

SECTION 07 13 13

HERITAGE® SERIES LAMINATED FIBERGLASS ASPHALT SHINGLES



This three-part specification is for design professionals for use as a guide and must be edited to delete information and instructions not required on a particular project. Delete the “specifier notes” in red once the editing is completed. The design professional and not TAMKO is responsible for the final specification. **IMPORTANT NOTICE: The product information provided is meant to be used in conjunction with the professional judgment of each builder, roofer, architect or other contractor installing the product in a particular application. TAMKO does not guarantee the workmanship of any builder, roofer, architect or other contractor and TAMKO's Limited Warranty excludes coverage for shingles that are not installed strictly according to TAMKO's installation instructions.** Rev 03/2021

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PART I GENERAL

1.01 SECTION INCLUDES

- A. Shingles - Granule surfaced asphalt shingle roofing
- B. Sheet membrane/Eave membrane - for eaves, valleys, and ridges
- C. Shingle underlayments
- D. Roofing cements
- E. Attic ventilation
- F. Nails
- G. Metal flashing associated with shingle roofing

1.02 RELATED SECTIONS

Note: Delete sections below not relevant to this project

- A. Section 061000 - Rough Carpentry: Framing, wood decking, and roof sheathing
- B. Section 061500 – Wood Decking
- C. Section 071354 – Sheet Waterproofing
- D. Section 072600 – Vapor Retarders
- E. Section 076000 – Flashing and Sheet Metal: Sheet metal flashing not associated with shingle roofing; gutters and downspouts
- F. Section 077200 – Roof Accessories for Ridge Vents
- G. Section 086200 – Unit Skylights

1.03 REFERENCES

Note: Delete references below not relevant to this project

- A. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 3. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 - 4. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 5. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials used as Steep Roofing Underlayment for Ice Dam Protection.
 - 6. ASTM D3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan Induced Method).
 - 7. ASTM D3462 – Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
 - 8. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 - 9. ASTM D4869 - Standard Specification for Asphalt –Saturated Organic Felt Underlayment Used in Steep Slope Roofing

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10. ASTM D7158 - Standard Test Method for Wind-Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method)
11. ASTM E108 - Standard Test Method for Fire Test of Roof Coverings
- B. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide
 1. UL 790 – Standard Test Methods for Fire Tests of Roof Coverings
- C. Asphalt Roofing Manufacturers Association (ARMA)
- D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual
- E. National Roofing Contractors Association (NRCA)
- F. American Society of Civil Engineers (ASCE)
- G. Miami-Dade County, Florida
- H. Florida Building Code

1.04 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.05 SUBMITTALS

*****Note: Delete sections below not relevant to this project and delete show drawing paragraph unless unusual project conditions mandate shop drawings*****

- A. Product Data: Provide copies of manufacturer's product data information and samples for each type of roofing product.
- B. Manufacturers Application Instructions: Provide manufacturer's application instructions that indicate preparation required, installation procedures, and detail drawings.
- C. Shop Drawings: Provide drawings to indicate specially configured metal flashing, jointing methods and locations and installation details as required by project conditions indicated.

1.06 MANUFACTURER & CONTRACTOR QUALIFICATIONS

- A. Manufacturer Qualifications: Provide all primary roofing products, including shingles, underlayment, sheet membrane-eaves membrane, and ridge ventilation, offered by a single manufacturer.
- B. Installer Qualifications: Installer must be licensed or otherwise authorized by all federal, state and local authorities for installation of all roofing products to be installed under this section.

*****Note: Jobs eligible for certain enhanced limited warranties installed by a TAMKO Pro or TAMKO MasterCraft Pro only*****

- C. Installer Qualifications: Installer must be a current TAMKO Pro or TAMKO MasterCraft Pro Certified Contractor who, inter alia, has passed TAMKO's strict evaluation process, is an

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experienced reputable professional, has been tested in roofing system product knowledge, and has been verified by customer satisfaction surveys.

1.07 REGULATORY REQUIREMENTS

- A. Provide a roofing system listed by Underwriters Laboratories (UL) for Class A fire classification.
- B. Install all roofing products in accordance with all applicable federal, state and local building codes.
- C. All work shall be performed in a manner consistent with current OSHA guidelines.

1.08 PREINSTALLATION MEETING

Note: Delete sections below not relevant to this project

- A. General: Roofing Contractor to conduct a pre-installation meeting at the site prior to commencing work of this section: Require attendance of entities directly concerned with roof installation.
- B. Agenda: Installation procedures; safety procedures; coordination with installation and other work; availability of roofing materials; regulatory requirements; preparation and approval of substrate and penetrations through roof; and other items related to successful execution of work.
- C. Maintain one copy of manufacturer's application instructions on the project site.

1.09 DELIVERY, STORAGE, AND HANDLING

Note: Delete sections below not relevant to this project

- A. Deliver shingles and other materials to site in manufacturer's unopened labeled packaging. Promptly verify quantities and conditions. Immediately remove damaged products from site.
- B. Store all products in manufacturer's unopened, labeled packaging until they are ready for installation.
- C. Store bundles on a flat surface. Maximum stacking height shall not exceed TAMKO's recommendations. Store all rolls on end.
- D. Store and dispose of solvent-based materials in accordance with all applicable federal, state and local regulations.

1.10 WEATHER CONDITIONS

- A. Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with TAMKO's application instructions.
- B. Take special care when applying shingles in temperatures below 40 degrees F (4.4 degrees C) to avoid damage to the edges and corners of the shingles.
- C. Apply TAMKO® Moisture Guard®, TW Metal & Tile Underlayment and TW Underlayment only in fair weather and when air, substrate, and membrane temperatures are above 40 degrees F (4.4 degrees C).

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1.11 LIMITED WARRANTY

SHINGLES BEGIN TO AGE AS SOON AS THEY ARE EXPOSED TO NATURE. BUILDINGS EXPERIENCE AGING FACTORS DIFFERENTLY, SO IT IS DIFFICULT TO PREDICT HOW LONG SHINGLES WILL LAST. TAMKO PROVIDES A LIMITED WARRANTY FOR MANY PRODUCTS, THAT INCLUDES A BINDING ARBITRATION CLAUSE AND OTHER TERMS AND CONDITIONS WHICH ARE INCORPORATED HEREIN BY REFERENCE. YOU MAY OBTAIN A COPY OF THE LIMITED WARRANTY AT TAMKO.COM OR BY CALLING 1-800-641-4691.

*****Note: Choose Limited Warranty Option and delete sections not required *****

*****IMPORTANT NOTE: THIS SECTION IS FOR INFORMATIONAL PURPOSES ONLY AND DOES NOT SUPERCEDE, ALTER OR LIMIT THE LIMITED WARRANTY. Contact TAMKO for a copy of the Limited Warranty and carefully read the Limited Warranty for complete and detailed limited warranty information*****

- A. **Manufacturer's Limited Warranty:** Provide to the owner a TAMKO® Fiberglass/Asphalt Shingle Limited Warranty for the product listed below which includes a binding arbitration provision.
1. Heritage® Shingle: Fiberglass/Asphalt Shingle Limited Warranty, 10-Year Full Start™ period. Available at tamko.com
 2. Heritage Proline StormFighter IR™ Shingle: TAMKO® Fiberglass/Asphalt Shingle Limited Warranty, 10-Year Full Start™ period. Available at tamko.com
 3. Heritage Proline Titan XT™ Shingle: TAMKO® Fiberglass/Asphalt Shingle Limited Warranty, 10-Year Full Start™ period. Available at tamko.com
 4. Heritage Woodgate® Shingle: TAMKO® Fiberglass/Asphalt Shingle Lifetime Warranty, 10-Year Full Start™ period. Available at tamko.com
 5. Heritage® Vintage® Shingle: TAMKO® Fiberglass/Asphalt Shingle Lifetime Warranty, 10-Year Full Start™ period. Available at tamko.com

The TAMKO® Fiberglass/Asphalt Shingle Limited Warranty provides the manufacturer's remedy to cover materials (and labor during the Full Start™ period) with manufacturing defects which have directly caused leaks:

1. Laminated Shingles: The laminated asphalt shingles as set forth in Table 1 below, which includes Heritage®, Heritage Woodgate®, Heritage® Vintage®, Heritage Proline Titan XT™, and Heritage Proline StormFighter IR™.
2. Term: The period of time this Limited Warranty lasts. The Term begins on the date of retail purchase of the Shingles and continues, unless sooner terminated, for the length of time set forth in Table 1 below. For Laminated Shingles installed on a Single-Family Structure, the Term is the period of time during which the Original Owner or Purchaser owns the building. For Laminated Shingles installed on structures other than Single-Family Structures, the Term is 480 months.

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3. Full Start™ period: The initial period of the Term during which TAMKO’s obligation is not prorated and includes the reasonable cost of labor necessary to install the applicable replacement Shingles. The length of the Full Start™ period is listed in Table 1 below.
4. 120 Month - Algae Cleaning Limited Warranty
5. Limited Wind Warranty Term: The period of time the Limited Wind Warranty lasts, beginning on the date of retail purchase of the Shingles and continuing for the length of time set forth in Table 1 below.
6. Transferability: The Original Owner of the Laminated Shingles may transfer this Limited Warranty one (1) time during the first five (5) years of the Term to a Purchaser of the building upon which the Shingles are installed.
7. Exclusions: See TAMKO® Fiberglass/Asphalt Shingle Limited Warranty for exclusions and other important details. Available at www.tamko.com.

TABLE 1

SHINGLE	TERM	FULL START™ NON-PRORATED WARRANTY PERIOD	STANDARD APPLICATION WIND WARRANTY	HIGH WIND APPLICATION WARRANTY	LIMITED WIND WARRANTY TERM	ALGAE CLEANING TERM
Heritage Proline Titan XT™	Limited Lifetime*	10 years	110 mph	160 mph	15 years	120 months
Heritage Proline StormFighter IR™	Limited Lifetime*	10 years	110 mph	160 mph	15 years	120 months
Heritage®	Limited Lifetime*	10 years	110 mph	130 mph	15 years	120 months
Heritage Woodgate®	Limited Lifetime*	10 years	110 mph	130 mph	15 years	120 months
Heritage® Vintage®	Limited Lifetime*	10 years	110 mph	130 mph	15 years	120 months

* Lifetime applies only to Shingles installed on a Single-Family Structure. The Term is 480 months for Shingles installed on non-Single-Family Structures.

- B. The TAMKO Edge™ contractor program offers the TAMKO Pro and TAMKO MasterCraft Pro enhanced limited warranties based upon their contractor certification. The TAMKO Edge™ program enables certified contractors to offer one-of-a-kind enhanced limited warranties with extended Full Start™ non-prorated warranty periods on select shingles. The shingles available for the enhanced limited warranties are Heritage Proline Titan XT™, Heritage Proline StormFighter IR™, Heritage Woodgate®, and Heritage® Vintage®. Information regarding The TAMKO Edge™ contractor program and enhanced limited warranties is available on tamko.com/edge.

PART II PRODUCTS

2.01 MANUFACTURERS

Note: Delete sections below not relevant to this project

- A. Acceptable Manufacturer: TAMKO Building Products LLC, P.O. Box 97, Galena, KS 66739-0097. Toll Free: 1-800-641-4691.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- C. Substitutions: Not permitted

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2.02 SHINGLES

***Note: Select All Applicable Products and delete products not required ***

- A. **Heritage® Shingles:** Self-sealing, granule surfaced, laminated asphalt shingle made with fiberglass mat, unique blends of granules, and shadowtone blended for natural looking shadow line. Architectural laminate styling provides a wood shake appearance with a 5-5/8 inch exposure. UL Listed for Class A Fire Resistance (UL 790/E108), UL Classified for Wind Resistance: ASTM D3161, Class F and ASTM D7158, Class H, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, Florida Building Code Approved FL 18355 and FL 35321, UL Evaluation Reports ER2919-01 and ER2919-02.
1. Color: As selected from manufacturers' full range colors.
 2. Color: _____
Miami-Dade County Product Control Approved (Note: Frederick, Tuscaloosa, Dallas, production only or remove)
- B. **Heritage Proline StormFighter IR™ Shingles:** A laminated shingle features a fiberglass mat construction, which is fully reinforced with a proprietary application that consists of a polyester mat across the entire width of the shingle, eliminating the need for backing aggregate, and uniform thickness throughout the entire overlay sheet. Each shingle is coated on both sides with a layer of weathering-grade asphalt and surfaced with ceramic granules. Heritage® IR is classified by UL for compliance with UL 2218 Class 4 Impact Resistance. UL Listed for Class A Fire Resistance (UL 790/E108), UL Classified for Wind Resistance: ASTM D3161, Class F and ASTM D7158, Class H, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, UL Classified in accordance with UL 2218, Class 4, UL Evaluation Reports ER2919-01 and ER2919-02.
1. Color: As selected from manufacturers' range of colors.
 2. Color: _____
- C. **Heritage Proline Titan XT™ Shingles:** A fiberglass mat construction with a random-cut sawtooth design. Two layers of fiberglass mat are coated with asphalt, surfaced with mineral granules and then laminated together. The shingles feature a self-sealing strip of asphalt and a reinforcing strip of polyester fabric on the back of the shingle, attached in the common bond area to provide added anchoring for the expanded nail zone. UL Listed for Class A Fire Resistance (UL 790/E108), UL Classified for Wind Resistance: ASTM D3161, Class F and ASTM D7158, Class H, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, Florida Building Code Approved FL 18355 and FL 35321, UL Evaluation Reports ER2919-01 and ER2919-02, Miami-Dade County Product Control Approved
1. Color: As selected from manufacturers' full range colors.
 2. Color: _____
- D. **Heritage Woodgate® Shingles:** Self-sealing, granule surfaced, laminated asphalt shingle made with fiberglass mat, unique blends of granules, and shadowtone blended for natural looking shadow line. Architectural laminate styling with a wide cut saw tooth cut provides a wood shake appearance with a 5-5/8 inch exposure. UL Listed for Class A Fire Resistance (UL 790/E 108), UL Classified for Wind Resistance: ASTM D3161, Class F and ASTM D7158, Class H, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, Miami-Dade County Product Control Approved,

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Florida Building Code Approved FL 18355 and FL 35321, UL Evaluation Reports, ER2919-01 and ER2919-02.

1. Color: As selected from manufacturers' full range of Colors.
 2. Color: _____
- E. **Heritage® Vintage® Shingles:** Self-sealing, granule surfaced, laminated asphalt shingle made with fiberglass mat, and unique blends of granules. Architectural laminate styling provides a wood shake appearance with a 5-inch exposure. UL Listed for Class A Fire Resistance (UL 790/E 108); UL Classified for Wind Resistance: ASTM D 3161, Class F and ASTM D 7158, Class H, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, Miami-Dade County Product Control Approved, Florida Building Code Approved FL 18355 and FL 35321, UL Evaluation Reports ER2919-01 and ER2919-02.
1. Color: As selected from manufacturer's full range of Colors.
 2. Color: _____

2.03 HIP & RIDGE SHINGLES

*****Note: Select All Applicable Products and delete products not required*****

- A. **Heritage® Vintage® 12" x 12" Hip & Ridge:** Self-sealing hip and ridge shingles complementing the color of Heritage® Vintage® roof shingles. UL Listed for Class A Fire Resistance (UL 790/E108), UL Classified for Wind Resistance: ASTM D3161, Class F, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, Miami-Dade County Product Control Approved, Florida Building Code Approved FL 18355 and FL 35321, UL Evaluation Reports, ER2919-01 and ER2919-02. Each bundle covers approx. 25 linear feet (7.62m) with a 5-inch (127 mm) exposure.
1. Color: As selected from manufacturers' full range of Colors.
 2. Color: _____
- B. **TAMKO® 12-1/4" x 12" Hip & Ridge:** Self-sealing hip and ridge shingles complementing the color of selected roof shingle. UL Listed for Class A Fire Resistance (UL 790/E108), UL Classified for Wind Resistance: ASTM D3161, Class F, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, Miami-Dade County Product Control Approved, Florida Building Code Approved FL 18355 and FL 35321, UL Evaluation Reports, ER2919-01 and ER2919-02. Each bundle covers approx. 33 linear feet (9.45 m) with a 5-1/8 inch (130.2 mm) exposure.
1. Color: As selected from manufacturers' full range of Colors.
 2. Color: _____
- C. **TAMKO® 12-1/4" x 12" Heritage® Hip & Ridge IR:** Self-sealing hip and ridge shingles complementing the color of selected roof shingle. Features a fiberglass mat construction with an additional polyester mat on the underside of the shingle. UL Listed for Class A Fire Resistance (UL 790/E108), UL Classified for Wind Resistance: ASTM D3161, Class F, UL Classified in accordance with ASTM D3462 and ICC-ES Acceptance Criteria AC438, UL Classified in accordance with UL 2218, Class 4, UL Evaluation Reports ER2919-01 and ER2919-02. Each bundle covers approx. 33 linear feet (9.45 m) with a 5-1/8 inch (130.2 mm) exposure.
1. Color: As selected from manufacturers' full range of Colors.
 2. Color: _____

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2.04 STARTER STRIP

Note: Select All Applicable Products and delete products not required

- A. **Heritage® Vintage® Starter:** 12-1/2" x 36" starter shingles designed for use with Heritage® Vintage® Shingles and available in complementing colors. Each bundle covers approx. 60 linear feet (18.29 m).
- B. **TAMKO® 10 Inch Starter:** Self-sealing 10" x 40" starter shingle designed for all roof shingles. Each bundle covers approx. 100 linear feet (30.48 m).
- C. **TAMKO® Shingle Starter:** Self-sealing 7" x 36" starter shingle designed for all roof shingles. Each bundle covers approx. 102 linear feet (31.1 m).
- D. **TAMKO® Perforated Starter:** Self-sealing 6-5/8" x 39-3/8" starter shingle designed for laminated roof shingles. Each bundle covers approx. 105 linear feet (m).

2.05 SHEET MEMBRANES – EAVES MEMBRANE

Note: Select All Applicable Products and delete products not required

- A. **Moisture Guard® Ice & Rain Underlayment:** Self-adhering, fiberglass mat, rubberized asphalt ice and rain underlayment surfaced with fine mineral granules. UL Classified as a Prepared Roofing Accessory, UL Classified in accordance with ASTM D1970, Miami-Dade County Product Control Approved, Florida Building Code Approved FL 12328.
 - a. **0.87 Square Roll** – Roll Coverage when applied according to instructions approx. 87.34 sq. ft. [±1.52 sq. ft.] (8.11 sq. m. [±0.14 sq. m.]), Roll Dimensions are 36" [±.07"] x 32'3" [±.05'] (91.44 cm. [±.17 cm.] x 9.83 m. [±.15m]) Roll Contains approx. 96.75 sq. ft. [±1.68 sq. ft.] (8.99 sq. m. [±0.16 sq. m.]). 55 mils thick.
 - b. **1.74 Square Roll** – Roll Coverage when applied according to instructions approx. 174.69 sq. ft. [±1.52 sq. ft.] (16.23 sq. m. [±0.14 sq. m.]), Roll Dimensions are 36" [±.07"] X 64'-6" [±.50'] (.91.44 cm. [±.17 cm.] x 19.66 m. [±.15 m.]). Roll Contains approx. 193.5 sq. ft. [±1.68 sq. ft.] (17.98 sq. m. [±0.16 sq. m.]). 55 mils thick.
- B. **TW Metal & Tile Underlayment:** Self-adhering, fiberglass mat, rubberized asphalt sheet membrane surfaced with polymer film. UL Classified as a Prepared Roofing Accessory, UL Classified in accordance with ASTM D1970.
 - a. **1.79 Square Roll** – Roll Coverage when applied according to instructions approx. 179.73 sq. ft. [±2.95 sq. ft.] (16.70 sq. m. [±0.27 sq. m.]), Roll Dimensions are 39-3/8" [±7/16"] X 60' 11-1/2" [±3"] (1 m [±1.11 cm.]x 18.59 m [±.28 m.]). Roll Contains approx. 200.05 sq. ft. [±3.03 sq. ft.] (18.59 sq. m. [±0.28 sq. m.]). 60 mils thick.
- C. **TW Underlayment:** Self-adhering, non- reinforced, rubberized asphalt sheet membrane surfaced with polymer film. UL Classified as a Prepared Roofing Accessory, UL Classified in accordance with ASTM D1970, Miami-Dade County Product Control Approved, Florida Building Code Approved FL 12328.
 - a. **1.84 Square Roll** – Roll Coverage when applied according to instructions approx. 184.91 sq. ft. [±2.97 sq. ft.] (17.18 sq. m. [±0.28 sq. m.]), Roll Dimensions are 39-3/8" [±7/16"] X

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61' [±3"] (1 m [±1.11 cm.]x 18.59 m [±.28 m.]). Roll Contains approx. 200.05 sq. ft. [±3.03 sq. ft.] (18.59 sq. m. [±0.28 sq. m.]). 40 mils thick.

2.06 SHINGLE UNDERLAYMENTS

*****Note: Select All Applicable Products and delete products not required*****

- A. **Synthetic Guard™:** A non-woven synthetic underlayment with a black coated polypropylene spun bond fabric surface, a polypropylene 5x5 scrim, and a black backside coating. Intertek Code Compliance Research Report CCRR-1056, Florida Building Code Approved FL 19948, Miami-Dade County Product Control Approved, Independently Tested For: CAN/CSA A123.3 - Type 3.
 - a. **9.20 Square Roll** – Roll Coverage when applied according to instructions approx. 920.59 sq. ft. (± 3.92 sq. ft.), Roll Dimensions are 48.1" x 250.5', Roll Contains approx. 1004.09 sq. ft. (± 4.09 sq. ft.).
- B. **Synthetic Guard™ Plus:** A non-woven synthetic underlayment with a grey coated polypropylene spun bond fabric surface, a polypropylene 10 x 5 scrim, and a grey backside coating. Intertek Code Compliance Research Report CCRR-1056, Florida Building Code Approved FL 19948, Miami-Dade County Product Control Approved, Independently Tested For: CAN/CSA A123.3 - Type 3.
 - a. **9.20 Square Roll** – Roll Coverage when applied according to instructions approx. 920.59 sq. ft. (± 3.92 sq. ft.), Roll Dimensions are 48.1" x 250.5', Roll Contains approx. 1004.09 sq. ft. (± 4.09 sq. ft.).
- C. **Moisture Guard® Ice & Rain Underlayment:** Self-adhering, fiberglass mat, rubberized asphalt ice and rain underlayment surfaced with fine mineral granules. UL Classified as a Prepared Roofing Accessory, UL Classified in accordance with ASTM D1970, Miami-Dade County Product Control Approved, Florida Building Code Approved FL 12328.
 - a. **0.87 Square Roll** – Roll Coverage when applied according to instructions approx. 87.34 sq. ft. [±1.52 sq. ft.] (8.11 sq. m. [±0.14 sq. m.]), Roll Dimensions are 36" [±.07"] x 32'3" [±.05'] (91.44 cm. [±.17 cm.] x 9.83 m. [±.15m]) Roll Contains approx. 96.75 sq. ft. [±1.68 sq. ft.] (8.99 sq. m. [±0.16 sq. m.]). 55 mils thick.
 - b. **1.74 Square Roll** – Roll Coverage when applied according to instructions approx. 174.69 sq. ft. [±1.52 sq. ft.] (16.23 sq. m. [±0.14 sq. m.]), Roll Dimensions are 36" [±.07"] X 64'-6" [±.50'] (.91.44 cm. [±.17 cm.] x 19.66 m. [±.15 m.]). Roll Contains approx. 193.5 sq. ft. [±1.68 sq. ft.] (17.98 sq. m. [±0.16 sq. m.]). 55 mils thick. Moisture Guard® Ice & Rain Underlayment by TAMKO. Square equals 100 sq. ft.
- D. **TW Metal & Tile Underlayment:** Self-adhering, fiberglass mat, rubberized asphalt sheet membrane surfaced with polymer film. UL Classified as a Prepared Roofing Accessory, UL Classified in accordance with ASTM D1970.
 - a. **1.79 Square Roll** – Roll Coverage when applied according to instructions approx. 179.73 sq. ft. [±2.95 sq. ft.] (16.70 sq. m. [±0.27 sq. m.]), Roll Dimensions are 39-3/8" [±7/16"] X 60' 11-1/2" [±3"] (1 m [±1.11 cm.]x 18.59 m [±.28 m.]). Roll Contains approx. 200.05 sq. ft. [±3.03 sq. ft.] (18.59 sq. m. [±0.28 sq. m.]). 60 mils thick.
- E. **TW Underlayment:** Self-adhering, non- reinforced, rubberized asphalt sheet membrane surfaced with polymer film. UL Classified as a Prepared Roofing Accessory, UL Classified in accordance with ASTM D1970, Miami-Dade County Product Control Approved, and Florida Building Code Approved FL 12328.

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- a. **1.84 Square Roll** – Roll Coverage when applied according to instructions approx. 184.91 sq. ft. [± 2.97 sq. ft.] (17.18 sq. m. [± 0.28 sq. m.]), Roll Dimensions are 39-3/8" [$\pm 7/16$ "] X 61' [± 3 "] (1 m [± 1.11 cm.] x 18.59 m [± 28 m.]). Roll Contains approx. 200.05 sq. ft. [± 3.03 sq. ft.] (18.59 sq. m. [± 0.28 sq. m.]). 40 mils thick.
- F. **TAMKO® No. 15 ASTM D4869:** No. 15 asphalt saturated organic felt. UL Classified in accordance with ASTM D4869, Type I. UL Classified as a Prepared Roofing Accessory.
 - a. **4.08 Square Roll** – Roll Coverage when applied according to instructions approx. 408 sq. ft. [± 4.41 sq. ft.] (37.9 sq. m. [± 0.41 sq. m.]), Roll Dimensions are 36" X 144' (.91 m. x 43.89 m.). Roll Contains approx. 432.00 sq. ft. [± 4.49 sq. ft.] (40.13 sq. m. [± 0.42 sq. m.]).
- G. **TAMKO® No. 30 ASTM D4869:** No. 30 asphalt saturated organic felt. UL Classified in accordance with ASTM D4869, Type I or Type III. UL Classified as a Prepared Roofing Accessory.
 - a. **2.04 Square Roll** – Roll Coverage when applied according to instructions approx. 204 sq. ft. [± 2.44 sq. ft.] (18.95 sq. m. [± 0.23 sq. m.]), Roll Dimensions are 36" X 72' (.91 m. x 21.95 m.). Roll Contains approx. 216.00 sq. ft. [± 2.49 sq. ft.] (20.07 sq. m. [± 0.23 sq. m.]).
- H. **TAMKO® No. 15 ASTM:** No. 15 asphalt saturated non-perforated, organic felt. UL Classified in accordance with ASTM D226, Type I. UL Classified as a Prepared Roofing Accessory.
 - a. **4.08 Square Roll** – Roll Coverage when applied according to instructions approx. 408 sq. ft. [± 4.41 sq. ft.] (37.9 sq. m. [± 0.41 sq. m.]), Roll Dimensions are 36" X 144' (.91 m. x 43.89 m.). Roll Contains approx. 432.00 sq. ft. [± 4.49 sq. ft.] (40.13 sq. m. [± 0.42 sq. m.]).
- I. **TAMKO® No. 30 ASTM:** No. 30 asphalt saturated non-perforated, organic felt. UL Classified in accordance with ASTM D226, Type II. UL Classified as a Prepared Roofing Accessory and is Florida Building Code Approved FL 12328.
 - a. **2.04 Square Roll** – Roll Coverage when applied according to instructions approx. 204 sq. ft. [± 2.44 sq. ft.] (18.95 sq. m. [± 0.23 sq. m.]), Roll Dimensions are 36" X 72' (.91 m. x 21.95 m.). Roll Contains approx. 216.00 sq. ft. [± 2.49 sq. ft.] (20.07 sq. m. [± 0.23 sq. m.]).
- J. **TAMKO® No. 15 UL:** No. 15 asphalt saturated non-perforated, organic felt. Tested by an independent laboratory for compliance with ASTM D226 Type I. UL Classified as a Built-up Type 15 Felt.
 - a. **4.08 Square Roll** – Roll Coverage when applied according to instructions approx. 408 sq. ft. [± 4.41 sq. ft.] (37.9 sq. m. [± 0.41 sq. m.]), Roll Dimensions are 36" X 144' (.91 m. x 43.89 m.). Roll Contains approx. 432.00 sq. ft. [± 4.49 sq. ft.] (40.13 sq. m. [± 0.42 sq. m.]).
- K. **TAMKO® No. 30 UL:** asphalt saturated non-perforated, organic felt. Tested by an independent laboratory for compliance with ASTM D226 Type II. UL Classified as a Built-up Type 30 Felt and Florida Building Code Approved FL 12328.
 - a. **2.04 Square Roll** – Roll Coverage when applied according to instructions approx. 204 sq. ft. [± 2.44 sq. ft.] (18.95 sq. m. [± 0.23 sq. m.]), Roll Dimensions are 36" X 72' (.91 m. x 21.95 m.). Roll Contains approx. 216.00 sq. ft. [± 2.49 sq. ft.] (20.07 sq. m. [± 0.23 sq. m.]).
- L. **TAMKO® No. 15 asphalt saturated organic felt:** UL Classified as a Prepared Roofing Accessory.

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- a. **4.08 Square Roll** – Roll Coverage when applied according to instructions approx. 408 sq. ft. [± 4.41 sq. ft.] (37.9 sq. m. [± 0.41 sq. m.]), Roll Dimensions are 36" X 144' (.91 m. x 43.89 m.). Roll Contains approx. 432.00 sq. ft. [± 4.49 sq. ft.] (40.13 sq. m. [± 0.42 sq. m.]).
- M. **TAMKO® No. 30 asphalt saturated organic felt:** UL Classified as a Prepared Roofing Accessory.
 - a. **2.04 Square Roll** – Roll Coverage when applied according to instructions approx. 204 sq. ft. [± 2.44 sq. ft.] (18.95 sq. m. [± 0.23 sq. m.]), Roll Dimensions are 36" X 72' (.91 m. x 21.95 m.). Roll Contains approx. 216.00 sq. ft. [± 2.49 sq. ft.] (20.07 sq. m. [± 0.23 sq. m.]).

2.07 ROOFING CEMENTS

Asphalt Plastic Roofing Cement meeting the requirements of ASTM D 4586, Type I

2.08 ATTIC VENTILATION

*****Note: Select All Applicable Products and delete products not required *****

A. RIDGE VENTS

1. **TAMKO® Roll Vent® Continuous Ridge Vent:** Lightweight, rolled, shingle over ridge ventilation. Use in conjunction with eave/soffit ventilation products. Provides 18 sq. inches Net Free Ventilation Area per linear foot (0.3 sq. m./m.). Each package contains 20 linear feet (6.10 m.) or 50 linear feet (15.2 m.) of vent. Hand-nail installation.
2. **TAMKO® Rapid Ridge® Nail Gun-able Ridge Vent:** Lightweight, rolled, shingle-over ridge ventilation. Use in conjunction with eave/soffit ventilation products. Provides 12.5 sq. inches Net Free Ventilation Area per linear foot (0.3 sq. m./m.). Each package contains 20 linear feet (6.10 m.) or 50 linear feet (15.2 m.) of vent. Nail-gun installed.
3. **TAMKO® CoolRidge® Sectional Ridge Vent** or **TAMKO® CoolRidge® Filtered Sectional Ridge Vent:** Lightweight, sectional injection molded polypropylene shingle-over ridge ventilation. Use in conjunction with eave/soffit ventilation products. Provides 18 sq. inches Net Free Ventilation Area per linear foot (0.3 sq. m./m.). Each package contains 48 linear feet (14.6 m.) of vent. Each piece is 14-3/4" x 48", 12 pieces per bundle, 48 ft. per bundle.
4. **TAMKO® Xtractor Vent® XLP Turbo Continuous Ridge Vent:** Lightweight, rolled injection molded polypropylene shingle-over ridge ventilation. Use in conjunction with eave/soffit ventilation products. Provides 12 sq. inches Net Free Ventilation Area per linear foot (0.3 sq. m. /m.). Each package contains 25 linear feet (7.6 m.) of vent. Nail-gun installed.
5. **TAMKO® Quick Vent Nail Gun-able Continuous Ridge Vent:** Lightweight, rolled, shingle over ridge ventilation. Use in conjunction with eave/soffit ventilation products. Provides 13.5 sq. inches Net Free Ventilation Area per linear foot (0.01 sq. m. /m.). Each package contains 20 linear feet (6.10 m.) or 50 linear feet (15.24 m.) of vent. Nail-gun installation.

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***Note: Select All Applicable Products and delete products not required ***

- B. FASCIA AND SOFFIT /UNDER EAVE VENTS: Soffit vents as required to provide balanced ventilation in accordance with TAMKO's ventilation requirements.

***Note: Select All Applicable Products and delete products not required ***

C. ROOF LOUVERS OR GABLE LOUVERS

1. Rooftop mounted louvers as required to help provide balanced ventilation in accordance with ventilation requirements.
2. Gable Louvers as required to help provide balanced ventilation in accordance with ventilation requirements.

2.09 NAILS

- A. Standard round wire, zinc-coated steel or aluminum, min 12 gauge, smooth, barbed or deformed shank, with heads 3/8 inch (9mm) to 7/16 inch (11mm) in diameter. Length must be sufficient to penetrate into solid wood at least 3/4 inch (19mm) or through roof deck by at least 1/8 inch (3.18mm).

Note: For use with Synthetic Guard™ or Synthetic Guard™ Plus Underlayment Only

- B. Standard round wire, zinc-coated steel or aluminum, min 12 gauge, smooth, barbed or deformed shank, with 1 inch round plastic caps. Length must be sufficient to penetrate into solid wood at least 3/4 inch (19mm) or through roof deck by at least 1/8 inch (3.18mm).

2.10 METAL FLASHING

***Note: Select All Applicable Products and delete products not required ***

- A. 24 gauge hot-dip galvanized steel sheet, complying with ASTM A653/A653M, G90/Z275.
- B. 16-oz/sq. ft. (0.56mm) copper sheet, complying with ASTM B370.
- C. 0.032-inch (0.8mm) aluminum sheet, complying with ASTM B209.

PART III EXECUTION

IMPORTANT NOTE: THIS SECTION IS FOR INFORMATIONAL PURPOSES AND DOES NOT SUPERCEDE, ALTER OR LIMIT THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. For a copy of the applicable installation instructions for complete and detailed product installation information visit our web site at www.tamko.com or contact TAMKO at 800-641-4691.

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Examine roof sheathing to verify the sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.

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2. Verify that the substrate is dry, sound, clean, smooth, sloped for drainage, and completely anchored, and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and roof deck has been properly prepared.
- C. If roof deck preparation is the responsibility of another installer, notify the architect or building owner of unsatisfactory preparation before proceeding.

3.02 PREPARATION

*****Note: Tear-Off Only*****

- A. Remove all existing roofing down to the roof deck.
- B. Verify that the deck is dry, sound, clean and smooth. It shall be free of any depressions, waves, and projections. Cover with sheet metal, all holes over 1 inch (25mm) in diameter, cracks over 1/2 inch (12mm) in width, loose knots and excessively resinous areas.
- C. Replace damaged deck with new materials.
- D. Clean deck surfaces thoroughly prior to installation of eaves membrane and shingle underlayment.

3.03 PREPARATION

*****Note: New Construction*****

- A. Clean deck surfaces thoroughly prior to installation of eaves membrane and shingle underlayment.
- B. At areas that receive eaves membrane, fill knotholes and cracks with latex filler.
- C. Install crickets on the upslope side of all chimneys in the north, any chimney wider than 24" (610mm), and on all roofs steeper than 6/12.

3.04 PREPARATION

*****Note: Recover Only*****

- A. Verify that the deck is structurally sound and free of deteriorated decking. All deteriorated decking shall be removed and replaced with new materials.
- B. Verify that the existing shingles are dry, sound, clean and smooth. All curled, buckled or loose tabs shall be nailed down or removed.

3.05 INSTALLATION OF TAMKO® UNDERLAYMENTS

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- A. General:

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1. Install using methods recommended by the manufacturer in accordance with local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
- B. Eaves:
1. Install eaves edge metal flashing tight with fascia boards, lap joints 2 inches (51mm) and seal with plastic cement or high quality urethane sealant, nail at the top of the flange.
 2. In the north, and on all roofs between 2/12 and 4/12 (low slopes) install TAMKO® Moisture Guard®, TW Metal & Tile Underlayment, or TW Underlayment up the slope from eaves edge a full 36 inches (914mm) or to at least 24 inches (610 mm) beyond the interior "warm wall". Lap ends 6 inches (152mm) and bond.
- C. Valleys:
1. Install eaves membrane at least 36 (914mm) inches wide and centered on the valley. Lap ends 6 inches (152mm) and seal.
 2. Where valleys are indicated to be "open valleys", install metal flashing over TAMKO® Moisture Guard® or TW Metal & Tile Underlayment before TAMKO® underlayment is installed, DO NOT nail through the flashing. Secure the flashing by nailing at 18 inches (457 mm) on center just beyond edge of flashing so that nail heads hold down the edge.
- D. Hips and Ridges:
1. Install TAMKO® Moisture Guard®, TW Metal & Tile Underlayment, or TW Underlayment along entire lengths. If ridge vents are to be installed, position the TAMKO® TW Metal & Tile Underlayment, or TW Underlayment so that the ridge slots will not be covered.
- E. Roof Deck:
1. Install one layer of TAMKO® underlayment over the entire area not covered by TAMKO® Moisture Guard®, TW Metal & Tile Underlayment, or TW Underlayment at the eaves or valley. Install sheets horizontally so water sheds and nail in place.
 2. On roofs sloped at more than 4:12, lap horizontal edges at least 2 inches (51mm) and at least 2 inches (51mm) over eaves membrane.
 3. On roofs sloped between 2" per foot up to but less than 4" per foot, lap horizontal edges at least 19 inches (482 mm) and at least 19 inches (482mm) over eaves membrane.
 4. Lap ends at least 4 inches (102 mm). Stagger end laps of each layer at least 36 inches (914 mm).
 5. Lap TAMKO® underlayment over TAMKO® Moisture Guard® or TW Metal & Tile Underlayment in valley at least 6 inches (152mm).
- F. Synthetic Guard™ Underlayment or Synthetic™ Guard Plus Underlayment Application.
1. Install in accordance with TAMKO's instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
 2. Synthetic Guard™ Underlayment or Synthetic™ Guard Plus Underlayment shall be installed over a clean, dry deck.
 3. Install TAMKO® Moisture Guard®, TW Metal & Tile Underlayment or TW Underlayment at eaves, rakes, skylights, dormers, and other vulnerable leak areas. Install TAMKO® Moisture Guard® or TW Metal & Tile Underlayment in valleys.
 4. Lay Synthetic Guard™ Underlayment or Synthetic™ Guard Plus Underlayment over deck and overlap 4" (mm) at side laps and 6" (152mm) at end laps.

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5. Follow the nail pattern as marked on the synthetic underlayment. Fasten at the fastener locations marked for all applications as solid circles. Fasteners on vertical and horizontal laps must be spaced 12" (305 mm) o.c.
 6. For high wind applications follow the nail pattern as marked on the underlayment. Fasten at the fastener locations marked for all applications as solid circles and fasten at the additional nail locations that are marked as crosses for high wind application. Fasteners on vertical and horizontal laps must be spaced (4" (102 mm) o.c. for high wind areas).
 7. For slopes less than 4:12, a double application of Synthetic Guard™ Underlayment or Synthetic™ Guard Plus Underlayment is required. See complete Synthetic Guard™ Underlayment or Synthetic™ Guard Plus Underlayment installation instructions at www.tamko.com.
- G. Penetrations:
1. Vent pipes: Install a 24 inch (610 mm) square piece of eaves membrane lapping over roof deck underlayment, seal tightly to pipe.
 2. Vertical walls: Install eaves membrane extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.
 3. Skylights and roof hatches: Install eaves membrane from under the built-in counter flashing and 12 inches (305mm) on to the roof surface lapping over roof deck underlayment.
 4. Chimneys: Install eaves membrane around entire chimney extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.
 5. Rake Edges: Install metal edge flashing over eaves membrane and roof deck underlayment, set tight to rake boards, lap joints at least 2 inches (51mm) and seal with plastic cement, secure with nails.

3.06 INSTALLATION OF TAMKO® STARTER SHINGLES

*****IMPORTANT NOTE: THIS SECTION IS FOR INFORMATIONAL PURPOSES AND DOES NOT SUPERCEDE, ALTER OR LIMIT THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. For a copy of the applicable installation instructions for complete and detailed product installation information visit our web site at www.tamko.com or contact TAMKO at 800-641-4691***.**

- A. General:
1. Install in accordance with TAMKO's application instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
 2. Refer to application instructions for the selected starter strip shingles.
- B. Placement and Nailing:
1. For maximum wind resistance along rakes & eaves, install any TAMKO® starter strip containing sealant or cement shingles to underlayment and each other in a 4" (102mm) width of any adhesive meeting the requirements of ASTM D4586, Type I.

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2. Place starter strip shingles 1/4" – 3/4" (6 – 19mm) over eave and rake edges to provide drip edge.
3. Nail approximately 1-1/2" – 3" (38 – 76mm) above the butt edge of the shingle.
4. Rake starter course should overlap eave edge starter strip at least 3" (76mm).

3.07 INSTALLATION OF TAMKO SHINGLES

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A. General:

1. Install in accordance with TAMKO's application instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
2. Minimize breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F (4.44 degrees C).
3. Handle carefully in hot weather to avoid scuffing the surfacing or damaging the shingle edges.

B. Placement and Nailing:

*****Note: Tear-Off or New Construction*****

1. Secure with nails per shingle per TAMKO's application instructions or local codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
2. Placement of nails varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.
3. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.
4. Shingle offset varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.

C. Placement and Nailing:

*****Note: Recover*****

1. Beginning with the starter strip, trim shingles so that they "nest" within the shingle located beneath it. This procedure will yield a first course that is typically 3 inch (76mm) to 4 inch (102mm) rather than a fully exposed shingle.
2. Laterally, offset the new shingles from the existing keyways, to avoid waves or depressions caused by excessive dips in the roofing materials.
3. Using the bottom of the tab on existing shingles, align subsequent courses.
4. *Note: DO NOT install standard sized shingles (5 inch exposure) over metric (5-5/8 inch exposure) shingles, as it will overexpose the shingles and reveal the nails. Use standard alignment methods to assure proper shingle placement.

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5. Secure with nails per shingle per TAMKO's instructions or local codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
6. Placement of nails varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.
7. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.
8. Shingle offset varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.

D. Valleys

*****Note: Choose a Method*****

For Heritage® Vintage® Shingles use Open Valley only

1. Install valleys using the "open valley" method:
 - a. Snap diverging chalk lines on the metal flashing, starting at 3 inches (76mm) each side of top of valley, spreading at 1/8 inch per foot (9mm per meter) to the eaves.
 - b. Run shingles to chalk line.
 - c. Trim last shingle in each course to match the chalk line, do not trim shingles to less than 12 inches (305mm) wide.
 - d. Apply a 2 inch (51mm) wide strip of plastic cement under ends of shingles, sealing them to the metal flashing.
2. Install valleys using the "Heritage® Valley" method per TAMKO's application instructions:
 - a. Run the first course of shingles from the higher roof slope across the valley at least 12 inches (305mm).
 - b. Run succeeding courses of shingles from the lower roof slope across the valley at least 12 inches (305mm) and nail not closer than 6 inches (152mm) to center of valley.
 - c. To the adjoining roof plane, apply one row of shingles vertically facing the valley and 2 inches back from the valley centerline.
 - d. To complete the valley, apply shingles on the adjoining roof plane by positioning the tip of the first shingle of each row at the 2 inch point from the centerline where the edge of the vertical shingle has been applied, covering the vertical shingle.
3. Install valleys using the "closed cut valley" method:
 - a. Run the first course of shingles from the higher roof slope across the valley at least 12 inches (305mm).
 - b. Run succeeding courses of shingles from the lower roof slope across the valley at least 12 inches (305mm) and nail not closer than 6 inches (152mm) to center of valley.
 - c. Run shingles from the upper roof slope into the valley and trim 2 inches (51mm) from the center line.

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A. General

1. Ventilation must meet or exceed current F.H.A., H.U.D. and local code requirements.

B. Ridge / Soffit Ventilation

1. Cut continuous vent slots through the sheathing, stopping 6 inches (152mm) from each end of the ridge.
2. On roofs without ridge beam, make a slot 1 inch (25mm) wide, on either side of the peak (2 inch (51mm) overall).
3. On roofs with ridge beam, make two slots 1-3/4 inches (44.5mm) wide, one on each side of the peak (3 ½ inch (89mm) overall).
4. Install ridge vent material along the full length of the ridge, including uncut areas.
5. Butt ends of ridge vent material and join using roofing cement.
6. Install eaves vents in sufficient quantity to equal or exceed the ridge vent area.

C. Roof and Gable Louvers:

1. Cut vent hole through sheathing as specified by the manufacturer for the type of vent to be installed.
2. Install a 24 inch (610mm) square of Moisture Guard® or TW Metal & Tile Underlayment, centered around the hole for roof louvers
3. Install according to manufacturer's instructions for flashing vent penetrations
4. Install eave vents in sufficient quantity to equal or exceed the exhaust vent area, calculated as specified by manufacturer.

D. Whole House Fans

1. Install at desired locations in ceiling below attic space per manufacturer recommended location and application instructions.

3.09 PROTECTION

- A. Protect installed products from foot traffic until completion of the project.
- B. Any roof areas that are not completed by the end of the workday are to be protected from moisture and contaminants.

END OF SECTION