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Product Evaluation

RC22 | 0221

Engineering Services Program

The following product has been evaluated for compliance with the wind loads specified in the International Residential Code (IRC) and the International Building Code (IBC).

This product evaluation is not an endorsement of this product or a recommendation that this product be used. The Texas Department of Insurance has not authorized the use of any information contained in the product evaluation for advertising, or other commercial or promotional purpose.

This product evaluation is intended for use by those individuals who are following the design wind load criteria in Chapter 3 of the IRC and Section 1609 of the IBC. The design loads determined for the building or structure shall not exceed the design load rating specified for the products shown in the limitations section of this product evaluation. This product evaluation does not relieve a Texas licensed engineer of his responsibilities as outlined in the Texas Insurance Code, the Texas Administrative Code, and the Texas Engineering Practice Act.

For more information, contact TDI Engineering Services Program at (800) 248-6032.

Evaluation ID: RC-22

Effective Date: February 1, 2021
Re-evaluation Date: February 2025

Product Name: ICP Adhesives Polyset® AH-160 Roof Tile Adhesive

Manufacturer: ICP Adhesives and Sealants
12505 NW 44th Street
Coral Springs, FL 33065
(954) 344-3566 ext. 203

General Description:
ICP Adhesives Polyset® AH-160 roof tile adhesive for adhering concrete and clay roofing tiles to roof underlayment systems. The two components of the adhesive system are referred to as chemical or component "A" and chemical or component "B" in the ICP Adhesives and Sealants literature. The two components are provided in color coded refillable tanks that are available in 17, 60, 120, and 350 gallon capacities or in disposable units called ProPack 30 and ProPack 100. Equipment for dispensing the ICP Adhesives Polyset® AH-160 is color coded for ease of use with the ICP Adhesives RTF1000EZ dispensing system.

Roof Tiles: Concrete and clay roof tiles must be installed in accordance with this product evaluation report and in accordance with the ICP Adhesives Polyset® AH-160 Installation Instructions published by ICP Adhesives and Sealants, © 2016. General installation requirements for the roof tiles must be as specified in the roof tile manufacturer's installation instructions.

Licensed Applicators: Installation must be performed by applicators who hold a current and valid Qualified Applicator Card presented by ICP Adhesives and Sealants.

Tile Dimension Limitations: The Flat/Low profile, Medium profile, and High profile roof tiles must be between 12" and 21" in length. The exposed width of the roof tiles must be between 8" and 15". The maximum thickness of the tail of the roof tiles must not exceed 1-3/8". Each roof tile must have at least 2/3 of the tile's area free of adhesive contact.

Roof Tile Profile Classifications: Roof tile profiles must be classified as one of the following:

Flat/Low Profile: Flat/Low profile tiles are defined as tiles having a rise equal to or less than 1/2" and a rise-to-width ratio of less than or equal to 1-1/2.

Medium Profile: Medium profile tiles are defined as tiles having a rise greater than 1/2" and a rise-to-width ratio of less than or equal to 1-1/2.

High Profile: High/Barrel profile tiles are defined as those tiles having a rise to width ratio greater than 1-1/2.

Roof Slope Limitations: The minimum roof slope is: 2-1/2:12.

Installation:

Roof Framing and Roof Deck: Roof framing members must be in accordance with either the IRC or the IBC. The roof framing members must not be spaced greater than 24" on center. The roof deck must be solidly sheathed with minimum 15/32" wood structural panels. The minimum thickness and application of the roof sheathing to the roof framing members must be in accordance with either the IRC or the IBC to resist the required wind loads.

If the existing roof deck is a spaced sheathing board roof deck, then the spaced sheathing boards must either be removed or covered with minimum 15/32" wood structural panels. The wood structural panels must be installed over the spaced sheathing boards in accordance with either the International Residential Code or the International Building Code to resist the required wind loads.

Metal Drip Edge: A metal drip edge must be installed as specified in the roof tile manufacturer's installation instructions.

Underlayment (Use one of the following options):

Option 1: Hot Mop 30/90 Underlayment: The underlayment must consist of a two-ply 30/90 hot mop underlayment system.

- The base ply (anchor sheet) of the underlayment system must be an ASTM D 226 Type II (No. 30) asphalt-saturated organic felt. The base ply must be fastened to the wood roof deck with minimum 11-gauge (minimum 0.120" shank diameter) corrosion resistant roofing nails (smooth, ring, or screw shank) with a minimum 1" diameter flat head or with minimum 1-5/8" diameter tin caps. The fasteners must be long enough to penetrate a minimum of 1/4" through the bottom (underside) of the wood deck.
- The top ply of the underlayment system must consist of one layer of No. 90 ASTM D249 mineral surfaced roll roofing. The top ply must be applied over the base ply by first adhering the top ply to the base ply with a full mopping of ASTM D 312 Type IV asphalt. Next, the top ply must be back nailed to the base ply with minimum 11-gauge (minimum 0.120" shank diameter) corrosion resistant nails (smooth, ring, or screw shank) with a minimum 1" diameter

flat head or with minimum 1-5/8" diameter tin caps. The fasteners must be long enough to penetrate a minimum of 1/4" through the bottom (underside) of the wood deck.

Attachment of 30/90 Underlayment to Roof Deck:

- The required underlayment design pressure is determined using analysis based on the Building Exposure, the mean roof height of the structure, the location of the structure, and the roof slope of the structure.
- The allowable uplift resistance for the underlayment attachment is specified in Table 1. The allowable uplift resistance of the underlayment attachment must be greater than the required underlayment design pressure determined from the analysis.

Option 2: Self-Adhering Underlayment: Self-adhering underlayment may be used in accordance with one of the following requirements:

- The self-adhering underlayment must be listed in a current ICC-ES Evaluation Report as approved for use with ICP Adhesives Polyset® AH-160, or
- Document through testing at a TDI accepted test laboratory as having met the requirements set forth in ICC-ES AC152 Section 3.4. For testing in accordance with ICC-ES AC152, Section 3.4.5, the tensile adhesion/long term aging tests must have been completed using ICP Adhesives Polyset® AH-160 with the subject self-adhering underlayment.

Attachment of Self-Adhering Underlayment to Roof Deck:

- The self-adhering underlayment must be installed in accordance with the self-adhering underlayment manufacturer's published installation instructions. The allowable uplift resistance of the self-adhering underlayment must be in accordance with the underlayment manufacturer's test and/or evaluation documentation. The underlayment must be backnailed to the roof deck with minimum 11-gauge (minimum 0.120" shank diameter) corrosion resistant nails (smooth, ring, or screw shank) with minimum 1-5/8" diameter tin caps spaced 12" on center. The fasteners must be long enough to penetrate a minimum of 1/4" through the bottom of the wood deck.

Moment of Resistance: The overturning resistance (moment of resistance) due to wind of the roof tiles based on the installation method for the roof tiles is shown in Tables 2A and 2B.

Aerodynamic Uplift Moment: The aerodynamic uplift moment for the roof tile is calculated using Equation 16-34 from the 2018 IBC. The aerodynamic uplift moment is calculated based on the mean roof height for the installation and the required wind speed and Exposure condition for the installation location using ASCE 7-16.

Permissible Tile Installation: The roof tiles may be installed if the Moment of Resistance for the roof tile specified in this evaluation report is greater than the Aerodynamic Uplift Moment for the roof tile calculated for the structure location.

Battens: Battens must be installed as required by the roof tile manufacturer. If battens are installed, then they must be installed over the underlayment. If battens are used, then the ICP Adhesives Polyset® AH-160 must not applied to the battens.

Table 1
Allowable Uplift Resistance for Two-Ply Underlayment Attachment (psf)

Method (see below)	Lap Row (inches o.c.)	Field Rows (inches o.c.)	Backnail Cap Sheet (inches o.c.)	Allowable Uplift Resistance (psf)			
				15/32" Plywood		19/32" Plywood	
				Smooth	Deformed[1]	Smooth	Deformed[1]
A	6	12	12	41.6	47.4	52.7	60.0
		11		43.1	49.1	54.6	62.1
		10		44.9	51.0	56.8	64.6
		9		47.0	53.5	59.5	67.7
		8		49.6	56.5	62.9	71.5
		7		53.0	60.3	67.2	76.4
		6		57.6	65.5	72.9	82.9
		5		63.9	72.7	81.0	92.0
		4		73.5	83.6	93.0	105.8
		3		89.3	101.6	113.2	128.6
B	6	12	12	49.6	56.5	62.9	71.5
		11		51.8	58.9	65.6	74.6
		10		54.4	61.9	68.9	78.3
		9		57.6	65.5	72.9	82.9
		8		61.5	70.0	78.0	88.6
		7		66.6	75.8	84.4	96.0
		6		73.5	83.6	93.0	105.8
		5		83.0	94.4	105.1	119.5
		4		97.3	110.7	123.2	140.1
		3		121.1	137.8	153.4	174.4
C	6	12	12	58.6	66.6	74.2	84.3
		11		61.4	69.9	77.8	88.5
		10		64.9	73.9	82.2	93.5
		9		69.2	78.7	87.6	99.6
		8		74.4	84.7	94.3	107.2
		7		81.3	92.4	102.9	117.0
		6		90.3	102.8	114.4	130.1
		5		103.0	117.2	130.5	148.4
		4		122.1	138.9	154.6	175.8
		3		153.9	175.1	194.9	221.6

Attachment Method A: One row at the minimum 2" wide base sheet side laps; two staggered rows in the field of the base sheet; and one row backnailed within the minimum 3" wide cap sheet side lap.
Attachment Method B: One row at the minimum 2" wide base sheet side laps; three staggered rows in the field of the base sheet; and one row backnailed within the minimum 3" wide cap sheet side lap.
Attachment Method C: One row at the minimum 2" wide base sheet side laps; four staggered rows in the field of the base sheet; and one row backnailed within the minimum 3" wide cap sheet side lap.
[1]Deformed shank includes either ring shank or screw shank nails

Table 2A
Summary of Allowable Overturning Moment (Field Tiles)

Tile Profile	Material	Paddy	Figure	Allowable Overturning Moment (ft-lbf)
Low/Flat	Concrete or Clay	Medium (~30 gram)	1	60
	Concrete or Clay	Large (~45 gram)	4	112
	Concrete or Clay	Two Paddy	7	54
Medium	Concrete or Clay	Medium (~30 gram)	2	39
	Concrete or Clay	Large (~54 gram)	5	67
	Concrete or Clay	Two Paddy	8	58
High	Concrete or Clay	Medium (~30 gram)	3	65
	Clay	Large (~45 gram)	6	134
	Concrete	Large (~63 gram)	6	109
	Concrete or Clay	Two Paddy	9	40
2-Piece Barrel	Clay	1 @ 2x10-inch (~35 gram) for pans; 2 @ 1x10-inch (~17 gram) for cap	10	147
	Concrete			107

Table 2B
Summary of Allowable Overturning Moment (Hip / Ridge Tiles)

Tile Material	Substrate	Paddy	Figure	Allowable Overturning Moment (ft-lbf)
Clay	2x wood stringer / ridge board	Continuous ribbon; ~34 gram/ft	11	135
Concrete	2x wood stringer / ridge board	Continuous ribbon; ~34 gram/ft	11	116
Clay	2x wood stringer / ridge board	Overlap: 1x6" bead (~10.5 gram) Head: One #10x2-1/2"screw	12	105
Concrete	2x wood stringer / ridge board	Overlap: 1x6" bead (~10.5 gram) Head: One #10x2-1/2" screw	12	76
Concrete or Clay	Trim Lock™ (aluminum, galvanized, Galvalume or stainless steel)	Continuous ribbon; ~34 gram/ft	11	180
Concrete or Clay	Trim Lock™ Plus (aluminum, galvanized, Galvalume or stainless steel)	Continuous ribbon; ~34 gram/ft	11	175
Concrete or Clay	Trim Lock™ or Trim Lock™ Plus (aluminum, galvanized, Galvalume or stainless steel)	Two paddy (~10.5 gram)	11	101

ICP Adhesives Polyset® AH-160: The ICP Adhesives Polyset® AH-160 is dispensed using an ICP RTF1000EZ dispensing system. The dispensing system must be operated in accordance with the ICP *RTF1000 Installation and Operating Manual*. Calibration of the ICP RTF1000EZ dispensing system equipment is required before the application of the ICP Adhesives Polyset® AH-160. The mix ratio between chemical "A" and chemical "B" must be within the range of 1.0 A:B to 1.15 A:B. The calibrated adhesive is dispensed in the form of paddies. The quantity of adhesive dispensed will depend on the paddy placement selected.

Roof Tile Installation: The roof tiles and the underlayment system must be clean and dry at the time of application.

The roof tiles must be adhered to the underlayment using ICP Adhesives Polyset® AH-160 in accordance with ICP Adhesives and Sealants published installation instructions and the paddy application methods provided in this product evaluation report. A brief overview of the installation instructions is presented in this section.

The roof tiles must be adhered directly to the underlayment system. Battens are permitted but are not required. If battens are used, then the roof tiles must not be adhered to the battens. Roof tiles must be adhered directly to freshly applied adhesive. The roof tile must be set within 1 to 2 minutes after the adhesive has been dispensed depending on the ambient temperature.

The adhesive is dispensed in the form of paddies. The following paddy application methods are acceptable:

(1) Medium paddy placement
(2) Large paddy placement
(3) Two paddy placement
(4) Two-Piece Barrel placement

Presented below are brief overviews of the installation instructions for flat/low profile, medium profile, high profile, and two-piece barrel profile roof tiles.

Flat/Low Profile, Medium Profile, and High Profile Roof Tiles:

General Installation Requirements: Apply a paddy of ICP adhesive vertically under the tile at the starting side of the roof. Install the first course of the tile over the paddy of ICP adhesive. Make certain that the tiles overhang the eave drip edge evenly along the entire first course. Apply a paddy of ICP adhesive vertically under the pan closest to the underlock of the previously installed tile. For flat tiles, place adhesive under the strengthening rib closest to the overlock of the tile being set.

Paddy Placement Application: Refer to either the medium or large paddy placement applications shown in Figures 1 thru 9 at the end of this product evaluation report for proper placement and sizes of adhesive paddies. Fasteners must be installed in addition to the adhesive as required based on roof slope. The fasteners must be as specified in the IRC or the IBC.

Two-Piece Barrel Roof Tiles:

General Installation Requirements: Apply a paddy of adhesive vertically under the pan tile at the starting side of the roof. Install the first course of tile over the paddy of ICP adhesive. Make certain that the tiles overhang the eave drip edge evenly along the entire first course. Turn the cover tile over on its back to allow for the application of ICP adhesive. Apply a bead of ICP adhesive directly onto the inner edge of each side of the cover tile. The cover tile is then turned over and placed onto previously installed pan tiles such that the adhesive is in contact with barrel edges of the pan tiles.

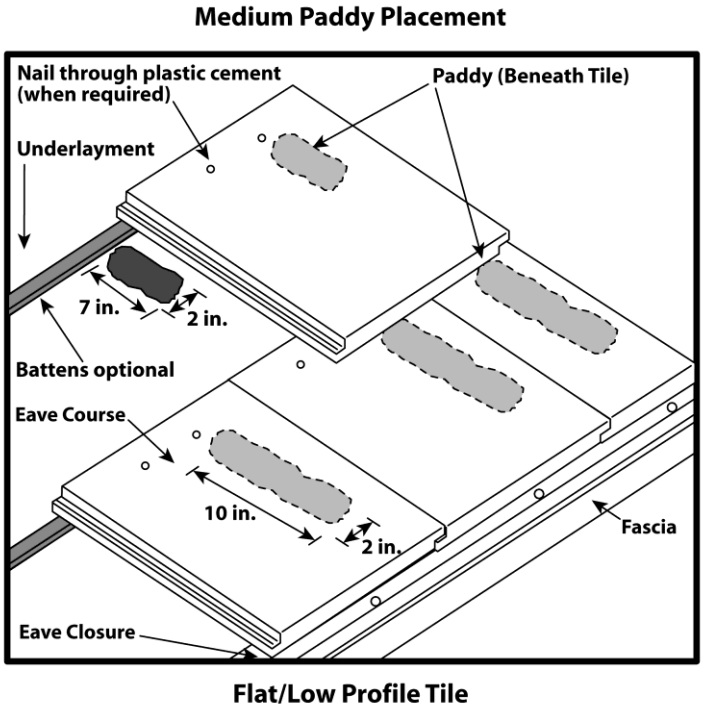
Paddy Placement Application: Refer to the large paddy application for two-piece barrel tiles shown in Figure 10 at the end of this product evaluation report for proper placement and size of adhesive paddies. Fasteners must be installed in addition to the adhesive as required based on roof slope. A 2"x4" nailer, placed on edge, straw nail or a wire and nailing system, may be required for fastening two-piece barrel tiles on steeper pitches.

Additional Attachment Requirements for Roof Tiles:

- For roof slopes above 6:12, the eave course must be fastened with a single corrosion resistant fastener in addition to the adhesive. The fasteners must be as specified in the IRC or the IBC. Flashing cement must be applied to seal all fastener penetrations when required by underlayment manufacturer.
- For roof slopes above 6:12 up to and including 7:12, every third tile in every fifth course must be fastened with a single corrosion resistant fastener in addition to the adhesive. The fasteners must be as specified in the IRC or the IBC. Flashing cement must be applied to seal all fastener penetrations when required by underlayment manufacturer.
- For roof slopes greater than 7:12, every tile must be fastened with a single corrosion resistant fastener in addition to the adhesive. The fasteners must be as specified in the IRC or the IBC. Flashing cement must be applied to seal all fastener penetrations when required by underlayment manufacturer.
- For roof slopes > 24:12, the nose end of all tiles must be fastened to the roof deck with a nose clip in addition to a large paddy of adhesive. The fasteners used to secure the nose clip to the roof deck must be as specified in the IRC or the IBC. Flashing cement must be applied to seal all fastener penetrations.

Note: The ICP Adhesives Polyset® AH-160 Installation Instructions published by ICP Adhesives and Sealants, Inc., © 2014, must be available on the job site during installation. Use fasteners that are corrosion resistant as specified in the IRC and the IBC.

Figure 1
Medium Paddy Placement – Flat/Low Profile Tile



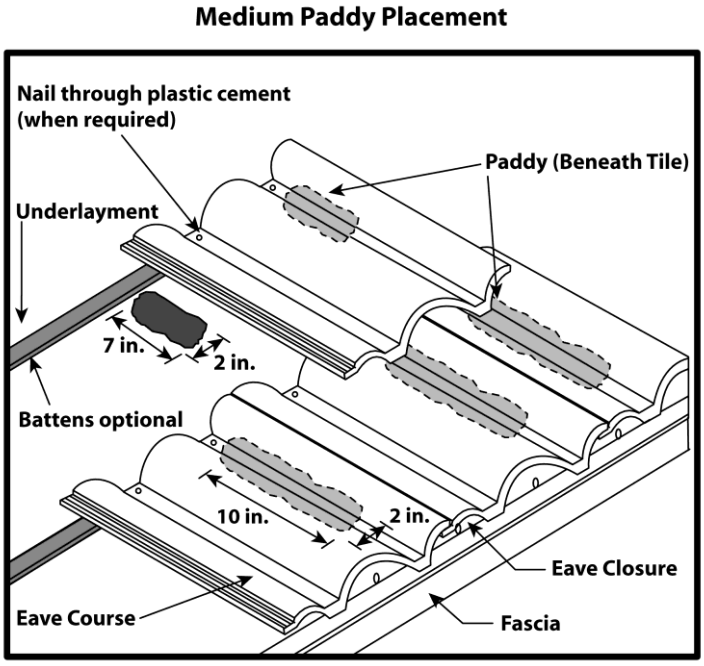
Medium Paddy Placement - Flat/Low Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the strengthening rib of the tile closest to the overlock of the tile being set. Insure approximately 17 to 23 square inch adhesive contact with the underside of tile. Refer to Figure 1.

2. At the second course, apply a minimum 2" x 7" x 1" paddy onto the underlayment positioned under the strengthening rib closest to the overlock of the tile being set.

3. Continue in the same manner. Insure approximately 10-12 square inch adhesive contact with underside of tile.

Figure 2
Medium Paddy Placement – Medium Profile Tile



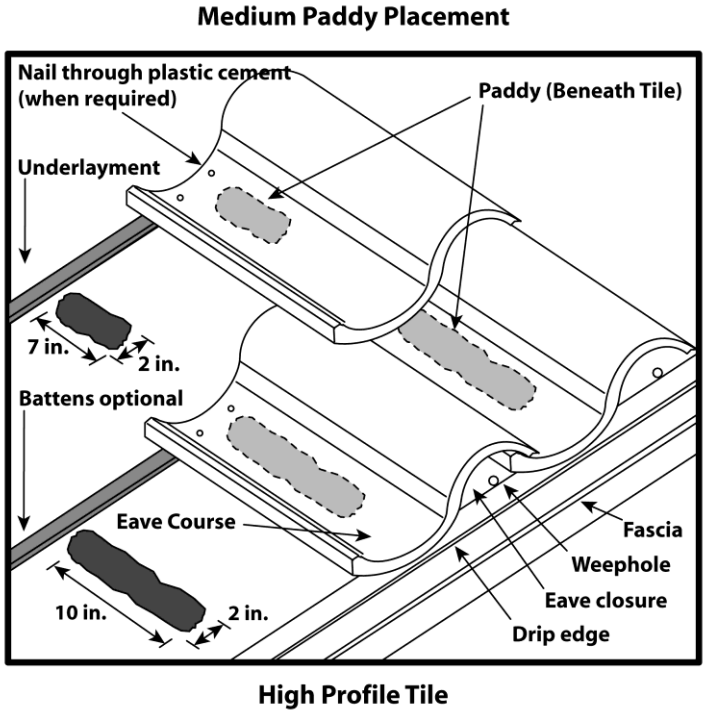
Medium Paddy Placement - Medium Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile closest to the overlock of the tile being set. Insure approximately 17 to 23 square inch adhesive contact with the underside of tile. Refer to Figure 2.

2. At the second course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile closest to the overlock of the tile being set.

3. Continue in the same manner. Insure approximately 12 to 14 square inch adhesive contact with underside of tile.

Figure 3
Medium Paddy Placement - High Profile Tile



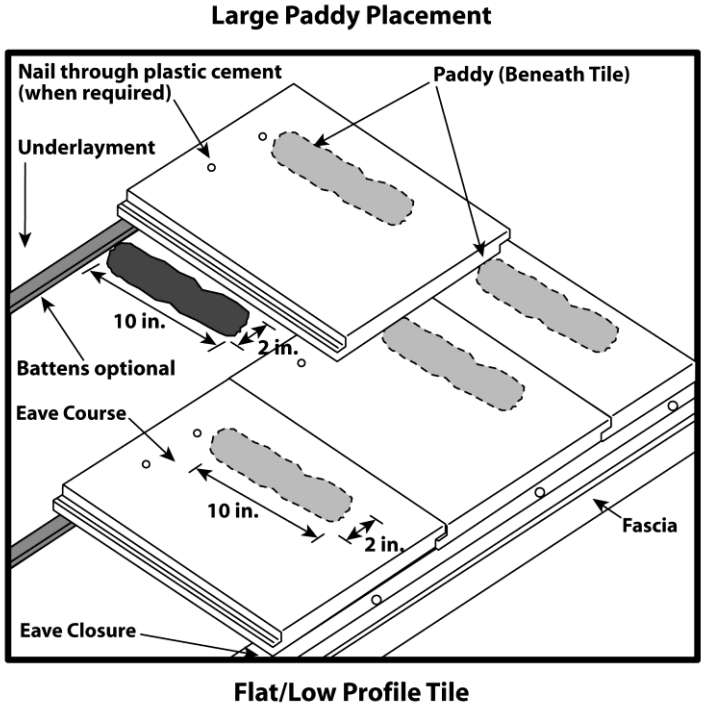
Medium Paddy Placement - High Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile closest to the overlock of the tile being set. Insure approximately 17 to 23 square inch adhesive contact with the underside of the tile. Refer to Figure 3.

2. At the second course, apply a minimum 2" x 7" x 1" paddy onto the underlayment positioned as shown under the pan portion of the tile closest to the tile being set.

3. Continue in the same manner. Insure approximately 12 to 14 square inch adhesive contact with underside of tile.

Figure 4
Large Paddy Placement – Flat/Low Profile Tile

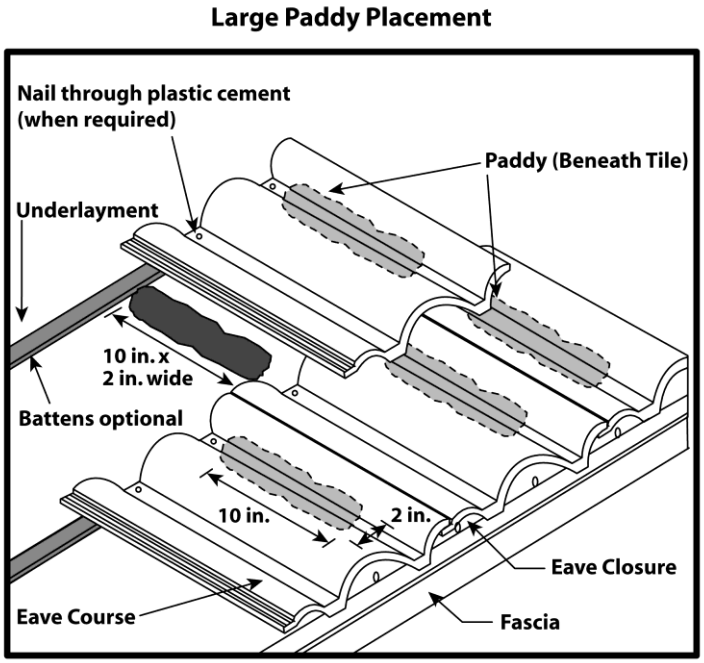


Large Paddy Placement - Flat/Low Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the strengthening rib closest to the overlock of the tile being set. Refer to Figure 4.

2. Continue in the same manner with the remaining tiles. Insure approximately 17 to 23 square inch adhesive contact with underside of tile.

Figure 5
Large Paddy Placement – Medium Profile Tile

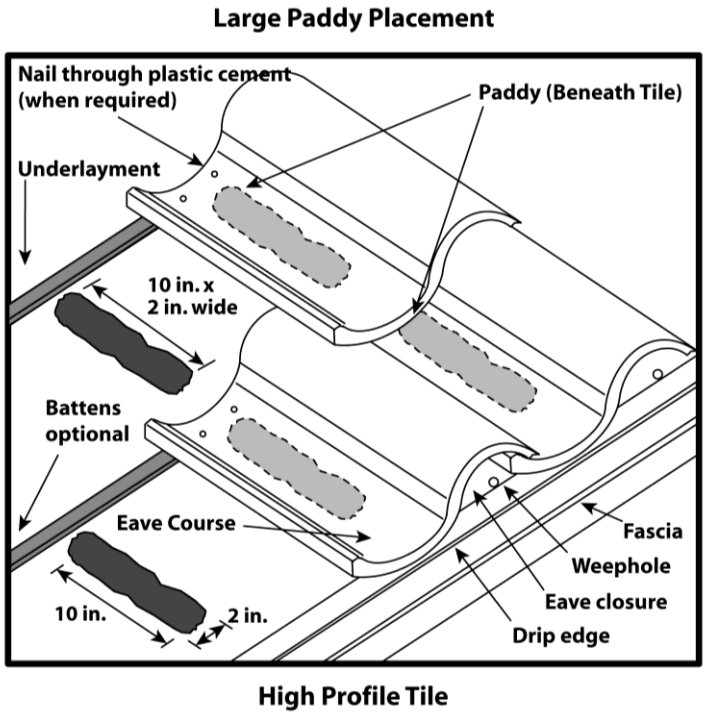


Large Paddy Placement - Medium Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile closest to the overlock of the tile being set. Refer to Figure 5.

2. Continue in the same manner with the remaining tiles. Insure approximately 17 to 23 square inch adhesive contact with underside of tile.

Figure 6
Large Paddy Placement - High Profile Tile

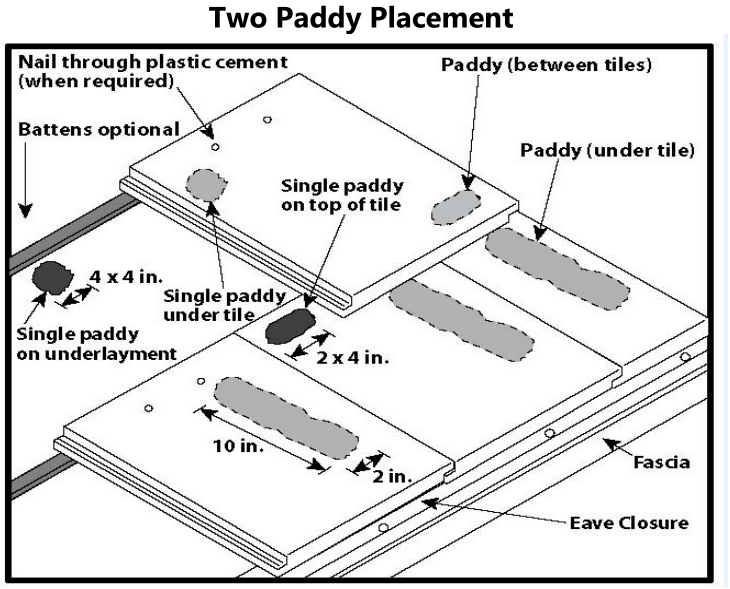


Large Paddy Placement - High Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile closest to the overlock of the tile being set. Refer to Figure 6.

2. Continue in the same manner with the remaining tiles. Insure approximately 17 to 23 square inch adhesive contact with underside of tile.

Figure 7
Two Paddy Placement – Flat/Low Profile Tile



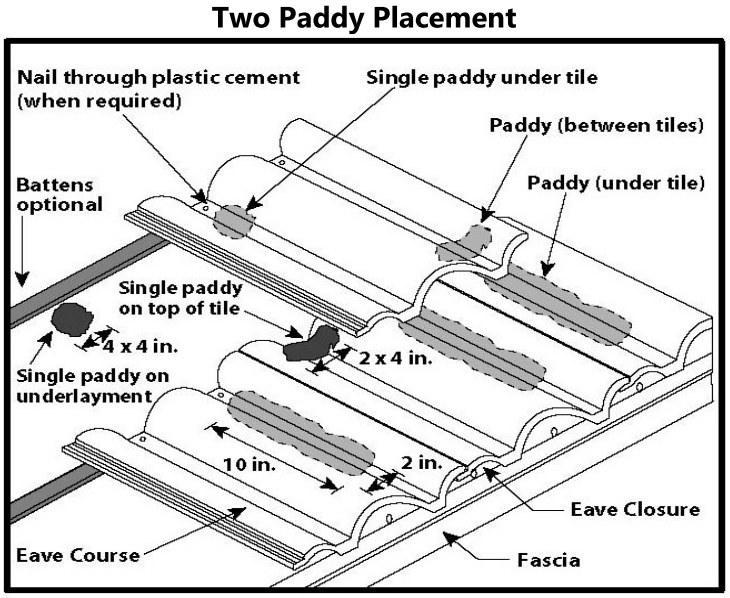
Two Paddy Placement - Flat/Low Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the strengthening rib closest to the overlock of the tile being set. Insure approximately 17 to 23 square inch adhesive contact to the underside of the tile. Refer to Figure 7.

2. Apply a 4" x 4" x 1" paddy onto the underlayment just below the second course line positioned under the strengthening rib closest to the underlock side of the tile being set. Insure approximately 7 to 9 square inch adhesive contact to the underside of the tile.

3. Also apply a 2" x 4" x 3/4" paddy on top of the eave course tile surface as shown, on top of the strengthening rib closest to the underlock of the first course of tile. Install second course of tile. Insure approximately 9 to 11 square inch adhesive contact to the underside of the tile at the overlap. Continue in the same manner with remaining tiles.

Figure 8
Two Paddy Placement - Medium Profile Tile



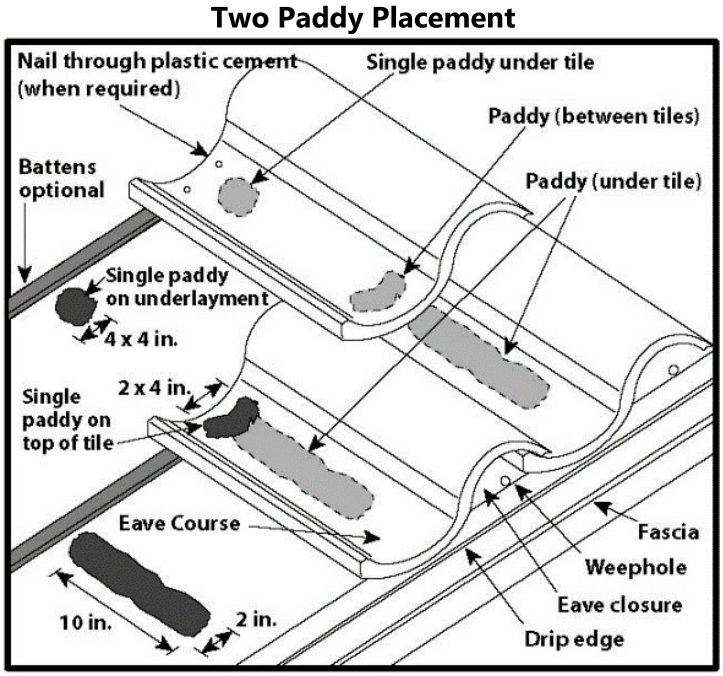
Two Paddy Placement - Medium Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile closest to the overlock of the tile being set. Insure approximately 17 to 23 square inch adhesive contact to the underside of the tile. Refer to Figure 8.

2. Apply a 4" x 4" x 1" paddy onto the underlayment just below the second course line positioned under the pan portion of the tile closest to the underlock for the second course tile being installed. Insure approximately 7 to 9 square inch adhesive contact to the underside of the tile.

3. Also apply a 2" x 4" x 3/4" paddy on top of the eave course tile surface on top of the pan portion of the tile closest to the underlock of the first course tile. Install second course of tile. Insure approximately 9 to 11 square inch adhesive contact to the underside of the tile at the overlap. Continue in the same manner with remaining tiles.

Figure 9
Two Paddy Placement - High Profile Tile



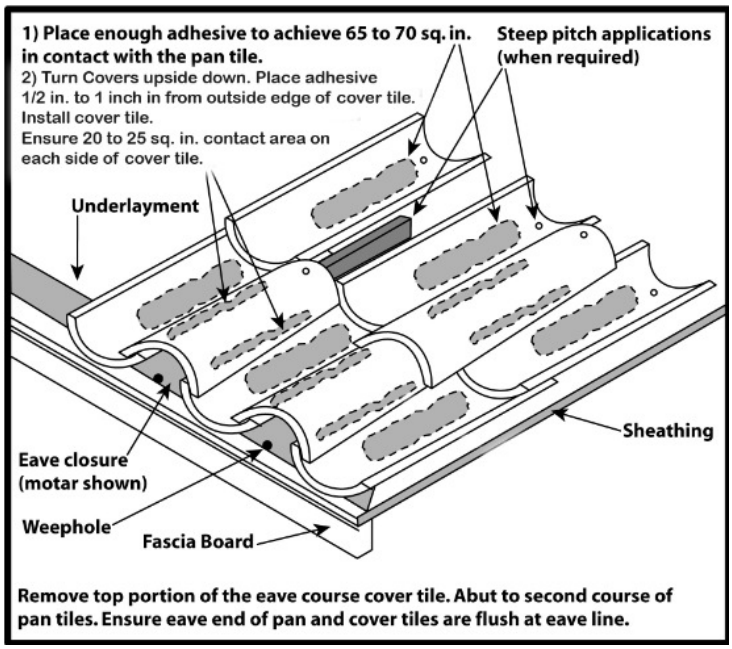
Two Paddy Placement - High Profile Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under the pan portion of the tile. Insure approximately 17 to 23 square inch adhesive contact to the underside of the tile. Refer to Figure 9.

2. Apply a 4" x 4" x 1" paddy onto the underlayment just below the second course line positioned under the pan portion of the tile closest to the underlock for the second course tile being installed. Insure approximately 7 to 9 square inch adhesive contact to the underside of the tile.

3. Also apply a 2" x 4" x 3/4" paddy on top of the eave course tile surface on top of the pan portion of the tile closest to the underlock of the first course tile. Install second course of tile. Insure approximately 9 to 11 square inch adhesive contact to the underside of the tile at overlap. Continue in the same manner with remaining tiles.

Figure 10
Two-Piece Barrel Tile



Large Paddy Placement - Two-Piece Barrel Tile

1. Starting at the eave course, apply a minimum 2" x 10" x 1" paddy onto the underlayment positioned under two adjacent pan tiles. Refer to Figure 10. Support the eave tiles from rocking until the adhesive has had a chance to cure.

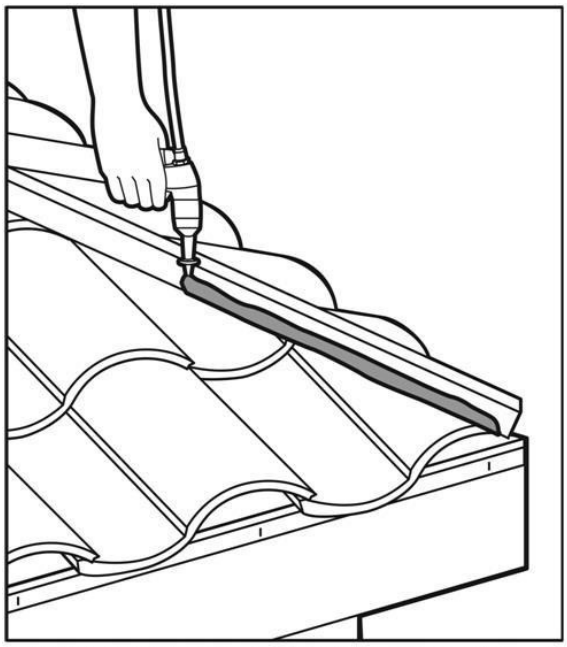
2. Continue in the same manner bringing two pan courses up toward the ridge. Insure approximately 65 to 70 square inches of adhesive contact with the underside of the pan tile.

3. Turn covers upside down exposing the underside of the tile. Apply a minimum 1" x 10" bead of adhesive directly over the inner edge of each side of the cover tile. Leave approximately 3/4" to 1" from the outer edge of the tile, inward, free of adhesive to allow for expansion.

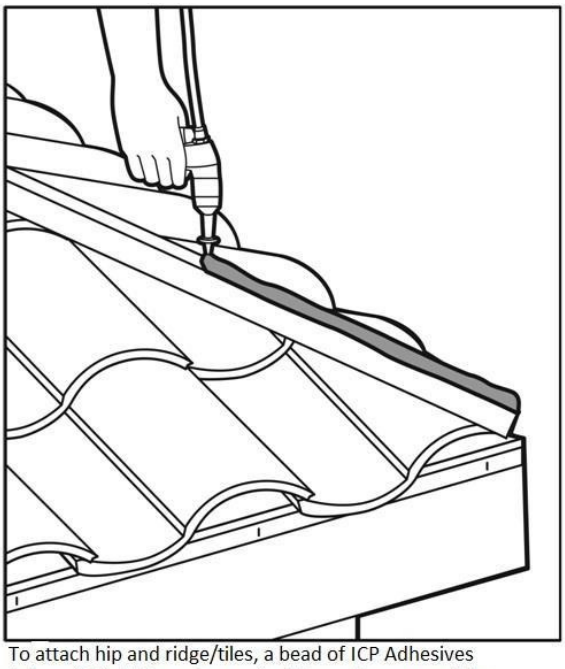
4. Turn cover tile over after adhesive is applied and place onto pan tile course. Insure a minimum of 20 to 25 square inches of contact area on each side of the cover tile to the pan tile. Continue in the same manner. Trim away any cured exposed adhesive.

5. When additional nailing is required for steep roofs, either a 2x4 nailer, placed on edge, straw nail, or a wire and nailing system may be used.

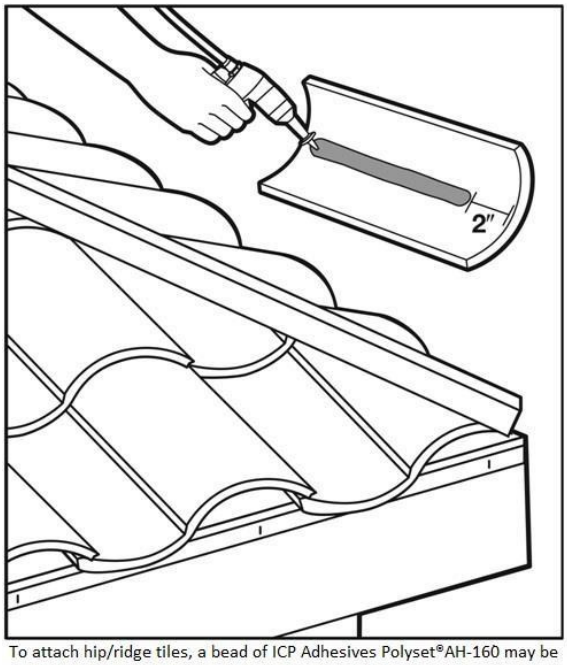
Figure 11
Independent Application – Hip and Ridge



A bead of ICP Adhesives Polyset®AH-160 may be applied above the field tile surface on both sides of the hip/ridge board or galvanized frame

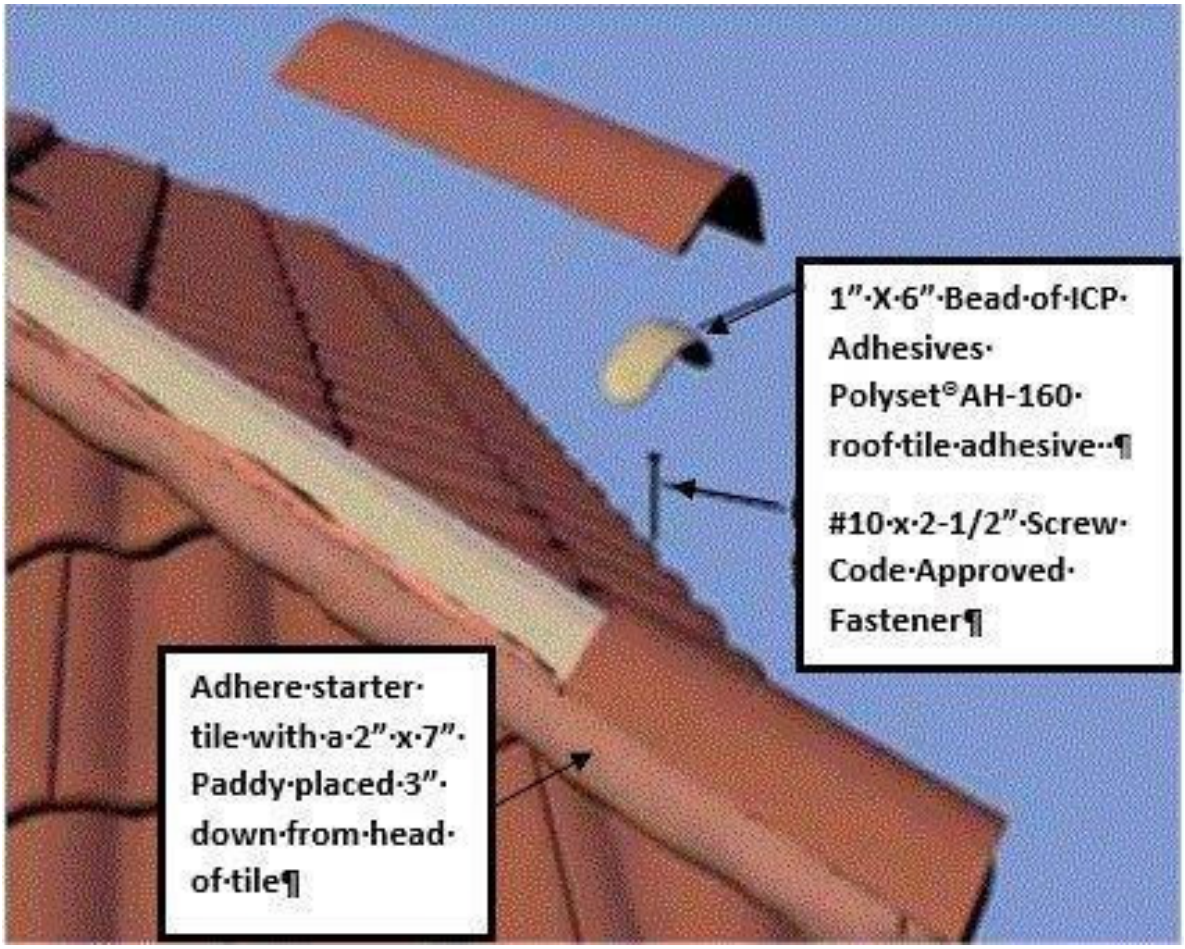


To attach hip and ridge/tiles, a bead of ICP Adhesives Polyset®AH-160 may be applied down the center of the hip/ridge board or galvanized frame



To attach hip/ridge tiles, a bead of ICP Adhesives Polyset®AH-160 may be applied along the full length of the tile excluding 2 inches on the eave end of the tile

Figure 12
Interdependent Application – Hip and Ridge



Note: Keep the manufacturer’s installation instructions available on the job site during the installation. Use corrosion resistant fasteners as specified in the IRC and the IBC.