

# UL Evaluation Report



## UL ER18590-01

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Sub-level 2: 07 30 00 - Steep Slope Roofing  
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Sub-level 4: 07 31 16 – Metal Shingles

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### 1. SUBJECT: MetalWorks® Steel Shingles - AstonWood®, StoneCrest® Tile and StoneCrest® Slate

For the purpose of this report, the products will be referred to as MetalWorks® Steel Shingles

### 2. SCOPE OF EVALUATION

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2012, 2009 and 2006 *International Residential Code*® (IRC)
- ICC ES Acceptance Criteria for Metal Roof Coverings (AC166), Dated October 2012
- ICC ES Acceptance Criteria for Quality Documentation (AC10), Dated December 2012

### The products were evaluated for the following properties:

- Roofing Systems for Exterior Fire Exposure (ANSI/UL 790)
- Roofing Systems, Wind Uplift Resistance (ANSI/UL 1897)
- Roof Deck Construction (ANSI/UL 580)

### 3. REFERENCED DOCUMENTS

- ANSI/UL 790, Standard Test Methods for Fire Tests of Roof Coverings
- ANSI/UL 1897, Standard for Uplift Tests for Roof Covering Systems
- ANSI/UL 580, Standard for Tests for Uplift Resistance of Roof Assemblies
- ICC ES Acceptance Criteria for Metal Roof Coverings (AC166), Dated October 2012
- ICC ES Acceptance Criteria for Quality Documentation (AC10), Dated December 2012

### 4. USES

MetalWorks® Steel Shingles are used as roof coverings in Class A, B or C roof covering systems on combustible decks for new and existing roofs when installed in accordance with this report and the manufacturer's published installation instructions.

### 5. PRODUCT DESCRIPTION

MetalWorks® Steel Shingles are metal roof coverings complying with [Section 1507.5](#) of the 2012, 2009 and 2006 IBC and [Section R905.4](#) of the 2012, 2009 and 2006 IRC.

MetalWorks® Steel Shingles are formed from sheet steel complying with ASTM A 653, Grade CS, Type B, with a G-90 zinc-coated coating. The base metal thickness is minimum No. 28 gauge [0.013 in. (0.33 mm)]. The steel has minimum yield strength of 30 ksi (207 MPa). The exterior finish consists of a fluoropolymer (PVDF) with an anti-corrosive primer. The interior finish consists of a wash coat with an anti-corrosive primer. The shingles are formed by an automated multistage die and have factory formed interlocking edges at the perimeter.

#### 5.1 AstonWood®, StoneCrest® Tile, StoneCrest® Slate:

AstonWood®, StoneCrest® Tile and StoneCrest® Slate Steel Shingles are nominally 12-5/8 in. long (321 mm) by 39-3/4 in. (1010 mm) wide. The shingles are nominally 2.5 lbs (1.13 kg) and an installed weight of 0.74 lbs per square foot (3.61 k/gm<sup>2</sup>). AstonWood® has the appearance of textured wood, StoneCrest® Slate has the appearance of natural slate and StoneCrest® Tile has the appearance of smooth and uniform tile. See Figure 1 for additional details.

**Fire Classification:** The MetalWorks® steel shingles covered under this Report have been tested for fire classification in accordance with ANSI/UL 790. Shingles tested in accordance with ANSI/UL 790 qualify for use under [Section 1505.1](#) of the 2012, 2009 and 2006 IBC and [Section R902.1](#) of the 2012, 2009 and 2006 IRC.

**Wind Resistance:** The MetalWorks® steel shingles covered under this Report have been tested for wind resistance in accordance with ANSI/UL 580 and ANSI/UL 1897 complying with [Section 1504.3](#) of the 2012, 2009 and 2006 IBC.

The roofing assemblies shall be designed to resist the design wind load pressures for components and cladding in accordance with [Chapter 16](#) and [Section 1504.3](#) of the 2012, 2009 and 2006 IBC and [Section R905.1](#) of the 2012, 2009 and 2006 IRC.

### 6. INSTALLATION

The MetalWorks® Steel Shingles must be installed in accordance with the applicable code, this report and the manufacturer's published installation instructions. The MetalWorks® steel shingles must be

installed in accordance with [Section 1507.5](#) of the 2012, 2009 and 2006 IBC or [Section R905.4](#) of the 2012, 2009 and 2006 IRC, as applicable, except as noted in this report.

The manufacturer's published installation instructions must be available at all times on the jobsite during installation.

The MetalWorks® Steel Shingles must be installed on roofs with minimum slopes of 3:12 (25-percent slope).

The MetalWorks® Steel Shingles must be installed in accordance with the manufacturer's detailed application instructions, published by TAMKO Building Products Inc., available at:

[\(TAMKO MetalWorks Application Instructions Link, 01/31/13 JP52221\)](#)

See Figure 2 for layout pattern details.

#### **6.1 Ice Barrier:**

In areas where there has been a history of ice forming along the eaves, causing a backup of water, an ice barrier must be provided in accordance with [Section 1507.5.4](#) of the 2012, 2009 and 2006 IBC and [Section R905.4.3.1](#) of the 2012, 2009 and 2006 IRC, as applicable.

At least two layers of the underlayment described in Section 7.5 cemented together or one layer of TAMKO's TW Underlayment or TW Metal and Tile Underlayment should extend from the lowest edge of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

#### **6.2 Flashing:**

Valleys must be flashed in accordance with [Section 1507.5.7](#) of the 2012, 2009 and 2006 IBC and [Section R905.4.6](#) of the 2012, 2009 and 2006 IRC, as applicable.

Valleys are flashed with TAMKO's TW Metal and Tile Underlayment or TW Underlayment beneath the metal valley flashing, in addition to the underlayment required for the field of the roof as described in Section 7.5.

### **7. INSTALLATION MATERIALS**

#### **7.1 Sheathing:**

The roof deck must be code-complying, minimum 15/32 inch-thick (11.9 mm) DOC PS-1 compliant exterior plywood sheathing.

Refer to Section 8 for specific construction requirements for Uplift Resistance assemblies.

## 7.2 Accessories:

Various accessories are available and are formed from the same material as the metal shingles. Metal accessories include starter/eave flashing, gable, valley, J-channel, sidewall, hip cap tapered, ridge cap, snow guard and trim coil.

## 7.3 Clips:

Clips used to fasten the shingles, flashing and accessories to the sheathing are formed from minimum 0.016 in. thick (0.4 mm), minimum No. 26 MSG G90 galvanized steel. See Figure 3 for additional details.

Refer to Section 8 for specific steel clips requirements for Uplift Resistance assemblies.

## 7.4 Fasteners:

Fasteners must be minimum No. 11 gauge [0.0120-inch-diameter shank (3.05 mm)], 3/8-inch diameter head (9.5 mm), galvanized steel nail/screw per clip. Fasteners must be sufficient length to penetrate into the sheathing 3/4-inch (19.1 mm) or through the sheathing, where the sheathing is less than 3/4-inch (19.1 mm) thick.

Refer to Section 8 for specific construction requirements for Uplift Resistance assemblies.

## 7.5 Underlayment:

TAMKO's TW Underlayment, TW Metal and Tile Underlayment or Tam-Shield Synthetic Underlayment or a product that complies with ASTM D226, Type II. TAMKO's TW Underlayment, TW Metal and Tile Underlayment or Tam-Shield Synthetic Underlayment are acceptable alternates to the underlayment specified in [Section 1507.5.3](#) of the 2012, 2009 and 2006 IBC and specified in [Section R905.4.3](#) of the 2012, 2009, 2006 IRC.

## 8. WIND RESISTANCE:

When MetalWorks® Steel Shingles are installed in accordance with any of the installation options in Table 1 of this report, the steel shingles may be installed in Exposure C areas on structures with a maximum roof height of 33 feet provided there are no additional special wind design considerations, where the ultimate design wind speed specified in [Section 1609](#) of the 2012 IBC is up to 136 mph or where the basic wind speed specified in [Section 1609](#) of the 2009 and 2006 IBC and [Section R301.2](#) of the 2012, 2009, and 2006 IRC is up to 105 mph.

When MetalWorks Steel Shingles are installed in accordance with any of the installation options in Table 1 of this report, the steel shingles may be installed in Exposure B areas on structures with a maximum roof height of 40 feet provided there are no additional special wind design considerations, where the ultimate design wind speed specified in [Section 1609](#) of the 2012 IBC is up to 136 mph or where the basic wind speed specified in [Section 1609](#) of the 2009 and 2006 IBC and [Section R301.2](#) of the 2012, 2009, and 2006 IRC is up to 105 mph.

For installations on buildings in areas outside these limitations, design may be undertaken using the pressures associated with the systems provided in Table 1. The wind design pressure required for the roof must be determined in accordance with [Section 1609.5](#) of 2012, 2009, 2006 IBC and [Section R301.2.1](#) of the 2012, 2009, 2006 IRC.

MetalWorks® Steel Shingles installed as described in this report are acceptable for the maximum allowable uplift loads specified in Table 1. Positive loads must be limited to adequacy of the structural framing and sheathing.

Table 2 shows the wind speed conversion for new construction assemblies referenced in Table 1.

Refer to the UL Certification Category for Roofing Systems, Uplift Resistance ([TGIK](#)) (ANSI/UL 1897), File R18590, for applicable coverage and details of the roof assembly.

## **9 FIRE CLASSIFICATION:**

### **9.1 New Construction – Installation as Class A, B and C Prepared Roof Coverings:**

Refer to the UL Certification Category for Prepared Roof-covering Materials, Formed or Molded Metal, Fiber-Cement, Plastic or Fire-retardant-treated Wood ([TFXX](#)), File R18590, for applicable coverage and details of the roof assembly.

### **9.2 Reroofing – Installation as Class A Prepared Roof Coverings:**

The existing roof shall be inspected in accordance with the provisions and limitations of [Section 1510](#) of the 2012, 2009 and 2006 IBC and [Section R907](#) of the 2012, 2009 and 2006 IRC, as applicable. Prior to the reroofing, hip and ridge coverings must be removed.

Flashing and edging must comply with Section 7.2 and with [Sections 1510.5](#) and [1510.6](#) of the 2012, 2009 and 2006 IBC and [Sections R907.5](#) and [R907.6](#) of the 2012, 2009 and 2006 IRC, as applicable.

AstonWood®, StoneCrest® Tile and StoneCrest® Slate may be installed over existing Class A Asphalt glass fiber mat shingles or any Class A UL Listed roof system as described in the UL Certification Category for Prepared Roof-covering Materials, Formed or Molded Metal, Fiber-Cement, Plastic or Fire-retardant-treated Wood ([TFXX](#)), File R18590, for applicable coverage and details of the roof assembly.

## **10. CONDITIONS OF USE**

The MetalWorks® Steel Shingles described in this Report comply with, or are suitable alternatives to, what is specified in those codes listed in Section 2 of this Report, subject to the following conditions:

- 10.1** Materials and methods of installation shall comply with this Report and the manufacturer's published installation instructions. In the event of a conflict between the installation instructions and this Report, this Report governs.
- 10.2** Only Metalworks® metal accessories and specified fasteners shall be used in the installation of the roof covering system.
- 10.3** See UL's Online Certification Directory for Prepared Roof Covering Materials, Formed or Molded Metal, Fiber-Cement, Plastic or Fire-retardant-treated Wood (TFXX) and Roofing Systems, Uplift (TGIK).
- 10.4** Wind uplift pressures on any roof area, including edges and corner zones shall not exceed the allowable wind pressure for the roof covering installed in that particular area. The allowable wind uplift pressure for the roof assembly shall be based on a minimum factor of safety of 2.0. A safety factor of 2.0 must be applied to the Classification for uplift resistance (TGIK). The allowable wind uplift pressure is for the roof system only. The deck and framing to which the roofing system is attached shall be designed for the applicable component and cladding, wind loads in accordance with the applicable code.
- 10.5** When application is over an existing roof, documentation of the wind uplift resistance of the composite roof construction shall be submitted to the code official.

- 10.6** The MetalWorks® Steel Shingles covered under this report are produced by TAMKO Building Products Inc. in Joplin, Missouri under the UL LLC Listing/Classification and Follow-Up Service Program, which includes audits in accordance with quality elements of ICC-ES Acceptance Criteria for Quality Documentation, AC 10.

## **11. SUPPORTING EVIDENCE**

- 11.1** Data in accordance with ICC-ES Acceptance Criteria for Metal Roof Coverings, AC166.
- 11.2** Manufacturer's descriptive product literature, including installation instructions.
- 11.3** UL Listing Report in accordance with ANSI/UL 790. See UL Product Certification Category for Prepared Roof Covering Materials, Formed or Molded Metal, Fiber-Cement, Plastic or Fire Retardant-Treated Wood ([TFXX](#)), File R18590.
- 11.4** UL Classification Report in accordance with ANSI/UL 1897. See UL Product Certification Category for Roofing Systems, Uplift ([TGIK](#)), File R18590.
- 11.5** UL Classification Report in accordance with ANSI/UL 580.
- 11.6** Documentation of quality system elements described in ICC-ES Acceptance Criteria for Quality Documentation, AC10.

## **12. IDENTIFICATION**

The MetalWorks® Steel Shingles described in this evaluation report are identified by a marking bearing the report holder's name (TAMKO Building Products Inc.), the plant identification (if required), the product name, the UL Listing Mark, and the evaluation report number UL ER18590-01. The validity of the evaluation report is contingent upon this identification appearing on the product or UL Listing Mark certificate.

## **13. USE OF UL EVALUATION REPORT**

- 13.1** The approval of building products, materials or systems is under the responsibility of the applicable authorities having jurisdiction.
- 13.2** UL Evaluation Reports shall not be used in any manner that implies an endorsement of the product, material or system by UL.
- 13.3** The current status of this report, as well as a complete directory of UL Evaluation Reports may be found at UL.com via our On-Line Certifications Directory:

[www.ul.com/erdirectory](http://www.ul.com/erdirectory)

**Table 1**

**Fire and Wind Resistance Assemblies**

**New Construction:**

<b>System No.</b>	1
<b>Deck</b>	Min. 15/32 in. plywood sheathing.
<b>Underlayment</b>	One layer "TW Underlayment", "TW Metal and Tile Underlayment", "Tam-Shield Synthetic Underlayment", "No. 30 ASTM", "No. 30 UL", min. 4 in. side lap, attached per manufacturer's recommendations.
<b>Fasteners</b>	Five No. 26 MSG steel clips designated as "Standard Tamko Clip" to attach the shingle to the plywood deck with one 1-1/2 in. long galvanized steel No. 10-8 screw per clip. One clip positioned at the middle along the width on one end of the shingle. The remaining four clips are positioned along the back edge of the shingle in slots spaced 4 in. OC, 11 in. OC, 26 in. OC and 37 in. OC, respectively from the right end.
<b>Prepared Roof Covering Material (Shingle)</b>	Min. 28 gauge steel shingle, 39-3/8 in. long and a maximum 12-5/8 in. wide. Designated "AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate". Maximum exposure of the shingles to be 12 in.
<b>Tested Pressure (psf)</b>	120
<b>Allowable Wind Uplift Pressure (psf)<sup>1</sup></b>	60
<b>Fire Rating in accordance with UL 790</b>	Class C at Unlimited incline

<b>System No.</b>	2
<b>Deck</b>	Min. 15/32 in. plywood sheathing.
<b>Underlayment</b>	One layer GAF "VersaShield Underlayment", min. 4 in. side lap, attached per manufacturer's recommendations.
<b>Fasteners</b>	Five No. 26 MSG steel clips designated as "Standard Tamko Clip" to attach the shingle to the plywood deck with one 1-1/2 in. long galvanized steel No. 10-8 screw per clip. One clip positioned at the middle along the width on one end of the shingle. The remaining four clips are positioned along the back edge of the shingle in slots spaced 4 in. OC, 11 in. OC, 26 in. OC and 37 in. OC, respectively from the right end.
<b>Prepared Roof Covering Material (Shingle)</b>	Min. 28 gauge steel shingle, 39-3/8 in. long and a maximum 12-5/8 in. wide. Designated "AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate". Maximum exposure of the shingles to be 12 in.
<b>Tested Pressure (psf)</b>	120
<b>Allowable Wind Uplift Pressure (psf)<sup>1</sup></b>	60
<b>Fire Rating in accordance with UL 790</b>	Class B at Unlimited incline

<b>System No.</b>	3
<b>Deck</b>	Min. 15/32 in. rated plywood sheathing.
<b>Barrier Board</b>	Min. 1/4 in. thick Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or min. 1/2 in. thick UL Classified gypsum board with all joints staggered a min. of 6 in. from the plywood joints.
<b>Underlayment</b>	One layer "Tam-Shield Synthetic Underlayment", "No. 30 ASTM", "TW Underlayment", "TW Metal and Tile Underlayment", or "No. 30 UL", min. 4 in. side lap, attached per manufacturer's recommendations.
<b>Fasteners<sup>2</sup></b>	Five No. 26 MSG steel clips designated as "Standard Tamko Clip" to attach the shingle to the plywood deck with one 1-1/2 in. long galvanized steel No. 10-8 screw per clip. One clip positioned at the middle along the width on one end of the shingle. The remaining four clips are positioned along the back edge of the shingle in slots spaced 4 in. OC, 11 in. OC, 26 in. OC and 37 in. OC, respectively from the right end.
<b>Prepared Roof Covering Material (Shingle)</b>	Min. 28 gauge steel shingle, 39-3/8 in. long and a maximum 12-5/8 in. wide. Designated "AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate". Maximum exposure of the shingles to be 12 in.
<b>Tested Pressure (psf)</b>	120
<b>Allowable Wind Uplift Pressure (psf)</b>	60
<b>Fire Rating in accordance with UL 790</b>	Class A at Unlimited incline

<b>System No.</b>	4
<b>Deck</b>	Min. 15/32 in. plywood sheathing.
<b>Underlayment</b>	One layer self-adhering "TW Metal and Tile Underlayment", min. 4 in. side lap, attached per manufacturer's recommendations.
<b>Fasteners</b>	Five No. 26 MSG steel clips designated as "Standard Tamko Clip" to attach the shingle to the plywood deck with one 1-1/2 in. long galvanized steel No. 10-8 screw per clip. One clip positioned at the middle along the width on one end of the shingle. The remaining four clips are positioned along the back edge of the shingle in slots spaced 4 in. OC, 11 in. OC, 26 in. OC and 37 in. OC, respectively from the right end.
<b>Prepared Roof Covering Material (Shingle)</b>	Min. 28 gauge steel shingle, 39-3/8 in. long and a maximum 12-5/8 in. wide. Designated "AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate". Maximum exposure of the shingles to be 12 in.
<b>Tested Pressure (psf)</b>	198
<b>Allowable Wind Uplift Pressure (psf)</b>	99
<b>Fire Rating in accordance with UL 790</b>	Class C at Unlimited incline



<b>System No.</b>	5
<b>Deck</b>	Min. 15/32 in. plywood sheathing.
<b>Underlayment</b>	One layer "TW Metal and Tile Underlayment", min. 4 in. side lap, attached per manufacturer's recommendations.
<b>Fasteners</b>	Five No. 26 MSG steel clips designated as "Standard Tamko Clip" to attach the shingle to the plywood deck with one 1-1/2 in. long galvanized steel No. 10-8 screw per clip. One clip positioned at the middle along the width on one end of the shingle. The remaining four clips are positioned along the back edge of the shingle in slots spaced 3 in. OC, 16 in. OC, 24 in. OC and 36 in. OC, respectively from the right end.
<b>Prepared Roof Covering Material (Shingle)</b>	Min. 28 gauge steel shingle, 39-3/8 in. long and a maximum 12-5/8 in. wide. Designated "AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate". Maximum exposure of the shingles to be 12 in.
<b>Tested Pressure (psf)</b>	105
<b>Allowable Wind Uplift Pressure (psf)<sup>1</sup></b>	52.5
<b>Fire Rating in accordance with UL 790</b>	Class C at Unlimited incline

<b>System No.</b>	6
<b>Deck</b>	Min. 15/32 in. plywood sheathing.
<b>Underlayment</b>	One layer "TW Metal and Tile Underlayment", min. 4 in. side lap, attached per manufacturer's recommendations.
<b>Fasteners</b>	Five No. 26 MSG steel clips designated as "Standard Tamko Clip" to attach the shingle to the plywood deck with one 1-1/2 in. long galvanized steel No. 10-8 screw per clip. One clip positioned at the middle along the width on one end of the shingle. The remaining four clips are positioned along the back edge of the shingle in slots spaced 3 in. OC, 16 in. OC, 24 in. OC and 36 in. OC, respectively from the right end.
<b>Prepared Roof Covering Material (Shingle)</b>	Min. 28 gauge steel shingle, 39-3/8 in. long and a maximum 12-5/8 in. wide. Designated "AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate". Maximum exposure of the shingles to be 12 in.
<b>Tested Pressure (psf)</b>	120
<b>Allowable Wind Uplift Pressure (psf)<sup>1</sup></b>	60
<b>Fire Rating in accordance with UL 790</b>	Class C at Unlimited incline

<sup>1</sup> The allowable wind uplift pressure is based on the Acceptance Criteria for Metal Roof Coverings (AC166), Section 3.1.4.1. A safety factor of 2.0 was applied to the maximum test load achieved without failure.

<sup>2</sup> The fasteners must be sufficient length to penetrate into the sheathing 3/4-inch (19.1 mm).

**Reroofing Construction:**

<b>System No.</b>	7
<b>Deck</b>	Min. 15/32 in. thick plywood decking
<b>Existing Roof</b>	Existing Class A Asphalt glass fiber mat shingles
<b>Underlayment</b>	One layer "Tam-Shield Synthetic Underlayment" or an asphalt saturated organic felt that meets ASTM D226, Type II, attached per manufacturer's recommendations.
<b>Prepared Roof Covering Material (Shingle)</b>	"AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate" installed in accordance with manufacturer's installation installations.
<b>Fire Rating in accordance with UL 790</b>	Class A at Unlimited incline

<b>System No.</b>	8
<b>Deck</b>	Min. 15/32 in. thick plywood decking
<b>Existing Roof</b>	Existing Class A UL Listed roof system
<b>Underlayment</b>	One layer of GAF "VersaShield Underlayment", attached per manufacturer's recommendations.
<b>Prepared Roof Covering Material (Shingle)</b>	"AstonWood®", "StoneCrest® Tile" or "StoneCrest® Slate" installed in accordance with manufacturer's installation installations.
<b>Fire Rating in accordance with UL 790</b>	Class A at Unlimited incline

**Table 2**

**Wind Speed**

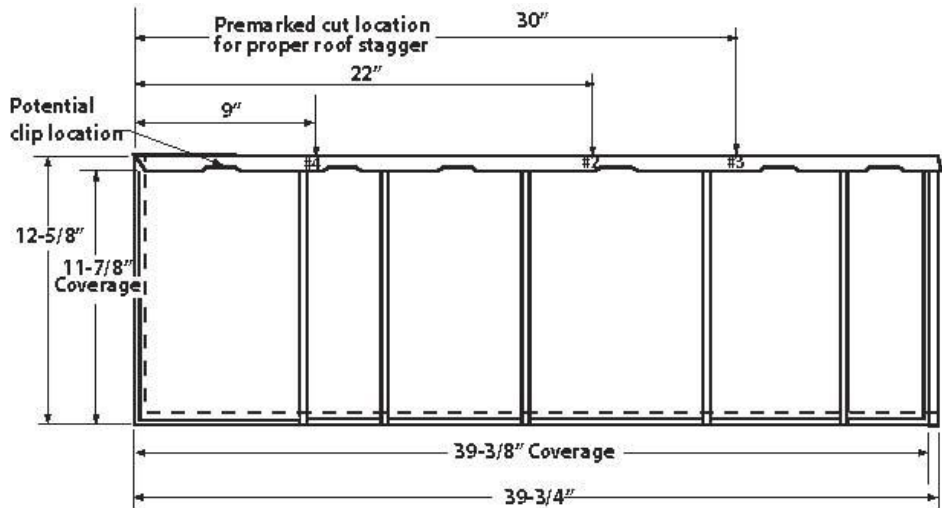
SYSTEM	ALLOWABLE WIND UPLIFT PRESSURE (psf)	Exposure B Heights up to 40 feet (mph)				Exposure C Heights up to 33 feet (mph)			
		IBC 2012 $V_{ult}$	IBC 2012 $V_{asd}$	IBC 2009, 2006; IRC 2012, 2009, 2006 $V_{3S}$	IBC 2009, 2006; IRC 2012, 2009, 2006 $V_{fm}$	IBC 2012 $V_{ult}$	IBC 2012 $V_{asd}$	IBC 2009, 2006; IRC 2012, 2009, 2006 $V_{3S}$	IBC 2009, 2006; IRC 2012, 2009, 2006 $V_{fm}$
1	60	146	113	146	129	146	113	146	129
2	60	146	113	146	129	146	113	146	129
3	60	146	113	146	129	146	113	146	129
4	99	187	145	187	169	187	145	187	169
5	52.5	136	105	136	120	136	105	136	120
6	60	146	113	146	129	146	113	146	129

$V_{ult}$  – Ultimate design wind speed (mph)

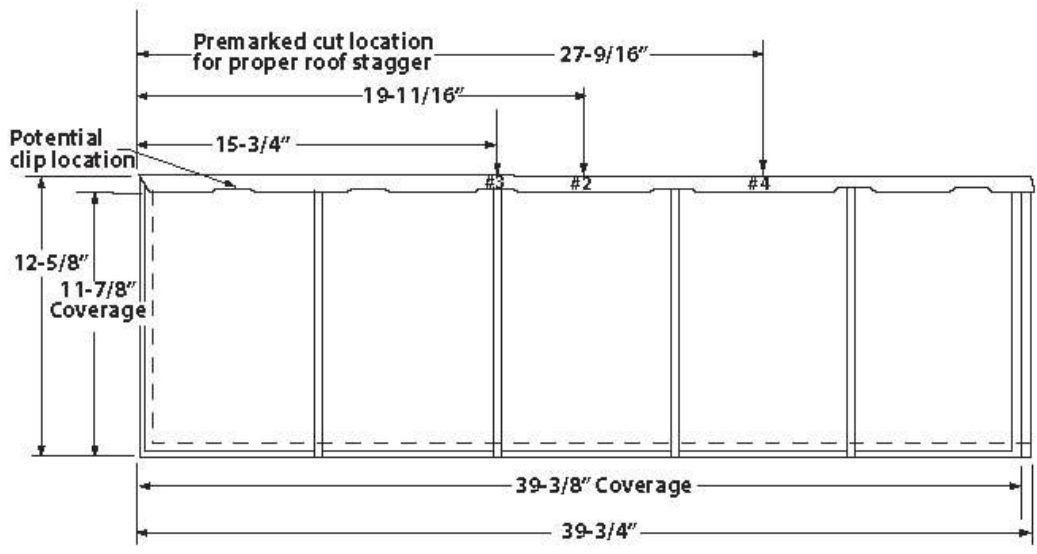
$V_{asd}$  - Nominal design wind speed (mph)

$V_{3S}$  – 3-second gust wind speed (mph)

$V_{fm}$  – Fastest mile wind speed (mph)

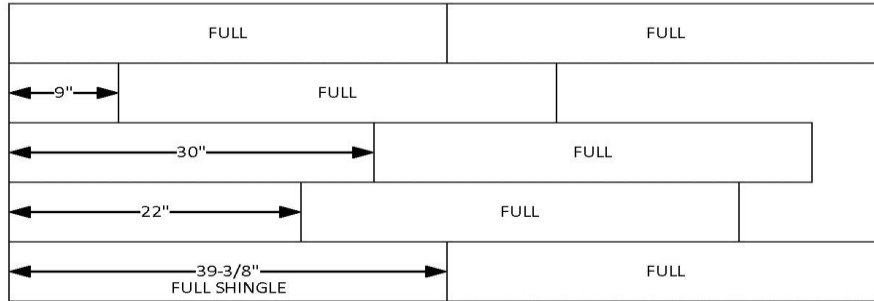


**AstonWood®**

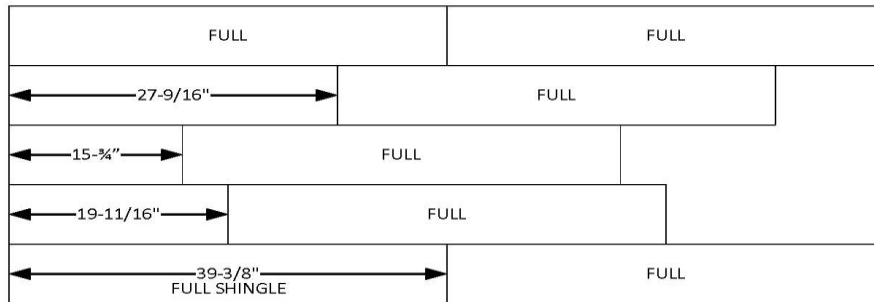


**StoneCrest® Tile and StoneCrest® Slate**

**FIGURE 1- PANEL DETAIL**

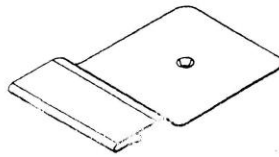
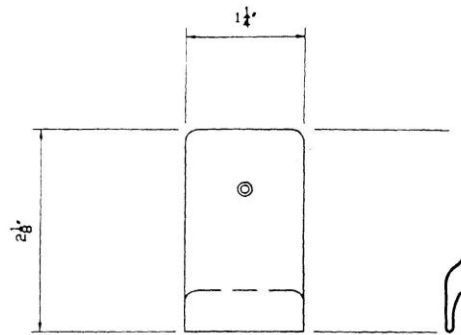


AstonWood – Layout  
Shingle Stagger Pattern



Stonecrest – Layout  
Shingle Stagger Pattern

**FIGURE 2 – LAYOUT PATTERN**



25

**Standard TAMKO Clip**

**FIGURE 3 – CLIP DETAIL**

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