not meet all of the criteria listed above, a licensed professional engineer must provide a written evaluation report of the continuous load path for review by IBHS. The evaluation report must address the elements outlined in Appendix F, “Structural Elements to be evaluated by a Professional Engineer.” Before retrofit construction begins, construction documents, which demonstrate that existing conditions or the proposed improvements to the building's load path adequately meets FORTIFIED Home™ Hurricane Gold Designation requirements, shall be submitted to IBHS.

Construction documents shall be prepared by the professional engineer and shall indicate:

- Design wind speed, exposure category, mean roof height,
- Description of roof, ceiling and floor framing.
- Number of stories.
- Verification that existing roof, ceiling, floor, and wall framing provides adequate support for required loads and/or specific details indicating method of strengthening.
- Verification of load path from roof to wall and/or specific details indicating method of retrofit.
- Verification of load path from upper floors to lower floors and/or specific details indicating method of anchorage of wall above to wall below.
- Verification of load path from lowest wall to foundation and/or specific details indicating method of retrofit.
- Verification that foundation is adequate for wind uplift and lateral loads.

### Load Path Prescriptive Retrofit Measures
Wood Framed Bearing Wall Requirements for the Prescriptive Retrofit Measures:

1. One story wood framed buildings must meet the following criteria:
   a. Wall stud spacing must be in accordance with Table G-01 with a maximum height of 10 feet.
   b. Roof support members must be pre-engineered wood trusses or wood rafter framing at maximum 24 inches on center spanning a maximum distance of 30 feet.
   c. Exterior wall must be sheathed with minimum of 7/16-inch wood structural panels.
   d. Existing frame bearing wall must have continuous double top plate at roof
   e. Portion of exterior walls that are fully sheathed must not be less than 40 percent as per Figure G-01.

Figure G-01: Example to Calculate the Percentage (%) of Wall Length with Full Height Sheathing
Calculation Example:

Shear Wall Percentage (%) = \( \left( \frac{L1+L2+L3}{\text{Total L}} \right) \times 100 \)

Example:

L1 = 4 ft.–fully sheathed  
L2 = 4 ft.–fully sheathed  
L3 = 5 ft.–fully sheathed  
Total L (Building Dimension) = 30 ft.

Shear Wall Length Percentage (%) = \( \frac{4+4+5}{30} \times 100 = 43.3 \) percent, which is greater than 40 percent, so this meets the wood-framed bearing wall requirements for the prescriptive retrofit measure.

Table G-01: Wall Stud Spacing and Wall Heights

<table>
<thead>
<tr>
<th>Wind Spacing</th>
<th>120 MPH Exposure B or less</th>
<th>130 MPH Exposure B</th>
<th>130 MPH Exposure C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>110 MPH Exposure C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12&quot; o.c.</td>
<td>2x4 (up to 10 ft.)</td>
<td>2x4 (up to 10 ft.)</td>
<td>2x4 (up to 8 ft.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2x6 (up to 10 ft.)</td>
<td>2x6 (up to 10 ft.)</td>
</tr>
<tr>
<td>16&quot; o.c.</td>
<td>2x4 (up to 10 ft.)</td>
<td>2x4 (up to 9 ft.)</td>
<td>2x4 (not allowed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2x6 (up to 10 ft.)</td>
<td>2x6 (up to 10 ft.)</td>
</tr>
<tr>
<td>24&quot; o.c.</td>
<td>2x4 (up to 8 ft.)</td>
<td>2x4 (not allowed)</td>
<td>2x4 (not allowed)</td>
</tr>
<tr>
<td></td>
<td>2x6 (up to 9 ft.)</td>
<td>2x6 (up to 8 ft.)</td>
<td>2x6 (up to 8 ft.)</td>
</tr>
</tbody>
</table>

Note: Table G-01 is based on S-P-F No. 3/stud for 2x4s, S-P-F No. 2 for 2x6s.
### Table G-02: Wood Roof Truss/Rafter Member to Bearing Wall Uplift Connection Designation Requirements

<table>
<thead>
<tr>
<th>Wind Speed &amp; Exposure Category</th>
<th>Roof Member Span (bearing to bearing)</th>
<th>Uplift Load ($P_{u1,2}$, pounds per linear foot, plf)</th>
<th>Uplift Force at Roof Member to Bearing Wall (lbs)$^{1,2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>12” o.c.</td>
<td>16” o.c.</td>
</tr>
<tr>
<td>110 MPH Or Less Exposure B</td>
<td>20’</td>
<td>219</td>
<td>219</td>
</tr>
<tr>
<td>100 MPH Or Less Exposure C</td>
<td>25’</td>
<td>251</td>
<td>251</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>346</td>
<td>346</td>
</tr>
<tr>
<td>130 MPH Exposure B</td>
<td>20’</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td>110 MPH Exposure C</td>
<td>25’</td>
<td>332</td>
<td>332</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>380</td>
<td>380</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>456</td>
<td>456</td>
</tr>
<tr>
<td>140 MPH Exposure B</td>
<td>20’</td>
<td>363</td>
<td>363</td>
</tr>
<tr>
<td>120 MPH Exposure C</td>
<td>25’</td>
<td>419</td>
<td>419</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>480</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>576</td>
<td>576</td>
</tr>
<tr>
<td>130 MPH Exposure C</td>
<td>20’</td>
<td>444</td>
<td>444</td>
</tr>
<tr>
<td></td>
<td>25’</td>
<td>514</td>
<td>514</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>590</td>
<td>590</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>708</td>
<td>708</td>
</tr>
<tr>
<td>110 MPH Or Less Exposure B</td>
<td>20’</td>
<td>165</td>
<td>165</td>
</tr>
<tr>
<td>100 MPH Or Less Exposure C</td>
<td>25’</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>216</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>260</td>
<td>260</td>
</tr>
<tr>
<td>130 MPH Exposure B</td>
<td>20’</td>
<td>216</td>
<td>216</td>
</tr>
<tr>
<td>110 MPH Exposure C</td>
<td>25’</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>285</td>
<td>285</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>342</td>
<td>342</td>
</tr>
<tr>
<td>140 MPH Exposure B</td>
<td>20’</td>
<td>273</td>
<td>273</td>
</tr>
<tr>
<td>120 MPH Exposure C</td>
<td>25’</td>
<td>315</td>
<td>315</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>432</td>
<td>432</td>
</tr>
<tr>
<td>130 MPH Exposure C</td>
<td>20’</td>
<td>333</td>
<td>333</td>
</tr>
<tr>
<td></td>
<td>25’</td>
<td>386</td>
<td>386</td>
</tr>
<tr>
<td></td>
<td>30’</td>
<td>442</td>
<td>442</td>
</tr>
<tr>
<td></td>
<td>36’</td>
<td>531</td>
<td>531</td>
</tr>
</tbody>
</table>

1. Tabulated uplift loads are based on Tables 3.4 and A-3.4 in the "Wood Frame Construction Manual", 2001
2. Tabulated uplift loads shall be permitted to be multiplied by 0.75 for roof framing not located within 8 feet of building corners.
Prescriptive solution for connection of roof support members to bearing wall:

Provide uplift connection for each roof support member to the bearing wall for the load shown in Table G-02.

One-story, Wood-framed Wall:
Prescriptive Retrofit Measure for Roof Member Attachment to Wall

Roof truss/rafter tie-down:

At each roof truss/rafter connection requiring an uplift resistance greater than 200 lbs., metal connectors must exist or be added to provide the required connection strength. The required uplift resistance for each roof member is listed in Table G-02. When the required uplift is greater than 200 lbs, an appropriate uplift connector similar to those illustrated in Figure G-02 must resist it. Existing connectors will be evaluated for capacity.

One-story, Masonry Wall:
Prescriptive Retrofit Measure for Roof Member Attachment to Wall

Roof truss/rafter tie-down:

At each roof truss/rafter connection, metal connectors must exist or be added to provide the required connection strength. The required uplift resistance for each roof member is listed in Table G-02, and must be resisted by an appropriate uplift connector. Five types of connectors are illustrated in Figure G-03. Existing connectors will be evaluated for capacity.

Prescriptive Retrofit Measure for Anchorage of the Roof through the Walls to the Foundation:

In addition to ensuring adequate roof to wall connections, the wall must be capable of passing uplift and shear forces to the supporting foundation to complete the continuous load path. Parts of these requirements are satisfied by the requirements for wall sheathing and restrictions on openings in the walls. The rest is achieved by the reinforcing of the walls and the anchorage of the walls at the house corners as outlined in this section.

The prescriptive retrofit measures for connecting the wall to the foundation are as follows:

Wood-framed Wall Construction:

Connecting the wall framing to the foundation

Option 1–Tie down threaded rod:

Connect the wall to the foundation with 5/8-inch diameter tie-down rods at spacing, as indicated in Table G-03 and as shown on Figure G-05 & G-06. If an opening is located at the corner of building, provide tie-down rods as described in the table. Wall opening shall not exceed 5 feet at these corner areas on walls parallel to ridge.

Option 1–Individual studs:

Connect the individual stud and built-up stud column with a tension connector at top and bottom, as indicated in Table G-04 and as shown on Figure G-07. If an opening is located at the corner of building, provide additional king studs (if necessary) and tension connectors as described in the table. Wall opening shall not exceed 5 feet at these corner areas.
<table>
<thead>
<tr>
<th>Description</th>
<th>Spacing/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tie-Down Rod at Corner</td>
<td>Within 8” of corner</td>
</tr>
<tr>
<td>Tie-Down Rod at End of Retrofitted Wall Section</td>
<td>Not Less Than 7’-0” From Corner And At Least 24” Beyond 1st Hip Support Girder</td>
</tr>
<tr>
<td>Spacing Along Retrofitted Wall Section</td>
<td>Maximum 4’-0” On Center Unless On Either End Of Opening Greater Or Equal To 3’-0” and Less Or Equal To 5’-0”</td>
</tr>
<tr>
<td>Beside Openings Greater Or Equal To 3’-0”</td>
<td>Maximum 8” from Corner @ Ea. Side, Total of (2).</td>
</tr>
</tbody>
</table>

**Note:**
1. Tie-down rod is intended to achieve continuous-load-path to transfer roof uplift force down to the support foundation.
2. The wood framed wall must have (2) 2x continuous top plates and a minimum of full 7/16” structural panel sheathing on the exterior face of wall.
3. Tie-down anchor system must have a minimum allowable tension capacity of 2630 lbs (pounds) and a 3”x3”x1/4” steel plate on top of continuous double top plates on top of existing wood bearing walls.

---

**Table G-04: Individual Stud and Built-up Stud Column Tension Connector for Wood Framed Wall Construction**

<table>
<thead>
<tr>
<th>8'-0” min. from corner or 24” beyond 1st Hip support (Girder) See Figure G-04</th>
<th>Wall Opening at Corners</th>
<th>Corner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3’-0” Wide or Less</td>
<td>More than 3’-0” Wide Less than 5’-0” Wide</td>
</tr>
<tr>
<td>1. Provide a stud plate tie at top and bottom of each stud.¹</td>
<td>No additional requirement</td>
<td>1. Min. (2) continuous king studs at each side of opening with a tension tie at the bottom.²</td>
</tr>
<tr>
<td>2. Provide 5/8” diameter bolt with ¾”x3”x3” steel plate at maximum 16” o.c. along continuous wood bottom plate.⁴</td>
<td>². Provide a tension strap from each end of wood header to built-up column.³</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Stud plate tie at the top is connected to double top plates and at the bottom is connected to a single bottom plate. Stud plate tie shall have a minimum uplift capacity of 500 lbs.
2. Tension tie shall have an allowable tension capacity of 2100 lbs.
3. Tension strap shall have a minimum uplift capacity of 1770 lbs. Select the appropriate strap and install sufficient fasteners to achieve the capacity.
4. Bolt can be either epoxy-based anchor or concrete screw with a minimum of 6” embedment into concrete and installed as per manufacturer’s specifications. Note: 16” on center maximum bolt spacing shall be based on spacing between existing and additional bolts. New bolts must be minimum of 5/8” in diameter and existing bolts must be minimum of 1/2” in diameter.
Figure G-04: Wall Tie-Down Diagram for Roof Rafter or Truss Framing
Figure G-05: Wood Framed Wall Tie-Down to Concrete Foundation Detail
Figure G-06: Wall Tie-Down 5/8” Diameter Tie Rod Placement At Corner Of Walls Parallel To Roof Ridge
RAFTER FRAMED ROOF: 8'-0" MIN. OR 24" BEYOND RIDGE INTERSECTION
TRUSS FRAMED ROOF: 8'-0" MIN. OR 24" BEYOND HIP SUPPORT (GIRDER)

ELEVATION VIEW

1. Indicates min. (2) studs side with a tension tie at the bottom.
2. Indicates existing interior bearing stud at spacing as per Table G-01; provide a stud plate tie at each end.
3. Indicates built-up stud column with a min. of (2) studs at each side of opening with a tension tie at the bottom. Fasten additional stud (if necessary) to existing stud with 16d nails @ 6" O.C. staggered. Kings studs shall be continuous extending from top to bottom wood plates w/ min. (2) 16d toe nails at each end per stud.
4. Indicates a tension strap from each end of wood beam to the built-up stud column.
5. Provide 5/8" bolt x 6" embedment w/ a 1/4x3x3 steel plate @ maximum 16" O.C. and including existing anchor bolt locations when existing anchor bolts are 5/8" diameter or larger.

WOOD STUDS TIE-DOWN AT EACH CORNER OF BUILDING ALONG WALLS PARALLEL TO ROOF RIDGE

Figure G-07: Stud and Built-up Column Tie-Down at Each Corner
Masonry/Concrete Wall Construction:

Provide grouted cell with reinforcement as indicated in Table G-04 and as detailed in Figure G-07.

Table G-05: #5 Vertical rebar in Grouted Cell Spacing for Masonry Bearing Wall

<table>
<thead>
<tr>
<th>8'-0&quot; from corner or to 1st Hip support (Girder)</th>
<th>Wall Opening Size</th>
<th>Corner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3'-0&quot; or Less</td>
<td>More than 3'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>Less than 5'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>4'-0&quot; o.c.</td>
<td>At least (1) @ 1 side of the opening</td>
<td>(1) @ Ea. Side of Opening</td>
</tr>
<tr>
<td></td>
<td>(1) @ Ea. Corner</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The top of masonry walls must have a reinforced concrete tie-beam or grouted bond beam cap at the top of the walls.
2. #5 vertical shall be drilled and epoxied 6" into existing at top and bottom at each grouted cell location.
3. Masonry block wall may be saw cut and removed at the vertical rebar locations then formed and filled with grout.
Figure G-07: Grouted Cell with #5 Reinforcement Detail for Masonry Bearing Wall
Securing Chimneys

Chimney framing that extends above the roof deck must be properly anchored to prevent the chimney from collapsing during high winds. Chimney collapse can lead to interior water intrusion and damage, as well as damage to other structures in the area. A prescriptive retrofit measure for strengthening chimneys located within the interior of the roof extending less than 5 feet above the roof deck is provided. Chimneys that extend greater than 5 feet above the roof deck or that are located along the edge of the roof are beyond the scope of the prescriptive strengthening solution and require engineering review and detailing by a professional engineer.

Chimney Retrofit

Prescriptive retrofit measures

Chimney structures are vulnerable when the vertical framing members are just nailed to the top of roof deck without adequate anchorage to roof members below. A prescriptive solution for strengthening a chimney structure with this condition is outlined below. See Figure G-08 for illustrative details.

For strengthening chimneys extending 5 feet or less above the roof that are located within the interior of the roof:

1. Each corner of the chimney structure must have a tension strap fastened to the corner stud and continues downward to the roof support members below. The tension strap must have a minimum tension capacity of 700 lbs at each end.
2. The chimney framing shall be sheathed with minimum 7/16-inch structural panel on exterior four sides.
3. The base perimeters of chimney framing must be continuously supported by minimum 2x4 blocking fastened to roof framing members with joist hangers.

Engineering-based retrofit measure

Chimney framing that extends greater than 5 feet above the roof and/or is located along the edge of building requires evaluation and detailing by a licensed professional structural engineer:

For chimneys located within the interior of the roof that extend above the roof more than 5 feet and/or are located along the edge of the building:

The licensed professional engineer should provide detailing similar to Figure G-08. The engineered details must incorporate the following design parameters:

1. Chimney wall framing adequacy.
2. Overall over-turning stability and base shear requirement.
3. Roof support members adequacy and bracing requirement.
4. Specific attachment schedule of chimney structure to the existing structure.
Figure G-08: Typical Tie-Down for Chimney Framing
Ensure Windows and Doors Meet Site Appropriate Design Pressures

Most shutter systems have gaps that are large enough to allow the hurricane-induced external pressures to build up on the windows and doors being protected. There have been numerous cases where windows or doors have failed due to wind pressure despite the fact that they were protected by shutters.

For the FORTIFIED Hurricane Resistance Silver Designation, it is sufficient to protect windows and doors to prevent pressurization of the house. For the FORTIFIED Hurricane Resistance Gold Designation, however, design pressure ratings for all windows and doors must meet the design wind pressures for the location and exposure (see Appendix C for design pressures).

If the existing windows and doors do not meet the appropriate design pressure requirements, they must be replaced with units that do. In addition, the windows and doors must be protected from windborne debris by either being impact rated or being protected by an impact-rated protective system (as required for FORTIFIED Hurricane Resistance Silver Designation).

Design pressure rating and impact designation requirements

Windows, skylights and glass doors: Windows and glass doors must be rated for the design pressures appropriate for the exposure category, wind speed, window size, and window location on the building (see Appendix C). Products must be tested, at a minimum, in accordance with International Residential Code (IRC) accepted standards (or with locally adopted standards if they are more restrictive) and installed in accordance with the manufacturer’s instructions. Acceptable International Residential Code (IRC) design pressure test standards for windows and glass doors include AAMA/WDMA/CSA 101/I.S.2/A440, ASTM E330 (products must be tested to one and a half times design pressure). The Florida Building Code Testing Application Standard, TAS 202 is also acceptable for the FORTIFIED Home™ program.

Entry doors: Entry doors must be tested and approved in accordance with, at a minimum, International Residential Code (IRC) design pressure test standards (or with locally adopted standards if they are more restrictive). Acceptable IRC design pressure test standards include AAMA/WDMA/CSA 101/I.S.2/A440 and ASTM E 330 (products must be tested to 1.5 times design pressure). The Florida Building Code Testing Application Standard, TAS 202 is also acceptable for the FORTIFIED Home™ program.

Garage doors: Garage doors must be tested and approved in accordance with, at a minimum, International Residential Code (IRC) accepted design pressure test standards (or with locally adopted standards if they are more restrictive). Acceptable IRC design pressure test standards include ANSI/ DASMA 108 or ASTM E 330 (products must be tested to 1.5 times design pressure). The Florida Building Code Testing Application Standard, TAS 202 is also acceptable for the FORTIFIED Home™ program. All installations must be in accordance with the manufacturer’s instructions.

Impact requirements: In addition to the design pressure rating requirements outlined above, all windows, skylights, glass doors, entry doors, and garage doors must be protected from wind borne debris in accordance with FORTIFIED Home™ Silver level requirements.
Appendix A

Gable End Wall Bracing Retrofit

Introduction

Gable ends are upper triangular walls that rest on rectangular walls. They do not have horizontal eaves. The triangles may be of various proportions and may be triangles with a section cutoff. Figures 1 through 6 show a variety of gable ends. The only gable ends for which retrofitting is addressed in this guide are ones that include an attic. It does not address gable end walls where the room behind the wall has a cathedral or vaulted ceiling. Gable ends taller than 4 foot but shorter than 16 foot are the ones that can to be retrofitted with the prescriptive method described in this section.

Wind Forces on Gable Ends: Hurricane wind force both push (inward acting) and pull (outward acting) on houses. It is critical to brace the gable end in both directions.

Typical Traditional Construction Practices: Gable end walls were not necessarily built to withstand the pressures that hurricanes can impose. Gable ends in some instances may not have structural wall sheathing; in such cases, existing exterior material must be removed and replaced with structural sheathing (minimum of 7/16-inch plywood or OSB or equivalent.)

Types of Failures

There are three things to be concerned about with gable end walls:

1. The most common type of failure is loss of roof sheathing from the gable end that results in the gable wall losing its bracing along the top edge. This type of failure is shown in Figure 7.

2. The second most common type of gable end failure is at the connection between the rectangular and triangular walls, as shown in Figure 8 and 9.

3. The third potential weak link is the actual framing members that make up the gable end wall structure. In many houses, these members may be a truss or 2x lumber framing.

Gable Ends Not Covered in this Retrofit Guide: Gable end walls on rooms with vaulted or cathedral ceilings, while common particularly when facing the coast or water, pose special problems for retrofitting. Unless care was taken in the design and construction of these walls to provide the kind of bracing they need to stand up to strong winds, they are very likely to fail. The structural solutions usually involve beams that either span across the width of the wall or columns that span from floor to ceiling.

Gable ends taller than 16 feet and/or that have irregular shape must be investigated by a licensed engineer, who must then develop bracing requirements to meet the appropriate design wind forces.
Prescriptive Method

The following pages of Appendix A provide prescriptive guidance for retrofitting wood frame gable end walls with heights between 4 feet and 16 feet. This prescriptive guidance has been adopted in the Florida Building Code and has been accepted for inclusion as an appendix to the 2012 Edition of the International Existing Building Code.

SECTION A101
GENERAL

A101.1 Intent and purpose: The provisions of this subsection provide prescriptive solutions for the retrofitting of gable ends of buildings. The retrofit measures are not intended to provide strengthening of buildings equal to the structural provisions of the latest building code requirements for new buildings. Design for compliance of new buildings and additions to existing buildings shall conform to the requirements of the appropriate adopted local building code.

A101.2 Scope: The following prescriptive methods are intended for applications where the gable end wall framing is provided by a wood gable end wall truss or a conventionally framed rafter system. The retrofits are appropriate for wall studs oriented with their broad face parallel to or perpendicular to the gable wall surface. An overview perspective drawing of the retrofit is shown in Figure A104.1.

SECTION A102
DEFINITIONS

ANCHOR BLOCK: A nominal 2 inches thick by at least 4 inches wide piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

COMPRESSION BLOCK: A nominal 2 inches thick by at least 4 inches wide piece of lumber used to restrain in the compression mode (force directed towards the interior of the attic) an existing or retrofit stud. It is attached to a horizontal brace and bears directly against the existing or retrofit stud.

CONVENTIONALLY FRAMED GABLE END: A framed gable end with studs whose faces are perpendicular to the gable end wall.

HORIZONTAL BRACE: A nominal 2 inches thick by at least 4 inches wide piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of floor framing members (truss bottom chords or ceiling joists) or on the bottom of pitched roof framing members (truss top chord or rafters).

RETROFIT STUD: A nominal 2-inch lumber member used to structurally supplement an existing gable end wall stud.

RIGHT ANGLE GUSSET BRACKET: A 14-gauge or thicker metal right angle bracket with a minimum load capacity perpendicular to the plane of either face of 350 lbs when connected to wood or concrete with manufacturer specified connectors.

STUD-TO-PLATE CONNECTOR: A manufactured metal connector designed to connect studs to plates with a minimum uplift capacity of 500 lbs.

TRUSS GABLE END: An engineered factory made truss or site built truss that incorporates...
factory installed or field installed vertical studs with their faces parallel to the plane of
the truss and are spaced no greater than 24 inches o.c. Web or other diagonal members
other than top chords may or may not be present. Gable end trusses may be of the same
height as nearby trusses or may be drop chord trusses in which the top chord of the
truss is lower by the depth of the top chord or outlookers.

SECTION A103
MATERIALS OF CONSTRUCTION

A103.1 Existing materials: All existing wood materials that will be part of the retrofit-
ting work (trusses, rafters, ceiling joists, top plates, wall studs, etc.) shall be in sound
condition and free from defects or damage that substantially reduce the load-carrying
capacity of the member. Any wood materials found to be damaged or deteriorated shall
be strengthened or replaced with new materials to provide a net dimension of sound
wood equivalent to its undamaged original dimensions.

A103.2 New Materials: All materials approved by this code, including their appropriate
allowable stresses, shall be permitted to meet the requirements of this chapter.

A103.3 Dimensional Lumber: All dimensional lumber for braces, studs, and blocking
shall conform to applicable standards or grading rules. Dimensional lumber shall be
identified by a grade mark of a lumber grading or inspection agency that has been
approved by an accreditation body that complies with DOC PS 20. All new dimensional
lumber to be used for retrofitting purposes shall be a minimum grade and species of #2
Spruce-Pine-Fir or shall have a specific gravity of 0.42 or greater. In lieu of a grade mark,
a certificate of inspection issued by a lumber grading or inspection agency meeting the
requirements of this code shall be accepted.

A103.4 Metal Plate Connectors, Straps and Anchors: Metal plate connectors, straps and
anchors shall have product approval. They shall be approved for connecting wood-to-
wood or wood-to-concrete as appropriate. Straps and tie plates shall be manufactured
from galvanized steel with a minimum thickness provided by 20 gauge. Tie plates shall
have holes sized for 8d nails.

A103.5 Twists in straps: Straps shall be permitted to be twisted 90 degrees in addition
to a 90 degree bend where they transition between framing members or connection
points.

A103.6 Fasteners: Fasteners meeting the requirements of Sections A103.6.1 and A103.6.2
shall be used and shall be permitted to be screws or nails meeting the minimum length
requirement shown in figures and specified in tables.

A103.6.1 Screws: Screws shall be a minimum #8 size with head diameters no less than
0.3 inches. Screw lengths shall be no less than indicated in the Figures and in Tables.
Permissible screws include deck screws, wood screws, or sheet metal screws (without
drill bit type tip, but can be sharp pointed). Screws shall have at least 1 inch of thread.
Fine threaded screws or drywall screws shall not be permitted. Note that many straps
will not accommodate screws larger than #8.

A103.6.2 Nails: Unless otherwise indicated in the provisions or drawings, where fastener
lengths are indicated in Figures and Tables as 1-¼ inches, 8d common nails with shank
diameter 0.131 inches and head diameters no less than 0.3 inches shall be permitted.
Unless otherwise indicated in the provisions or drawings, where fasteners lengths are
indicated in Figures and Tables as 3 inches, 10d common nails with shank diameter of
0.148 inches and head diameters no less than 0.3 inches shall be permitted.
A103.7 Fastener spacing:

Fastener spacing shall be as follows:

a. Distance between fasteners and the edge of lumber shall be a minimum of ½ inch unless otherwise indicated;

b. Distance between fasteners and the end of lumber shall be a minimum of 2½ inches;

c. Distance between fasteners parallel to grain (center-to-center) when straps are not used shall be a minimum of 2-1/2 inches unless a ½-inch stagger (perpendicular to the grain) is applied for adjacent fasteners, then the distance between fasteners parallel to the grain shall be a minimum of 1-1/4 inches;

d. Distance between fasteners across grain (row spacing) when straps are not used shall be a minimum of 1 inch; and

e. Distance between fasteners inserted in metal plate connectors, straps and anchors as defined in Section A103.4 shall be those provided by holes manufactured into the straps.

SECTION A104
RETROFITTING GABLE END WALLS

A104.1 Scope and intent: Gable ends to be strengthened shall be permitted to be retrofitted using methods prescribed by provisions of this section. These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end wall construction for out-of-plane wind loads resulting from high-wind events. The retrofit method addresses four issues. These include strengthening the framing members of the walls if necessary (retrofit studs), bracing the top and bottom of the gable wall so that lateral loads are transmitted into the roof and ceiling diaphragms (horizontal braces, straps to retrofit studs and compression blocks) and connecting the bottom of the gable end wall to the wall below to help brace the top of that wall (specialty metal brackets).

The following prescriptive methods are intended for applications where the gable end wall framing is provided by a wood gable end wall truss or a conventionally framed rafter system. The retrofits are appropriate for wall studs oriented with their broad face parallel to or perpendicular to the gable wall surface. An overview perspective drawing of the retrofit is shown in Figure A104.1.

A104.2 Horizontal Braces: Horizontal braces shall be installed approximately perpendicular to the top and bottom chords of the existing roof trusses or approximately perpendicular to the rafter and ceiling joists at the location of each existing gable end wall stud greater than 3 feet in length. If the spacing of existing gable end studs is greater than 24 inches or no vertical gable end stud is present, a stud and horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be 24 inches. Additional gable end wall studs shall not be required at locations where their length would be 3’ or less. Each required added stud shall be attached to the existing roofing framing members (truss top chord or rafter and truss bottom chord or ceiling joist) using a minimum of two 3-inch toenail fasteners (No. 8 wood screws or 10d nails) and a metal connector or mending plate with a minimum of four 1-1/4 inch fasteners (No. 8 wood screws or 8d nails) at each end. The horizontal braces shall consist of the minimum size member indicated in Table A104.2. The horizontal brace shall be oriented with their long face across the top and bottom chords of the wood trusses (or rafters and ceiling joists) and extend a minimum of three framing spaces from the gable end wall plus 2-1/2 inches beyond the last top chord or bottom chord member (rafter or...
ceiling joist) as shown in Figure A104.2.1 (and A104.2.6). The horizontal brace shall be located no farther than 1/2 inch from the inside face of the gable end wall truss. Each horizontal brace shall be fastened to each existing framing member (top chord or rafter or bottom chord or ceiling joist) that it crosses using three 3-inch fasteners (No. 8 wood screws or 10d nails) as indicated in Figures A104.2.2 through A104.2.5 for trusses (and Figures A104.2.7 through A104.2.10 for rafters).

Exceptions:
1. Where obstructions, other permanently attached obstacles or conditions exist that will not permit installation of new horizontal braces at the indicated locations, refer to Section A104.5 for permitted modification of these prescriptive retrofit methods.
2. Where obstructions, other permanently attached obstacles or conditions exist that will not permit extension of the new horizontal braces across the existing framing members a minimum of three framing spaces from the gable end wall, the horizontal braces may be shortened provided that all of the following conditions are met.
   a. The horizontal brace shall be installed across a minimum of two framing spaces and fastened to each existing framing member with three 3-inch fasteners (No. 8 wood screws or 10d nails).
   b. The minimum size of the anchor block shall be equivalent to the existing framing members. The anchor block shall be fastened to the side of the horizontal brace in the second framing space from the gable end wall as shown in Figure A104.2.11. Six 3-inch fasteners (No. 8 wood screws or 10d nails) shall be used to fasten the anchor block to the side of the horizontal brace.
   c. The anchor block shall extend beyond the surface of the horizontal brace that is in contact with the existing framing members a minimum of one-half the depth of the existing framing member. The anchor block shall be installed tightly between the existing framing members such that the gap at either end shall not exceed 1/8 inch.

A104.3 Retrofit Studs: The retrofit studs shall consist of the minimum size members for the height ranges of the existing vertical gable end wall studs indicated in Table A104.2. Retrofit studs shall be installed adjacent to the existing or added (Section A104.2) vertical gable end wall studs and extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace. A maximum gap of 1/8 inch shall be permitted between the retrofit stud and the bottom horizontal brace. A maximum gap of 1/2 inch shall be permitted between the top edge of the retrofit stud closest to the upper horizontal brace and the horizontal brace surface.

Exception:

Where obstructions, other permanently attached obstacles or conditions exist that will not permit the installation of a new retrofit stud adjacent to an existing gable end wall stud, refer to Section A104.5 for permitted modification of these prescriptive retrofit methods.

A104.3.1 Retrofit Stud Fastening: Each retrofit stud shall be fastened to the top and bottom horizontal brace members with a minimum of a 20 gauge, 11/4-inch wide flat metal strap with pre-punched fastener holes. The flat metal straps shall be the minimum length as indicated in Table A104.2. Each top and bottom strap shall extend sufficient distance onto the vertical face of the retrofit stud and be fastened with the number of 1-1/4 inch fasteners (No. 8 wood screws or 8d nails) indicated in Table A104.2. Each strap shall be fastened to the top and bottom horizontal brace members with the minimum number of 1-1/4-inch fasteners (No. 8 wood screws or 8d nails) as indicated in Table A104.2. The retrofit stud members shall also be fastened to the side of the existing verti-
cal gable end wall studs with 3-inch fasteners (No. 8 wood screws or 10d nails) spaced at 6 inches o.c., as shown in Figure A104.2.1.

**A104.3.2 Retrofit Stud Splices:** Retrofit studs greater than 8 feet in height may be field spliced as shown in Figure A104.3.

**A104.4 Compression Blocks:** Compression blocks shall have minimum lengths as indicated in Table A104.2. Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. For clarity, Figures A104.2.2 through A104.2.5 (trusses) and Figures A104.2.7 through A104.2.10 (rafters) show the installation of the compression block against the existing vertical gable end wall stud with the strap from the retrofit stud running beside the compression block. When the compression block is installed against the retrofit stud, the block shall be allowed to be placed on top of the strap. A maximum gap between the compression block and the existing vertical gable end wall stud member or retrofit stud of 1/8-inch shall be permitted. Compression blocks shall be fastened to the horizontal braces with the minimum number of 3-inch fasteners (No. 8 wood screws or 10d nails). End and edge distances for fastener installation shall be as listed in Section A103.7 and shown in Figures A104.2.2 through A104.2.5 (trusses) and Figures A104.2.7 through A104.2.10 (rafters).

**A104.5 Obstructions – Permissible modifications to prescriptive gable end retrofits:** Where obstructions, other permanently attached obstacles or conditions exist in attics that preclude the installation of a retrofit stud or horizontal braces in accordance with Sections A104.2 or A104.3, the gable end retrofit shall be deemed to meet the requirements of this section if the requirements of Section A104.5.1 are met. Obstructions to the installation of retrofit studs or horizontal braces include gable end vents, attic accesses, recessed lights, skylight shafts, chimneys, air conditioning ducts, or equipment. Where the installation of a horizontal brace for the top of a center stud is obstructed by truss plates near the roof peak, methods prescribed in A104.5.1 are permitted to be used, or retrofit ridge ties as prescribed in Section A104.5.2 are permitted to be used to support the horizontal brace.

**A104.5.1 Remedial measures where obstacles prevent installation of retrofit studs or horizontal braces:** If a retrofit stud or horizontal brace cannot be installed because of an obstruction, the entire assembly can be omitted from that location provided all of the following conditions are met.

1. No more than two assemblies of retrofit studs and horizontal braces are omitted on a single gable end.

2. There shall be at least two retrofit studs and horizontal brace assemblies on either side of the locations where the retrofit studs and horizontal bracing members are omitted (no two ladder braces bearing on a single retrofit stud).

3. The retrofit studs on each side of the omitted retrofit stud are increased to the next indicated member size in Table A104.2 and fastened as indicated in Section A104.3.1.

4. The horizontal bracing members on each side of the omitted brace shall be sized in accordance with Table A104.2 for the required retrofit studs at these locations.

5. The horizontal bracing members on each side of the omitted brace shall extend a minimum of three framing spaces from the gable end wall unless anchor blocks are installed in accordance with Exception 2 of Section A104.2.

6. Ladder bracing is provided across the location of the omitted retrofit studs as indicated in Figures A104.5.1.1 (trusses) and A104.5.1.2 (rafters).
7. Ladder bracing shall consist of a minimum 2x4 members oriented horizontally and spaced at 12 inches o.c. vertically. Ladder bracing shall be attached to each adjacent retrofit stud with a metal framing angle with a minimum lateral capacity of 175 lbs. Ladder bracing shall be attached to the existing stud at the location of the omitted retrofit stud with a metal hurricane tie with a minimum capacity of 175 lbs.

8. Where ladder bracing spans across a gable end vent, no attachment to the gable end vent framing shall be required.

9. Notching of the ladder bracing shall not be permitted.

A104.5.2 Retrofit ridge ties: When obstructions along the ridge of the roof obstruct the installation of a horizontal brace for one or more studs near the middle of the gable wall, retrofit ridge ties may be used to provide support for the required horizontal brace. Retrofit ridge tie members shall be installed a maximum of 12 inches below the existing ridge line. The retrofit ridge tie members shall be installed across a minimum of three bays to permit fastening of the horizontal brace. A minimum of a 2x4 member shall be used for each ridge tie and fastening shall consist of two 3-inch wood screws, four 3-inch 10d nails or two 3-1/2 inch 16d nails driven through and clinched at each top chord or web member intersected by the ridge tie as illustrated in Figure A104.5.2.

A104.5.3 Notching of retrofit studs: Retrofit studs may be notched in one location along the height of the stud member provided that all of the following conditions are met:

1. The retrofit stud to be notched shall be sized such that the remaining depth of the member at the location of the notch (including cut lines) shall not be less than that required by Table A104.2.

2. The notched retrofit stud shall not be spliced within 12 inches of the location of the notch. The splicing member shall not be notched and shall be installed as indicated in Figure A104.3.

3. The length of the flat metal straps indicated in Table A104.2 shall be increased by the increased depth of the notched retrofit stud member to be installed.

4. The height of the notch shall not exceed 12 inches vertically as measured at the depth of the notch.

5. The notched retrofit stud member shall be fastened to the side of the existing gable end wall studs in accordance with Section A104.3.1. Two additional 3-inch fasteners (No. 8 wood screws or 10d nails) shall be installed on each side of the notch in addition to those required by Section A104.3.1.

A104.6 Connection of gable end wall to wall below: The bottom chords or bottom members of wood framed gable end walls shall be attached to the wall below using one of the methods prescribed in Sections A104.6.1 or A104.6.2. The particular method chosen shall correspond to the framing system and type of wall construction encountered. Due to access considerations, this retrofit needs to be carried out before any of the other gable end retrofit activities referenced in Sections A104.2, A104.3, A104.4 or A104.5.

A104.6.1 Truss gable end wall: The bottom chords of the gable end wall shall be attached to the wall below using right angle gusset brackets consisting of 14 gauge or thicker material with a minimum load capacity of 350 lbs perpendicular to the plane of either face of the connector. The right angle gusset brackets shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3’ at the spacing specified in Table A104.6. A minimum of two of the fasteners specified by the manufacturer shall engage the body of the bottom chord. Connection to the wall below shall be by one of the methods listed on the next page:
1. For a wood frame wall below, the two fasteners into the top of the wall below that are closest to the face of the gable end bottom chord shall be 4-1/2 inches long and of the same diameter and style specified by the bracket manufacturer. Other fasteners shall be consistent with the bracket manufacturer’s specifications for size, style and length.

2. For a concrete or masonry wall below without a sill plate, the fasteners into the wall shall be consistent with the bracket manufacturer’s specifications for fasteners installed in concrete or masonry.

3. For a concrete or masonry wall below with a 2x sill plate, the fasteners into the wall below shall be of the diameter and style specified by the bracket manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below. Alternatively, the bracket can be anchored to the sill plate using fasteners consistent with the bracket manufacturer’s specifications for wood connections provided that the sill plate is anchored to the wall on each side of the bracket by a ¼-inch diameter masonry screw with a 2-1/2-inch embedment into the concrete or masonry wall; ¼-inch washers shall be placed under the heads of the masonry screws.

**A104.6.2 Conventionally framed gable end wall:** Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3 feet, shall be attached to the bottom or sill plate using a stud to plate connector. The bottom or sill plate shall then be connected to the wall below using one of the methods listed below:

1. For a wood frame wall below, the sill or bottom plate shall be connected to the top plates below using ¼-inch diameter, 41/2-inch screws. The fasteners shall be installed at the spacing indicated in Table A104.6.

2. For a concrete or masonry wall below, the sill or bottom plate shall be connected to the concrete or masonry wall below using ¼-inch diameter concrete or masonry screws of sufficient length to provide a 2-1/2-inch embedment into the top of the concrete or masonry wall. The fasteners shall be installed at the spacing indicated in Table A104.6.
The gable end shown is a truss gable end. Similar retrofit measures apply to conventionally framed gable ends.

Regular trusses may have diagonal members that connect the bottom and top chords. Fasteners shown illustrate locations and not the number of fasteners.
Figure A104.2.1 Gable end retrofit components and connections.
Figure A104.2.2 Details of strap and compression block installation – 2x4 retrofit stud.
Figure A.8 Details of strap & compression block installation – 2x6 retrofit stud.
Figure A104.2.4 Details of strap and compression block installation – 2x8 retrofit stud.
Figure A104.2.5 Details of strap and compression block installation– (2)2x8 retrofit stud.
FIGURE A104.2.6 Section view of gable end retrofit (Conventionally framed).
FIGURE A104.2.7 Details of strap and compression block installation–2x4 retrofit stud.
FIGURE A104.2.8 Details of strap and compression block installation–2x6 retrofit stud.
FIGURE A104.2.9 Details of strap and compression block installation - 2x8 retrofit stud.
FIGURE A104.2.10 Details of strap and compression block installation- (2)2x8 retrofit stud.
FIGURE A104.2.11 Details of anchor block installation.
FIGURE A104.3 Detail of retrofit stud splice.
FIGURE A104.5.1.1 Detail of ladder bracing for omitted retrofit stud (truss gable end).
FIGURE A104.5.1.2 Detail of ladder bracing for omitted retrofit stud (conventional framing).
FIGURE A104.5.2 Detail of retrofit ridge tie installation.
### TABLE A104.2  Gable End Retrofit Element Sizing and Fastening

<table>
<thead>
<tr>
<th>Exposure Category</th>
<th>Maximum 3-sec Gust Basic Wind Speed</th>
<th>Maximum Height of Gable End Stud ².&lt;br&gt;</th>
<th>Method #1</th>
<th>Method #2</th>
<th>Method #3</th>
<th>Method #4</th>
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<td>8'-0&quot;</td>
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<td>14'-9&quot;</td>
<td>16'-0&quot;</td>
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<td>6&quot;</td>
</tr>
<tr>
<td>B</td>
<td>150</td>
<td>7'-0&quot;</td>
<td>10'-0&quot;</td>
<td>12'-3&quot;</td>
<td>16'-0&quot;</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

---

a. Interpolation between given wind speeds is not permitted.
b. Existing gable end studs less than or equal to 3'-0" in height shall not require retrofitting.
c. N/N = Not applicable. Exceeds 16'-0" maximum height.

Fasteners shall be No. 8 screws or 10d nails.
### TABLE A104.6  Spacing of Right Angle Gusset Bracket and Connecting Gable End Wall to Wall Below

<table>
<thead>
<tr>
<th>Exposure Category</th>
<th>Wind Speed, mph</th>
<th>Maximum 3-Sec. Gust</th>
<th>Maximum Spacing of Right Angle Gusset Brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>110</td>
<td>38- inches</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>120</td>
<td>32- inches</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>130</td>
<td>28- inches</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>140</td>
<td>24- inches</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>150</td>
<td>20- inches</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>110</td>
<td>48- inches</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>120</td>
<td>40- inches</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>130</td>
<td>36- inches</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>140</td>
<td>30- inches</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>150</td>
<td>26- inches</td>
<td></td>
</tr>
</tbody>
</table>

Note: See section A104.2 for definition of right angle gusset brackets.
Appendix B

Exposure Categories

B-1 Definition of exposure category from the International Residential Code (IRC)

Exposure category: For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arises from natural topography and vegetation as well as from constructed features. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

Exposure B: Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.

Exposure C: Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country, grasslands and shorelines in hurricane prone regions.

The two relevant exposure categories for the FORTIFIED Home™ program are Exposure B and Exposure C.
### Appendix C

Design Wind Pressures for Components: Windows, Entry Doors, Patio Doors, Garage Doors, and Opening Protection Products

#### Table C-1 Design Wind Pressures (PSF) for Components within 4 feet of a Corner 30 foot Mean Roof Height, Exposure B \(^1,2\)

<table>
<thead>
<tr>
<th>Effective wind area (ft(^2))</th>
<th>Basic Wind Speed (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>18.0</td>
</tr>
<tr>
<td>20</td>
<td>17.2</td>
</tr>
<tr>
<td>50</td>
<td>16.1</td>
</tr>
<tr>
<td>100</td>
<td>15.3</td>
</tr>
</tbody>
</table>

#### Table C-2 Design Wind Pressures (PSF) for Components more than 4 feet from a corner 30 foot Mean Roof Height, Exposure B \(^1,2\)

<table>
<thead>
<tr>
<th>Effective wind area (ft(^2))</th>
<th>Basic Wind Speed (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>18.0</td>
</tr>
<tr>
<td>20</td>
<td>17.2</td>
</tr>
<tr>
<td>50</td>
<td>16.1</td>
</tr>
<tr>
<td>100</td>
<td>15.3</td>
</tr>
</tbody>
</table>

#### Table C-3 Design Wind Pressures (PSF) for Garage Doors 30 foot Mean Roof Height, Exposure B \(^1,2\)

<table>
<thead>
<tr>
<th>Effective wind area (ft(^2))</th>
<th>Basic Wind Speed (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>50 (Single Car)</td>
<td>16.0</td>
</tr>
<tr>
<td>100 (Two Car)</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Notes for Tables C-1, C-2, and C-3:

1 Positive pressures indicate pressure acting toward the building surface; negative pressures indicate pressure acting away from the building surface.

2 Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table C-4.
### Table C-4: Height and Exposure Adjustment Coefficients for Use with Tables C-1, C-2, and C-3

<table>
<thead>
<tr>
<th>Mean Roof Height Ft.</th>
<th>Exposure B</th>
<th>Exposure C</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>1.00</td>
<td>1.21</td>
</tr>
<tr>
<td>20</td>
<td>1.00</td>
<td>1.29</td>
</tr>
<tr>
<td>25</td>
<td>1.00</td>
<td>1.35</td>
</tr>
<tr>
<td>30</td>
<td>1.00</td>
<td>1.40</td>
</tr>
<tr>
<td>35</td>
<td>1.05</td>
<td>1.45</td>
</tr>
<tr>
<td>40</td>
<td>1.09</td>
<td>1.49</td>
</tr>
<tr>
<td>45</td>
<td>1.12</td>
<td>1.53</td>
</tr>
<tr>
<td>50</td>
<td>1.16</td>
<td>1.56</td>
</tr>
<tr>
<td>55</td>
<td>1.19</td>
<td>1.59</td>
</tr>
<tr>
<td>60</td>
<td>1.22</td>
<td>1.62</td>
</tr>
</tbody>
</table>
## Appendix D: Corrosion Protection Retrofit Requirements

Minimum fastener and connector corrosion protection retrofit requirements for FORTIFIED Home™

<table>
<thead>
<tr>
<th>Fasteners/Connector</th>
<th>Structures within 300 ft. of saltwater</th>
<th>Structures more than 300 ft. but less than 1000 ft. from saltwater&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Structures more than 1000 ft. but less than 3000 ft. from saltwater</th>
<th>Structures more than 3000 ft. from saltwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roofing nails for shingles</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Hot dip galvanized&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Corrosion resistant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Concrete and clay roof tile fasteners</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Hot dip galvanized&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Corrosion resistant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Metal roof clips and fasteners (exposed)</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Corrosion resistant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Fasteners used for attachment of underlayment to roof deck</td>
<td>Hot dip galvanized&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Hot dip galvanized&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Hot dip galvanized&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Corrosion resistant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Aluminum soffits</td>
<td>Not allowed</td>
<td>Not allowed</td>
<td>Not allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td>Soffit and roof vent fasteners</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Corrosion resistant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Metal framing connectors, fasteners, anchors, and hangers in exposed areas&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel or G185 galvanized</td>
</tr>
<tr>
<td>Metal framing connectors, fasteners, anchors, and hangers in vented enclosed areas&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Stainless steel</td>
<td>Stainless steel or G185 galvanized coating</td>
<td>Stainless steel or G185 galvanized coating</td>
<td>Corrosion resistant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> Buildings on open, elevated foundations within 1000 feet of saltwater shall follow the requirements of structures within 300 feet of saltwater.

<sup>2</sup> Examples of exposed areas include areas that are under roof overhangs, decks and covered walkways or in any location that is openly or partially exposed to saltwater air.

<sup>3</sup> Examples of vented enclosed areas include attics with vents.

<sup>4</sup> Hot dip galvanized shall meet the requirements of ASTM A153, Class D for nails and screws.

<sup>5</sup> Corrosion resistant nails and screws shall meet the requirements of ASTM A 641, Class 1 or an equal corrosion resistance by coating, galvanization, stainless steel, or other suitable corrosion resistant material. Corrosion resistant sheet metal connectors, anchors and hangars shall meet the requirements of ASTM A653, G90.
Appendix E

Design Wind Pressures for Components:
Windows, Entry Doors, Patio Doors, Garage Doors, and Opening Protection Products

Table A-1: Design Wind Pressures (PSF) for Components within 4 feet of a Corner 30 foot Mean Roof Height, Exposure B\textsuperscript{1,2}.

<table>
<thead>
<tr>
<th>Effective wind area (ft. \textsuperscript{2})</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
<th>140</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>18.0, -24.1</td>
<td>21.8, -29.1</td>
<td>25.9, -34.7</td>
<td>30.4, -40.7</td>
<td>35.3, -47.2</td>
<td>40.5, -54.2</td>
</tr>
<tr>
<td>20</td>
<td>17.2, -22.5</td>
<td>20.8, -27.2</td>
<td>24.7, -32.4</td>
<td>29.0, -38.0</td>
<td>33.7, -44.0</td>
<td>38.7, -50.5</td>
</tr>
<tr>
<td>50</td>
<td>16.1, -20.3</td>
<td>19.5, -24.6</td>
<td>23.2, -29.3</td>
<td>27.2, -34.3</td>
<td>31.6, -39.8</td>
<td>36.2, -45.7</td>
</tr>
<tr>
<td>100</td>
<td>15.3, -18.7</td>
<td>18.5, -22.6</td>
<td>22.0, -26.9</td>
<td>25.9, -31.6</td>
<td>30.0, -36.7</td>
<td>34.4, -42.1</td>
</tr>
</tbody>
</table>

Table A-2: Design Wind Pressures (PSF) for Components more than 4 feet from a corner 30 foot Mean Roof Height, Exposure B\textsuperscript{1,2}.

<table>
<thead>
<tr>
<th>Effective wind area (ft. \textsuperscript{2})</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
<th>140</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>18.0, -19.5</td>
<td>21.8, -23.6</td>
<td>25.9, -28.1</td>
<td>30.4, -33.0</td>
<td>35.3, -38.2</td>
<td>40.5, -43.9</td>
</tr>
<tr>
<td>20</td>
<td>17.2, -18.7</td>
<td>20.8, -22.6</td>
<td>24.7, -26.9</td>
<td>29.0, -31.6</td>
<td>33.7, -36.7</td>
<td>38.7, -42.1</td>
</tr>
<tr>
<td>50</td>
<td>16.1, -17.6</td>
<td>19.5, -21.3</td>
<td>23.2, -25.4</td>
<td>27.2, -29.8</td>
<td>31.6, -34.6</td>
<td>36.2, -39.7</td>
</tr>
<tr>
<td>100</td>
<td>15.3, -16.8</td>
<td>18.5, -20.4</td>
<td>22.0, -24.2</td>
<td>25.9, -28.4</td>
<td>30.0, -33.0</td>
<td>34.4, -37.8</td>
</tr>
</tbody>
</table>

Table A-3: Design Wind Pressures (PSF) for Garage Doors 30' Mean Roof Height, Exposure B\textsuperscript{1,2}.

<table>
<thead>
<tr>
<th>Effective wind area (ft. \textsuperscript{2})</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
<th>140</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 (Single Car)</td>
<td>16, -18</td>
<td>20, -22</td>
<td>23, -26</td>
<td>27, -30</td>
<td>31, -35</td>
<td>36, -40</td>
</tr>
<tr>
<td>100 (Two Car)</td>
<td>15, -17</td>
<td>19, -21</td>
<td>22, -25</td>
<td>26, -29</td>
<td>30, -33</td>
<td>35, -38</td>
</tr>
</tbody>
</table>

Notes for Tables A-1, A-2, and A-3:

\textsuperscript{1} Positive pressures indicate pressure acting toward the building surface; negative pressures indicate pressure acting away from the building surface.

\textsuperscript{2} Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table A-4.

Table A-4: Height and Exposure Adjustment Coefficients for Use with Tables A-1, A-2, and A-3

<table>
<thead>
<tr>
<th>Mean Roof Height (feet)</th>
<th>Exposure B</th>
<th>Exposure C</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>1.00</td>
<td>1.21</td>
</tr>
<tr>
<td>20</td>
<td>1.00</td>
<td>1.29</td>
</tr>
<tr>
<td>25</td>
<td>1.00</td>
<td>1.35</td>
</tr>
<tr>
<td>30</td>
<td>1.00</td>
<td>1.40</td>
</tr>
<tr>
<td>35</td>
<td>1.05</td>
<td>1.45</td>
</tr>
<tr>
<td>40</td>
<td>1.09</td>
<td>1.49</td>
</tr>
<tr>
<td>45</td>
<td>1.12</td>
<td>1.53</td>
</tr>
<tr>
<td>50</td>
<td>1.16</td>
<td>1.56</td>
</tr>
<tr>
<td>55</td>
<td>1.19</td>
<td>1.59</td>
</tr>
<tr>
<td>60</td>
<td>1.22</td>
<td>1.62</td>
</tr>
</tbody>
</table>
Appendix F

Continuous Load Path Evaluation and Verification by an Engineer:
FORTIFIED Hurricane Resistance Gold Designation requirements

Compliance Process:

While Tier II Prescriptive Retrofit Measures are available for retrofitting the Continuous Load Path of relatively simple homes, the variations in roof, ceiling, and floor framing, variability of foundation types, wall supports, location of openings, and home geometry of most homes are beyond the scope of a prescriptive solution. Determining the specific retrofits required for an existing home that falls outside the prescriptive criteria requires evaluation of the Continuous Load Path by a professional engineer.

Phase 1

1. The process begins with the decision by a homeowner to pursue a Gold FORTIFIED designation. Homeowners are advised that the Tier II inspections required for a Gold designation will comprise all of the evaluation elements required for a Tier 1 evaluation (Bronze/Silver designation) along with the additional requirement of evaluating the home’s foundation, structural components above grade, and structural connections comprising the load path. Depending upon the home and its construction type, this evaluation process may require limited amounts of invasive investigation to gather the necessary information to provide an appropriate retrofit action plan.

2. The homeowner then must engage a licensed professional engineer to engage in site inspection(s) to evaluate the structural elements of the home and to identify those structural elements that require retrofits to meet the current building codes and the FORTIFIED designation requirements.

3. The professional engineer shall generate a written report and submit to IBHS and homeowner for review. The report shall include a roof framing evaluation, wall construction evaluation, floor system evaluation, continuous load path evaluation, and a foundation support system evaluation. See “Structural Elements to be Evaluated by a Professional Engineer” for details.

4. Upon IBHS’s review and approval of the report, the homeowner can decide whether to proceed to Phase 2, the design, and implementation of the retrofits for the structure based on the approved report.

Phase 2

1. Homeowner engages a professional engineer to prepare engineering documents for construction and any required jurisdictional permitting purposes.

2. The professional engineer shall generate engineering plans that identify the structural elements to be retrofitted and details the method of retrofitting.

3. Once the professional engineer completes the plans, the plans shall be submitted to IBHS for approval to ensure they comply with gold level criteria.

4. If required, the engineering plans shall also be submitted to local building department for construction permit approval.

5. The homeowner shall engage an approved FORTIFIED Home™ Evaluator or the professional engineer to perform site inspections during construction to verify all structural elements on IBHS approved plans are installed correctly. This inspection requirement does not negate
any local building department inspection designation requirements.

6. After satisfactory completion of construction and final approval from IBHS, the homeowner will receive a designation certificate from IBHS indicating compliance with the Gold designation criteria.

**Structural Elements to be Evaluated by a Professional Engineer**

**Roof Framing Evaluation and Verification**

**Roof Framing Members**

A. Engineered wood trusses:

- Verify that truss framing does not exceed 24” on center unless substantiated by engineering documentation.
- Verify that truss members and connector plates are not damaged or deteriorated.
- Alterations and/or repairs of any truss members shall be certified by a design professional to ensure such member(s) can safely carry the appropriate gravity and uplift loads.

B. Wood roof rafter and ceiling joist framing:

- Roof rafters and ceiling joist member size, spacing, span, and framing must conform to Chapter 8 of IRC 2006 or must be evaluated for strength and deflection by accepted engineering principles and practices and be in compliance with IRC or IBC 2006 requirements.

1) Roof framing that does not meet strength or deflection requirements must be strengthened to meet code requirements.

C. Other types of roof framing materials:

- Must be evaluated for strength and deflection by accepted engineering principles and practices and be in compliance with IRC or IBC 2006 requirements.

1) Roof framing that does not meet strength or deflection requirements must be strengthened to meet code requirements.

- Roof framing members shall be anchored at each support wall, beam, or column to resist the appropriate gravity and wind uplift forces.
- Connections of roof framing members to other roof-framing members shall have sufficient capacity to resist appropriate gravity and wind uplift forces.
- Support girders or beams shall be evaluated to determine adequate capacity for the support of applied gravity and/or uplift loads.
- Girders and beams shall be connected to supports with sufficient capacity to resist the appropriate gravity and wind uplift forces.
Wall Construction Evaluation and Verification

Wall framing system shall be capable of supporting all gravity and wind (uplift and lateral) loads at each level of the building:

A. Exterior Bearing Walls:
   - Supporting roof framing only (single story building):
     i. Wall framing system shall be capable of supporting all vertical and lateral wind loads applied to wall.
     ii. Connections to structural framing members at the top and bottom of the wall framing system shall be evaluated and meet required resistance for lateral wind pressures and uplift forces.
   - Supporting intermediate floor(s) above plus roof framing (multi-story up to 3 stories):
     i. Wall framing system shall be capable of supporting cumulative wind loads (lateral and vertical) from each floor framing system above plus the roof framing system and applicable lateral loads.
        • Connections to structural framing members at the top and bottom of the wall framing system shall be evaluated and meet required resistance for lateral wind pressures and uplift forces.

B. Interior Bearing Walls:
   - Interior wall framing system shall be capable of supporting all applicable gravity, and vertical and lateral wind loads applied to the wall.
   - Top of wall framing system shall provide sufficient bearing surface for roof or floor framing members.
   - Connections of all supported framing shall be evaluated and meet required resistance for applicable gravity, uplift and lateral forces.
   - Foundation, floor framing, or bearing wall shall adequately support bottom of wall framing system.
   - Connection of wall to support below shall be evaluated and capable of transmitting applicable gravity, uplift and lateral forces to the support system below.

Floor Framing System Evaluation and Verification

A. Floor framing system shall be capable of supporting applicable gravity and wind loads, including wall and column loads above.

B. Floor framing system shall be adequately supported. Connection of floor framing to support system below shall be evaluated and capable of transmitting applicable gravity, uplift and lateral forces to structural support system below.
Continuous-Load-Path Evaluation and Verification

A. A continuous and adequate load path from the roof to the foundation of the home must exist. The building must have positive connections of all elements from the roof to foundation to ensure that loads are transmitted safely to the ground.

B. Roof framing-to-wall connection shall resist applicable uplift loads.

C. Wall above-to-wall below connection shall resist applicable accumulated uplift and shear forces.

D. Wall-to-foundation connection shall resist applicable accumulated uplift and shear forces.

Foundation Support System Evaluation and Verification

A. Existing foundation support system shall be capable of resisting applicable uplift and lateral shear forces to provide building stability.

Chimney Structure and Anchorage:

A. Existing chimney shall have adequate structural capacity and anchorage to the structure to resist the expected wind loads on the chimney.
FORTIFIED Home™ is a service mark owned by the Institute for Business & Home Safety (IBHS) and may not be used without the express written permission of IBHS. The process for receiving a Fortified Home™ designation is governed exclusively by the guidelines developed by IBHS.

Participation in the FORTIFIED Home™ program can reduce the risk of damage to a home, but it cannot eliminate it. Residents of FORTIFIED homes should prepare for potential disasters and heed all evacuation warnings.

IBHS assumes no responsibility or liability for any advice or services rendered by any builder, engineer, architect, plan reviewer, plan designer, inspector, manufacturer, or other professional as a result of the certification of such individual as a FORTIFIED Home™ Evaluator.

Applicants considering designation for their homes are solely responsible for determining whether to pursue designation and should obtain any additional information necessary to make an informed decision. If the Applicant is dissatisfied with any aspect of the FORTIFIED Home™ program, the sole and exclusive remedy is to discontinue activities relating to this program. No refunds of any fees paid will be provided by IBHS to Applicants who fail to obtain any designation under the FORTIFIED Home™ program.
IBHS is a non-profit applied research and communications organization dedicated to reducing property losses due to natural and man-made disasters by building stronger, more resilient communities.
Sealed Roof Deck

Installation of 2 Layers of #30 Felt as a Qualified Sealed Roof Deck System for Asphalt Shingle or Metal Roofing

Abstract
The installation of 2 layers of #30 roofing felt has been tested, evaluated and approved by IBHS as a qualified sealed roof deck system for asphalt shingle or metal roofing.

Requirements
- Two (2) layers of ASTM D226 Type II (#30) or ASTM D4869 Type III or Type IV (#30) underlayment shall be installed in a shingle fashion, lapped 19 in. on horizontal seams (36-in. roll), and 6 in. on vertical seams.
  - NOTE: Be sure to check product labeling carefully. Not all products labeled 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 of first course of felt to be installed as described below and shown in Figure 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. Carefully install a 36-in.-wide roll of underlayment* over the 19-in.-wide course of underlayment along the eave. Follow the same procedure for each, overlapping the sheets 19 in. (leaving a 17-in. exposure). Fasten with one row in the field of the sheet at 12 in. o.c. and one row at the overlaps fastened 6 in. o.c.
  *Must use ASTM D226 Type II (#30) or ASTM D4869 Type III or Type IV (#30) underlayment.
- Fasten underlayment at approximately 6 in. o.c. along the laps and at approximately 12 in. o.c. in the field of the sheet between the side laps.
  - For design wind speeds less than 140 mph (ASCE 7-05): secure underlayment using annular ring or deformed shank nails with 1-in.-diameter caps (button cap nails).
For design wind speeds 140 mph or greater (ASCE 7-05): secure underlayment using annular ring or deformed shank nails with thin metal disks ("tincaps").

Compliance Verification Requirements

This method of sealing the roof deck is to be documented and verified by a certified FORTIFIED evaluator. Acceptable documentation includes but is not limited to: pictures of laps and fasteners at 4 different locations of the roof; a completed Roof Compliance Form (RCF-1); certification by the installer; bills of lading; invoices; and product packaging.

Completing Evaluation Form (For FORTIFIED Evaluators Only)

On the evaluation form, in the “Sealed Roof Deck” section, for question SRD System Type, select “Other” (see Figure 2 below). It will be necessary to provide documentation as described above.

Figure 2. Evaluation Form; Section—Sealed Roof Deck; Question—SRD System Type?
Material Options for Taping Roof Deck Seams

Abstract
The material options for taping the seams of the roof deck have been expanded to include AAMA 711-13, Level 3 (for exposure up to 80°C/176°F).

Requirements
There are two material options for taping the seams on the roof deck.

Option 1
Apply an ASTM 1970 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.

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) 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 the wax used to improve the water resistance of the OSB panel. 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 code-compliant #30 ASTM D226 Type II or ASTM D4869 Type IV underlayment over the self-adhering tape. This underlayment must be attached using annular ring or
Sealed Roof Deck

dehformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at 6 in. o.c. spacing along all laps and at 12 in. o.c. 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 2 in. and end laps must be a minimum of 6 in.

Figure 0-1. Minimum photograph requirement and locations (Front, Rear, Left and Right).

Compliance Verification Requirements

This method of sealing the roof deck is to be documented and verified by a certified FORTIFIED Evaluator. Acceptable documentation includes, but is not necessarily limited to:

Pictures of Tape Installed

Count: Minimum = 4

- Must show 4 different sections of the roof (Front, Rear, Left and Right). See Fig. 0-1.
- Must clearly show tape fully adhered to the deck without wrinkles or voids. See Fig. 0-2.
- Must show at least one full sheet of roof decking (with all 4 seams taped) per photo.
- Must be in focus.

Note: Although 4 photographs is the minimum number of pictures required, the goal is to achieve a 360° view of the house and FORTIFIED upgrades. Most photographs will be taken from the ground and site conditions may dictate that more than the minimum be provided.
Sealed Roof Deck

Bulletin No. 2015-02

First Release:
July 31, 2015

Prepared by:
Fred Malik, Vice President, FORTIFIED Programs

Applicable Standards:
FORTIFIED Home™—Hurricane
FORTIFIED Home™—High Wind
FORTIFIED Home™—High Wind & Hail
FORTIFIED for Safer Living™

Applicable Designation Level:

Pictures of Felt Installed
Count: Minimum = 4
- Must show 4 different sections of the roof (Front, Rear, Left and Right).
- Must clearly show laps and fasteners.
- Must have the following clearly visible: date, address or FORTIFIED ID, location (e.g., Front, Rear, Left and Right).

Other Documentation Required
- Completed Roof Compliance Form (RCF-1) identifying tape manufacturer, specification requirement (ASTM 1970 or AAMA 711-13, Level 3) and type of compatible primer, if used.

OR
- Invoices and product packaging identifying tape product name, manufacturer, specification requirement (ASTM 1970 or AAMA 711-13, Level 3) and type of compatible primer, if used.

Figure 0-2. Applying qualified tape to roof deck seams using flat blade to eliminate voids and wrinkles.
Sealed Roof Deck

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Fred Malik, Vice President,
FORTIFIED Programs

Applicable Standards:
FORTIFIED Home™—Hurricane
FORTIFIED Home™—High Wind
FORTIFIED Home™—High Wind & Hail
FORTIFIED for Safer Living™

Applicable Designation Level:

Completing Evaluation Form
When completing the Sealed Roof Deck section of a FORTIFIED Home Evaluation form, select SRD System Type as shown in Fig. 0-4. Add photos and other documentation by clicking on the camera icon.

Figure 0-3. Labeling of roof deck to identify project and photo location.

Figure 0-4. Selection for SRD system type.
Using 2-Part Closed-Cell Foam Adhesive

Abstract

Strengthening the attachment of roof sheathing and installation of a sealed roof deck system can be achieved simultaneously by applying an ASTM or TAS tested two-part, spray polyurethane foam adhesive to the underside of the roof deck as shown in Figure 1.

This system can satisfy two FORTIFIED Home™–Bronze requirements:

1. Sealing the roof deck.
2. Supplemental deck attachment, when the roof deck is fastened with staples, 6d common nails or 8d common nails at 12 in. on center in the field.

Figure 1. Closed-cell polyurethane foam adhesive applied to the underside of the roof sheathing at the joints between the sheathing panels and along all intersections between roof sheathing and all roof framing members.
Sealed Roof Deck Supplemental Deck Attachment

Requirements

A 2-part closed-cell foam polyurethane adhesive can be used on new or existing homes. This system is most commonly used on existing homes where the roof cover is deemed to be in good condition and NOT in need of replacement. When the roof cover is not being replaced, other systems that are installed from the topside cannot be used. Spray foam allows for improvements to be made from within the attic. This system can be used to satisfy two FORTIFIED Home™–Bronze requirements:

1. Sealing the roof deck.
2. Supplemental deck attachment, when the roof deck is fastened with staples, 6d common nails or 8d common nails at 12 in. on center in the field.

The minimum requirements for spray adhesives are:

- Product must be tested and evaluated in accordance with either ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference (applied to roof sheathing), or TAS 202-94, Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure. The minimum allowable Design Uplift Pressure must be greater than or equal to those listed below.
  - FORTIFIED Home™–Hurricane: at least 110 psf (proof test of at least 165 psf)
  - FORTIFIED Home™–High Wind: at least 80 psf (proof test of at least 120 psf)
  - FORTIFIED Home™–High Wind & Hail: at least 80 psf (proof test of at least 120 psf)
- Two-component spray polyurethane foam system with a minimum core density of 1.5–3.0 pcf in accordance with ASTM D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- Spray polyurethane foam adhesive system must be installed by a properly trained and qualified applicator in accordance with the manufacturer’s maintenance and installation guidelines.
Sealed Roof Deck Supplemental Deck Attachment

To provide enhanced roof sheathing attachment and to seal the roof deck, apply a 1.5- to 3-in. fillet of 2-part spray-applied polyurethane foam adhesive to:

- All joints between sheathing
- All intersections between roof sheathing and roof framing members
- All valleys

Use the minimum density and installation requirements prescribed by the manufacturer to meet a minimum Design Uplift Pressure on the sheathing of 80 psf or 110 psf; as appropriate to the applicable standard.

All installations must be in accordance with the manufacturer’s instructions.

Compliance Verification Requirements

It is not possible to determine the chemistry of a spray foam product by visual inspection. Therefore, it is necessary to collect documentation from the installing contractor identifying the manufacturer and product used for the improved roof sheathing attachment/sealed roof deck.

Documentation must be provided to the Certified FORTIFIED Home™ Evaluator and be included with the FORTIFIED Home evaluation checklist. Documentation must state the installation meets the manufacturer’s requirements for an allowable Design Uplift Pressures detailed below.

- FORTIFIED Home™–Hurricane: at least 110 psf (proof test of at least 165 psf)
- FORTIFIED Home™–High Wind: at least 80 psf (proof test of at least 120 psf)
- FORTIFIED Home™–High Wind & Hail: at least 80 psf (proof test of at least 120 psf)

Note: In order for this method to be accepted for sealing the roof deck and for adding supplemental roof deck attachment, access to the entire underside of the roof deck within the attic must be available. If the slope of the roof is low, such that eaves are inaccessible, or any portion of the underside of the deck is obstructed by equipment or ductwork, or is otherwise inaccessible, it will be necessary to use an alternative qualified method to seal the portion of the deck that is unreachable by the spray foam installer.
Sealed Roof Deck Supplemental Deck Attachment

Minimum Documentation Required

- Letter from installing contractor, on company letterhead, that the material was applied by a trained installer and the installation meets the manufacturer’s requirements for an allowable Design Uplift Pressure specified for the appropriate standard.
- Documentation from Miami-Dade, FBC, TDI product approvals or ICC Evaluation Reports, if applicable (invoices and/or product labels identifying product name and manufacturer may be substituted in the absence of product test documents).
- A minimum of 4 photos of the material applied to the entire underside of the roof deck. Pictures must be taken at 4 different locations of the attic to show complete coverage.

Completing Evaluation Form
(For FORTIFIED Evaluator)

Entering Supplemental Deck Attachment
Section: Roof Deck

First, identify type of attic accessibility.

Next, indicate qualified supplemental documentation is installed. Select closed-cell foam adhesive and upload documentation.

Entering the SRD System Type
Section: Sealed Roof Deck

Select a closed-cell foam applied along all roof framing members and over all horizontal roof deck seams. Upload documentation.

Note: Although 4 photographs is the minimum number of pictures required, the goal is to achieve a complete view of the underside of the roof deck. Photographs must be taken from inside the attic and show product installed in accordance with the requirements listed above. Site conditions may dictate that more than the minimum be provided.
FORTIFIED Home™ Dwelling Type Eligibility Requirements

Abstract
The purpose of this document is to provide specific information about the type of residential building that is eligible for designation consideration in the FORTIFIED Home™ program.

Introduction
The goal of IBHS FORTIFIED Home™ program is to strengthen homes against specific natural hazards using system-based resilience upgrades and a comprehensive verification process. “Home” or “dwelling” encompasses a broad category of residential buildings. This technical bulletin defines the specific types of residential buildings that are eligible for consideration in the FORTIFIED Home™ program.

Eligibility
Qualifying Homes—Dwelling Type
1. Single-family detached homes
2. Two-family dwelling units (duplex)
3. (HUD) manufactured homes
4. Townhouses

Definitions and Conditions
1. **Single-family detached home**—a freestanding residential building occupied by one family. Limited to three stories above grade. This also includes detached single-family factory-built modular homes that are designed, built and sited to meet all local building codes.
2. **Two-family dwelling units (duplex)**—a freestanding residential building occupied by two families. Limited to three stories above grade. Note: The entire two-family building, which includes both dwelling units under consideration, must be evaluated under the appropriate FORTIFIED Home™ requirements. Individually evaluated
Eligible Dwellings

units are NOT eligible for designation outside of the entire building being designated.

3. **(HUD) manufactured homes**—a single-family residential home manufactured to HUD’s Manufactured Home Construction and Safety Standards. Must be sited on a permanent foundation. HUD manufactured homes built before July 1994 are NOT eligible.

4. **Townhouse**—a single-family dwelling unit constructed in a group of three or more attached units in which *each unit extends from foundation to roof and has a yard or public way on not less than two sides*. Limited to three stories above grade. Mixed use (commercial and residential) buildings are NOT eligible. Note: The entire townhouse building, which includes all townhouse units under consideration, must be evaluated under the appropriate FORTIFIED Home™ requirements. Individually evaluated townhouse units are NOT eligible for designation outside of the entire building being designated. Example: A four-unit, two-story townhouse with all units attached is eligible for FORTIFIED only if the entire building, including each and every townhouse unit, is evaluated.

Completing Evaluation Forms
(For the FORTIFIED Evaluator)

Address Entry in Evaluation Application
When completing the FORTIFIED Home Evaluation Application for two-family dwelling units (duplex) or townhouses, list all dwelling unit addresses for the entire building under consideration on the Property Address lines. The example below lists four address numbers for a four-unit townhouse.
Eligible Dwellings

Bulletin No. 2016-01

First Release:
March 4, 2016

Prepared by:
Remington Brown,
Senior Engineering Director

Applicable Standards:
FORTIFIED Home™—Hurricane
FORTIFIED Home™—High Wind
FORTIFIED Home™—High Wind & Hail
FORTIFIED for Safer Living®

Applicable Designation Level:

Dwelling Type Entry in Evaluator Checklist

Figure 2 shows dwelling type options available on the Evaluator Checklist. This drop-down menu can be found in the General/Site Information section.

Figure 1. Application indicating four addresses for a four-unit townhouse.

Figure 2. FORTIFIED Home Evaluator Checklist indicating dwelling type options.
Designation Certificates

Designation certificates will be issued based on verification of the appropriate FORTIFIED requirements and will list a single address for single-family detached homes. Two-family homes (duplex) and townhouse designation certificates will be issued with all addresses for the building listed on the certificate. Figure 3 is an example of a designation certificate for a four-unit townhouse.

Figure 3. Example certificate for a qualified, four-unit townhouse.
Shingle Installation at Roof Edge

Asphalt Shingle Installation at Roof Edges, Intersections and Valleys

Abstract
This updated document is intended to provide additional guidance and options for asphalt shingle installations at roof edges, intersections and valleys. The verification and documentation requirement referenced in the original technical bulletin (Technical Bulletin 2016-05, released November 3, 2016) was effective December 5, 2016.

Introduction
Research conducted at the IBHS Research Center on a number of three-year-old roofs with various edge attachment details clearly demonstrated the need to ensure that shingles are properly installed and well adhered along the perimeter of a roof. While this directive has been included in standards and guidance since the beginning of the program, and also addressed in manufacturers’ high-wind guidance for asphalt shingle installation, it has not been specifically spotlighted in compliance forms or in evaluator training.

As a result, IBHS is issuing this updated technical bulletin to provide additional guidance with options that describe alternate methods to help ensure that asphalt shingles are well sealed and connected at roof edges, intersections and valleys. Please make sure you become familiar with the installation requirements outlined below and work with roofers to ensure proper installation instructions are followed. Additionally, appropriate documentation described at the end of this bulletin continues to be required for all asphalt shingle roof installations.
Sealed Roof Deck Installation Options

Taped Sheathing Seams

Tape Installation
Tape must be rolled to help ensure it is installed flat and adheres to the deck. If the tape doesn’t stick well, the seams must be primed or a different product that does stick well must be used. Recent IBHS experience suggests that there may be fewer adhesion problems for installations on OSB decks with the high temperature–rated acrylic tape allowed by the program.

Underlayment Installation
Apply a code-compliant ASTM D226, Type II underlayment over the self-adhering tape (felt or synthetic is allowed). This underlayment shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps at 6 in. o.c. spacing along all laps and two rows 12 in. o.c. in the field or a more stringent fastener schedule if required by the manufacturer for high-wind installations. Horizontal laps shall be a minimum of 2 in. and end laps shall be a minimum of 6 in. Nails with plastic or metal caps are allowed in areas where the design wind speed is less than 140 mph. Metal caps are required for areas where the design wind speed is greater than or equal to 140 mph.

ASTM D1970 Self-Adhered Membranes

ASTM D1970 Membrane Installation
Cover the entire roof with a full layer of self-adhering polymer-modified bitumen membrane meeting ASTM D1970 requirements.

Recommended Bond Break Installation
It is recommended that #15 felt be installed over the membrane to provide a bond break between the self-adhering membrane and the shingles in order to prevent the shingles from fusing with the self-adhering membrane. The bond break shall be held back 8 in. from the eave and rake edges to allow application of flashing cement along the edges to ensure proper sealing of shingles along the roof edges.
Shingle Installation at Roof Edge

Bulletin No. 2016-05

First Release:
November 3, 2016

Prepared by:
Fred Malik, Vice President, FORTIFIED Programs
Mark Zehnal, Senior Roofing Specialist, FORTIFIED Program Manager – Great Plains

Applicable Standards:
FORTIFIED Home™–High Wind
FORTIFIED Home™–High Wind & Hail
FORTIFIED Home™–Hurricane

Applicable Designation Level:

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Roof Edges, Intersections and Valleys

Drip Edge Installation Requirements

1. Provide code-compliant, minimum gauge metal drip edge at eaves and gables.
2. Overlap to be a minimum of 3 in. at joints.
3. Eave drip edges shall extend ½ in. below sheathing and extend back on the roof a minimum of 2 in.
4. The drip edge shall be mechanically fastened to the roof deck. Fasteners shall be fabricated from similar or compatible material. For FORTIFIED–Hurricane compliance, spacing shall be a maximum of 4 in. o.c. For FORTIFIED–High Wind and FORTIFIED–High Wind & Hail compliance, spacing shall be a maximum of 12 in. o.c. Mechanical fasteners shall 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.
5. Drip edge at eaves shall be installed over the underlayment (this is compatible with high-wind installations where flashing cement is used to seal the edges).

Installation of Starter Strips at Eaves (Drip Edge Installed Over Underlayment)

Manufacturer-approved starter strips at eaves shall be set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be ⅛ 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 ¼ in. beyond the drip edge.

Approved Option

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 Rakes (Drip Edge Installed Over Underlayment)
Install shingles at rakes set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be ⅛ in. Fasten shingles at the rakes according to the manufacturer’s specifications.

Optional Installation of Starter Strips at Rakes (Drip Edge Installed Over Underlayment)
Manufacturer-approved starter strips at rakes shall be set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be ⅛ 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 ¼ in. beyond the drip edge.

Approved Option
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.

Attachment of Shingles at Intersections and Valley
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 ⅛ in. Cut side of closed valleys shall be set in a minimum 2-in.-wide, ⅛-in.-thick strip of flashing cement. Woven valleys to be according to the manufacturer’s specifications.
Shingle Installation at Roof Edge

Verification and Documentation

The contractor shall complete the revised compliance form and provide in-progress photos with identifiable traits or landmarks of the property showing the following:

1. Installation of tape or self-adhered membrane.
2. Fastening of underlayment.
3. Fastening of drip edge metal over underlayment.
4. Application of flashing cement or approved alternate means of attachment along roof edges, intersections and valleys.
5. Installation of approved starter strips at eaves.

The Evaluator shall verify that shingles along the edges of the roof do not overhang more than ¼ in. beyond the drip edge metal.
Roof Flashing

Abstract
Roof flashing is an integral component of the roof system. It is used to seal roof systems where the system is interrupted or terminated and is always required when installing a new roof or re-roofing an existing home. Examples of roof flashing include: drip edge at the eave and rake, valley flashing, wall and chimney flashing, flashing at roof pitch changes, and flashing at all roof penetrations. This bulletin instructs installers that all flashing installed on a FORTIFIED roof must be in new condition and points to roof covering manufacturers for flashing installation instructions.

Requirements
When re-roofing an existing home or installing a roof on a new home, all installed flashing shall be new material. When re-roofing, all existing flashing material shall be removed and discarded. New flashing shall be properly installed in accordance with the roof manufacturer’s installation instructions and in compliance with all applicable building codes.

FORTIFIED has specific requirements for asphalt shingle drip edge flashing installation and attachment that may go beyond roof manufacturers’ flashing installation instruction and/or typical building code requirements. New drip edge metal must be installed at the eaves and the gable rakes.

Documentation Requirements
The installation of new roof flashing is to be verified by a certified FORTIFIED Evaluator through observation and photographs.
Retrofit for Ladder Framed Gable Overhang 12–18 in. Depth

Applicable Conditions
1. Existing homes only
2. Silver and Gold designation levels

Abstract
Older homes are often constructed with overhangs greater than 12 in. in depth. This bulletin provides prescriptive instructions, for the site condition limitations outlined below, on how to retrofit ladder framing on gable end overhangs to achieve a maximum depth of 18 in. from the face of the wall. Gable ends with ladder framed plywood/OSB overhangs greater than 18 in. seeking a Silver or Gold designation will require a site-specific engineered solution.

Site Condition Limitation
Exposure B
Mean Roof Height = 30 ft maximum

<table>
<thead>
<tr>
<th>Wind Provision</th>
<th>ASCE 7-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Speed (mph)</td>
<td>160 (ultimate)</td>
</tr>
</tbody>
</table>

Requirements
FORTIFIED Home™ requirements have not changed. This prescriptive retrofit utilizes 2x framing members and 7/16-in. structural sheathing (plywood or OSB) at soffits to form a structural box which will enable an existing gable overhang to extend 18 in. to the outermost surface of the overhang without site-specific engineering.

Documentation Requirements
All components installed must be documented with photos and verified by a certified FORTIFIED Evaluator. Required photos include all installed framing and sheathing. Include photos of fasteners that clearly indicate sizes and spacing of the fasteners installed as well as at least one overview showing the continuous ledgers in place.
For Evaluators Only: Evaluation Form Input

Overhang retrofit documentation photos, material invoices, etc., should be uploaded into the SOFFIT section of the evaluation in FOCUS.

Retrofit Specifications

1. 7/16-in. structural sheathing (plywood or OSB) fastened to 2- x 4-in. ledgers with 8d nails at 3 in. o.c. at each end. Provide 2- x 4-in. blocking at all soffit panel joints.
2. 2- x 4-in. continuous ledger fastened to wall framing through exterior sheathing with #10 x 4-in.-long deck screw and a 1.5-in.-diameter washer at 6 in. o.c. and 3 in. from each end of the ledger.
3. 2- x 4-in. continuous ledger fastened to 2- x 6-in. fascia with #10 x 3-in.-long deck screw and a 1.5-in.-diameter washer at 8 in. o.c. and 3 in. from each end of the ledger.
4. 2x minimum fascia board.
5. Nail the roof deck to the fascia and first and second rafters with 8d ring shank nails at 4 in. o.c. (minimum 1⅛-in. penetration).
Low-Slope Roof Guidelines in Mobile and Baldwin Counties, Alabama

Abstract

This bulletin is intended to provide design guidance for residential roof systems installed over wood roof decks with a roof slope less than 2/12 (10 degrees). Low-slope roof systems must meet the required design pressures for the site and the locations on the building. Roofing manufacturers’ tested uplift design pressures must have a factor of safety of 2:1; roof system design pressures listed in an ICC Evaluation Service Report, Florida Product Approval, or Miami-Dade Notice of Acceptance (NOA) have the 2:1 factor of safety already applied. These reports can be used to validate compliance with the project site-specific design pressure requirements. The report documents can be difficult to navigate; the roofing manufacturer technical services department is the best resource to help identify the correct system for the project.

Typical Residential Low-Slope Systems

Built-up roof (BUR) systems are composed of multiple layers of reinforcing membranes held together with hot bitumen, solvent-based adhesives, torch welding and self-adhered plies that create a finished membrane. The number of plies in a cross section is the number of membrane layers on a roof. The term “two-ply” denotes a two-layer membrane construction. When installed directly over the wood deck, the base sheet (also known as an anchor sheet) can either be mechanically fastened or attached with an adhesive foam or be a self-adhered product.

Modified bitumen roof systems are a form of BUR system that uses multiple layers of reinforcing membranes with a granulated or uncoated finish cap sheet that includes added modifiers to give plastic or rubber-like properties. Modified bitumen roof systems usually consist of two- or three-ply systems.
Roof System

Single-ply roofing membranes are flexible sheets of compounded synthetic materials that are generally mechanically attached or fully adhered to rigid insulation or a cover board. There are two categories of single-ply membranes: thermoplastic membranes such as TPO (thermoplastic olefin), PVC (polyvinyl chloride), and KEE (ketone ethylene ester), and thermoset membranes such as EPDM (ethylene propylene diene monomer).

Example for Mobile and Baldwin Counties

Low-slope roofs must be installed to meet design pressures for the site location and for the location on the roof. Figure 1 (below) shows three roof “zones.” Use 4 ft for dimension “a.” The Corner Zone (Zone 3) is the roof zone that has the highest pressure (see Table 1) and is a 4-ft x 4-ft area in each of the four corners of the roof. The End Zone (Zone 2) is a 4-ft wide strip around the perimeter of the roof and the Interior Zone is the rest of the roof (anything not in Zones 2 or 3).

In Mobile and Baldwin counties, use Table 1 to determine the roof uplift pressure you need for an approved roof system. Note that the ASCE 7-10 wind speed in Mobile and Baldwin counties does not exceed 160 mph in any location.

Table 1. Roof Uplift Pressures: 160 mph, 30 ft Max Roof Height

<table>
<thead>
<tr>
<th>160 mph (ASCE 7-10)</th>
<th>Zone 1 (interior)</th>
<th>Zone 2 (end)</th>
<th>Zone 3 (corner)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure B (residential neighborhood)</td>
<td>-28 psf</td>
<td>-47 psf</td>
<td>-70 psf</td>
</tr>
<tr>
<td>Exposure C (open area)</td>
<td>-39 psf</td>
<td>-66 psf</td>
<td>-98 psf</td>
</tr>
<tr>
<td>Exposure D (on water)</td>
<td>-47 psf</td>
<td>-78 psf</td>
<td>-116 psf</td>
</tr>
</tbody>
</table>
Basic Procedure for Selecting a Roof Assembly

1. From Table 1, determine uplift pressure required for Zone 1 (field), Zone 2 (perimeter), and Zone 3 (corners).
2. Select a roofing system manufacturer and a method of application (self-adhered, mechanically fastened, hot mopped, single-ply, etc.).
3. There are many variables associated with flat roof systems; make sure you select a system that’s appropriate for the roof deck. Most residential flat roof assemblies are applied over a wood deck without insulation; make sure the system you choose is compatible.
4. Select a roof assembly from the manufacturer that has an approval for a design pressure greater than or equal to the uplift pressures determined in step 1.
   a. **NOTE**: It would be best to select a system rated for the corner (Zone 3) uplift pressures and use it for the entire roof. For a home located in a residential neighborhood (Exposure B) in Mobile or Baldwin county, look for a roof assembly system that has an approval indicating a design uplift pressure of 70 psf. The ICC Evaluation Service Report, Florida Product Approval, and Miami-Dade Notice of Acceptance (NOA) already have the required 2:1 factor of safety incorporated in the listed design pressures.

Installation

1. Re-fasten the wood deck as required by FORTIFIED or the roofing approval if it’s more restrictive.
2. Apply base/anchor sheet, intermediate plies, cap sheet, and roof coating as required by the system approval. **Do not substitute materials; use the components and fasteners as listed in the system approval.**
3. Follow roof manufacturers’ installation guidelines for edge details, parapet details, skylight curb details, pitch transitions, wall connections where roofs meet upper stories, and penetrations for vent stacks or hardware mounts.
Bulletin No. 2017-03

First Release:
November 15, 2017

Prepared by:
Remington Brown
Senior Engineering Director

Applicable Standards:
FORTIFIED Home™–Hurricane
FORTIFIED for Safer Living™

Applicable Designation Level:

Documentation Requirements

The Roofing Compliance Form must indicate the manufacturer and system type of the roof assembly.

The product approval indicating the design pressure rating for the installed system must be provided to the Evaluator.

Photos indicating the attachment of the base/anchor sheet in compliance with the roofing system approval must be provided.
Eligibility Requirements and Retrofit Requirements for Elevated-Floor (Not Slab-on-Grade) Houses

Applicable Conditions

1. Dry stack foundations: all house types
2. All elevated-floor home-to-foundation connections

Abstract

This technical bulletin is intended to clarify FORTIFIED Home™ requirements that relate to a home’s foundation and the need for the home to have a positive connection to the foundation in order to be eligible for a FORTIFIED Home designation. The criteria included are requirements for any and all FORTIFIED Home designations and are not limited to FORTIFIED Home Gold designations which address the continuous load path.

Requirements

**Dry Stack Foundations**

A dry stack foundation is defined as a foundation constructed of unrestrained stacked masonry or stone.

**Eligibility:** Homes that are supported by a dry stack foundation are ineligible for any level of FORTIFIED Home designation unless the home is retrofitted so that it is supported by and attached to a permanent foundation capable of resisting the design level wind uplift and lateral forces on the building.

**All Foundations**

To be eligible for designation or re-designation under the FORTIFIED Home program, homes with elevated floors (not slab-on-grade construction) must have adequate positive connections from the floor or wall structure to the supporting foundation, e.g. homes on piers or pilings must have a connection from the
Eligibility Requirements—Foundations

Bulletin No. 2017-04

First Release:
December 12, 2017

Prepared by:
Fred Malik, Vice President,
FORTIFIED Programs

Applicable Standards:
FORTIFIED Home™—Hurricane
FORTIFIED Home™—High Wind
FORTIFIED Home™—High Wind & Hail
FORTIFIED for Safer Living™

Applicable Designation Level:

FORTIFIED Home™—Hurricane
FORTIFIED Home™—High Wind
FORTIFIED Home™—High Wind & Hail
FORTIFIED for Safer Living™

piers/pilings to the perimeter beams of the house. All connectors must be free from damage, corrosion-resistant (if applicable) in accordance with Appendix D of the FORTIFIED Home—Hurricane standards, and installed per the connector manufacturer’s installation instructions.

HUD-Code Manufactured Home Foundations

Foundation must meet the design wind load requirements with no more than ¼-in. lateral deflection. Requirements specified in the U.S. Department of Housing and Urban Development (HUD) Permanent Foundation Guide for Manufactured Housing (HUD-4930.3G) dated September 1996 or later provide useful assistance in identifying suitable foundation options. Based on results of past inspections of home installations that were reported as permanent, the following requirements of the HUD Guide and FORTIFIED Home requirements are emphasized and are part of the Field Evaluation inspection.

1. Screw-in soil anchors are not considered a permanent anchorage and cannot be used as any part of the required permanent foundation unless their heads are restrained from lateral movement by embedment in a reinforced concrete footing or concrete slab.

2. All concrete masonry unit (CMU) bearing walls, piers and columns, as well as any units used as part of systems to resist uplift, overturning and lateral loads must be composed of reinforced concrete masonry with mortared bed and head joints. Cells with reinforcing must be fully grouted. Dry-stacking of CMU is not allowed.

3. All bearing walls, piers and columns must be installed on and connected to acceptable footings or a concrete slab. Footings and slabs must be protected from the effects of frost heave by extending below the frost line or by using a frost protected shallow foundation design.

4. Walls and piers used as part of the uplift, overturning or lateral load–resisting system must include adequately sized connections and elements capable of resisting tension or compression loads as appropriate. Straps or cables are acceptable, provided they are connected to the home or its chassis and transfer the design loads to the slab or footings supporting the walls, piers or columns. Use
Eligibility Requirements—Foundations

Bulletin No. 2017-04

First Release:
December 12, 2017

Prepared by:
Fred Malik, Vice President,
FORTIFIED Programs

Applicable Standards:
FORTIFIED Home™—Hurricane
FORTIFIED Home™—High Wind
FORTIFIED Home™—High Wind & Hail
FORTIFIED for Safer Living™

Applicable Designation Level:

of frictional resistance between the home or its chassis and the tops of the walls, piers or columns or between the bottom of the walls, piers or columns and the footings to resist lateral loads is not allowed.

Eligibility: Manufactured homes must be installed on a foundation designed and installed in accordance with the criteria outlined above. A certification attesting to compliance with the design requirements of the HUD Permanent Foundations Guide for Manufactured Housing (HUD-4930.3G) dated September 1996 or later, and the requirements outlined above must be provided by a licensed professional engineer or registered architect. A copy of the certification and foundation design must be provided before or during the Field Evaluation at the time of the house setting for reference by the inspector and submission to IBHS.

Documentation Requirements

A minimum of four (4) photographs of a home’s foundation is required. The photographs must be taken from four different locations around the perimeter of the home.

Photographs of connectors are required. If any damaged or corroded connectors are present, photographs of the damaged connector(s) need to be provided in the “General/Site Information” section of the evaluation form regardless of designation level being sought. Photographs can be added to the Finished Elevation Photos portion of the form.

For Evaluators Only: Evaluation Form Input

Photographs of the foundation and connectors from perimeter beam to foundation need to be uploaded in the “General/Site Information” section of the evaluation form regardless of designation level being sought. Photographs can be added to the Finished Elevation Photos portion of the form.
Corrosion-Resistant Fasteners

Technical Bulletin
FH 2018-01

First Release:
March 20, 2018

Prepared by:
Fred Malik, Vice President,
FORTIFIED Building Programs

Applicable Standards:
FORTIFIED Home™–Hurricane

Applicable Designation Level:

New Documentation Requirements

Abstract
Metals exposed to salt and moisture in the air in coastal areas are highly susceptible to accelerated corrosion. The intent of this bulletin is to highlight the requirement for metal structural connections and materials fasteners used to retrofit or construct FORTIFIED buildings less than 3,000 ft. from saltwater to be suitably protected from corrosion. The corrosion resistance outlined in the FORTIFIED standards is not new; however, there are new documentation requirements.

Introduction

Appendix D: Corrosion Protection Retrofit Requirements

<table>
<thead>
<tr>
<th>Fasteners/Connector</th>
<th>Structures within 300 ft. of saltwater</th>
<th>Structures more than 300 ft. but less than 1000 ft. from saltwater</th>
<th>Structures more than 1000 ft. but less than 3000 ft. from saltwater</th>
<th>Structures more than 3000 ft. from saltwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roofing nails for shingles</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Hot dip galvanized</td>
<td>Corrosion resistant</td>
</tr>
<tr>
<td>Concrete and clay roof tile fasteners</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Hot dip galvanized</td>
<td>Corrosion resistant</td>
</tr>
<tr>
<td>Metal roof clips and fasteners (exposed)</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Corrosion resistant</td>
</tr>
<tr>
<td>Fasteners used for attachment of underlayment to roof deck</td>
<td>Hot dip galvanized</td>
<td>Hot dip galvanized</td>
<td>Hot dip galvanized</td>
<td>Corrosion resistant</td>
</tr>
<tr>
<td>Aluminum soffits</td>
<td>Not allowed</td>
<td>Not allowed</td>
<td>Not allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td>Soffit and roof vent fasteners</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Corrosion resistant</td>
</tr>
<tr>
<td>Metal framing connectors, fasteners, anchors, and hangers in exposed areas</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel or G185 galvanized</td>
</tr>
<tr>
<td>Metal framing connectors, fasteners, anchors, and hangers in vented enclosed areas</td>
<td>Stainless steel</td>
<td>Stainless steel or G185 galvanized coating</td>
<td>Stainless steel or G185 galvanized coating</td>
<td>Corrosion resistant</td>
</tr>
</tbody>
</table>
Corrosion-Resistant Fasteners

Technical Bulletin
FH 2018-01

First Release:
March 20, 2018

Prepared by:
Fred Malik, Vice President,
FORTIFIED Building Programs

Applicable Standards:
FORTIFIED Home™—Hurricane

Applicable Designation Level:

1 Buildings on open, elevated foundations within 1,000 ft of saltwater shall follow the requirements of structures within 300 ft of saltwater.
2 Examples of exposed areas include areas that are under roof overhangs, decks and covered walkways, or in any location that is openly or partially exposed to saltwater air.
3 Examples of vented enclosed areas include attics with vents.
4 Hot-dip galvanized shall meet the requirements of ASTM A153, Class D for nails and screws.
5 Corrosion-resistant nails and screws shall meet the requirements of ASTM A641, Class 1 or an equal corrosion resistance by coating, galvanization, stainless steel, or other suitable corrosion-resistant material. Corrosion-resistant sheet metal connectors, anchors and hangars shall meet the requirements of ASTM A653, G90.

FORTIFIED Home Evaluators Only: New Applications & Evaluation Form Input

When a new residential application is made, a notification will appear if the address is within a coastal zip code. You will be asked to select one of four approximate distances from a shoreline.

For reference, there is a direct weblink to Appendix D within the note.
FORTIFIED Home Evaluators Only: Documentation Requirements

If the distance from a saltwater shoreline is MORE than 3,000 ft, no additional documentation is required. If the distance is LESS than 3,000 ft, documentation of the corrosion-resistant connections and fasteners used on the home is now required. This information will be entered on the first page of the evaluation.

Photographs of labels, copies of invoices, and/or field delivery tickets indicating corrosion-resistance level for the connections and fasteners used are required. Photographs of the connections and fasteners should also be provided in this location.
Corrosion-Resistant Fasteners

Examples

<table>
<thead>
<tr>
<th>GULF SHORES, AL.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sections</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Code</th>
<th>Description</th>
<th>Qt/Footage</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZ-41734 HDG 1-1/2&quot;X.148 PP 2M JOIST HANGER NAIL 34DG</td>
<td>2 BOX</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>EZ-41650HDG 5X120 HDG RING 33D 2.8M/CTN</td>
<td>2 BOX</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>EZ-41653S2-3/8&quot;X.113 RS HDG 2.5M</td>
<td>2 BOX</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>STAINLESS STEEL JOIST HANGER 17154 PNEU 1-1/2X148 1M</td>
<td>2 BOX</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>MFM WIND AND WATER SHIELD SMOOTH 25QF</td>
<td>4 EA</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>FRM RT7A-SS STAINLESS STEEL HURRICANE C</td>
<td>100 EA</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SPF 2X6-18 #2 &amp; BTR. SPRUCE-PINE-FIR</td>
<td>10 pc</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

First Release:
March 20, 2018

Prepared by:
Fred Malik, Vice President,
FORTIFIED Building Programs

Applicable Standards:
FORTIFIED Home™—Hurricane

Applicable Designation Level:
Gable End Overhangs and Roof Sheathing Fastening: Re-Roofing to Meet Bronze, New Roof Designation

Applicable Conditions
1. Re-roofing projects only.
2. Bronze, new roof designation only. Silver or Gold designations for existing homes with gable overhangs greater than 12 in. require retrofit in accordance with TB2017-02, revised March 21, 2018.

Abstract
Attachment requirements for roof sheathing along the gable end truss or rafter to achieve a FORTIFIED Home™–Hurricane Bronze new roof designation have been enhanced to allow roofers, in most cases, to complete necessary retrofits without having to engage a general contractor. Exceptions, which still require structural modifications by a general contractor, include vented gable rakes and gable ends with overhangs greater than those shown in Table 1 on page 2 of this document.
Technical Bulletin
FH 2018-02

First Release:
March 28, 2018

Prepared by:
Remington Brown,
Senior Engineering Director

Applicable Standards:
FORTIFIED Home™–Hurricane

Applicable Designation Level:
BRONZE, New Roof Requirements

Gable End Roof Sheathing Fastening Requirements

BRONZE, New Roof Requirements

Roof sheathing shall be continuously fastened to the top of the gable wall with the minimum fastener size and spacing specified in Table 1 below. These solutions are limited to the maximum overhang length listed in Table 1 and to gable ends with roof sheathing continuously supported by and attached to the gable wall framing.

For gable rake overhangs exceeding the maximum overhang length in Table 1 or for unsupported gable rakes, a professional engineer must develop a building-specific solution.

Table 1. Roof Sheathing Minimum Fastening Requirements at the Gable Truss or Rafter

<table>
<thead>
<tr>
<th>Roof Sheathing Thickness</th>
<th>Maximum Overhang Length</th>
<th>Attachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/16–1/2 in. OSB or plywood</td>
<td>18 in.</td>
<td>8d ring shank nails at 4 in. o.c.</td>
</tr>
<tr>
<td>19/32–3/4 in. OSB or plywood</td>
<td>18 in.</td>
<td>10d ring shank nails at 4 in. o.c.</td>
</tr>
<tr>
<td>1x6 or narrower planks</td>
<td>24 in.</td>
<td>(2) 10d common nails per plank</td>
</tr>
<tr>
<td>1x8 to 1x10 planks</td>
<td>24 in.</td>
<td>(3) 10d common nails per plank</td>
</tr>
</tbody>
</table>

Compliance Verification Requirements

The re-nailing of the deck at all applicable gable end overhangs is to be documented and verified by a certified FORTIFIED evaluator. Acceptable documentation includes but may not be limited to the following:

- Pictures of roof deck nailed in accordance with Table 1.
- Size, type and spacing of the fastener attaching the roof sheathing to the gable end must be listed in the RE-NAILING section of the Roofing Compliance Form.
Completing Evaluation Form (For FORTIFIED Evaluators Only)

In the FOCUS software:

Photos showing roof sheathing attachment at the gable wall that clearly illustrate the fastener spacing conforms to Table 1 requirements must be uploaded by the Evaluator as additional photos in the Roof Deck section of FOCUS under “Roof deck fastener count.”

From inside the attic, if adequate access exists, verify roof sheathing is supported at the top of the gable wall. If roof sheathing support at the gable end wall cannot be verified from within the attic, evaluator should select “Partial” under Attic Accessibility, in the Roof Deck portion of the evaluation form. Then describe limited access (e.g., Gable end sheathing support cannot be verified due to limited attic access).