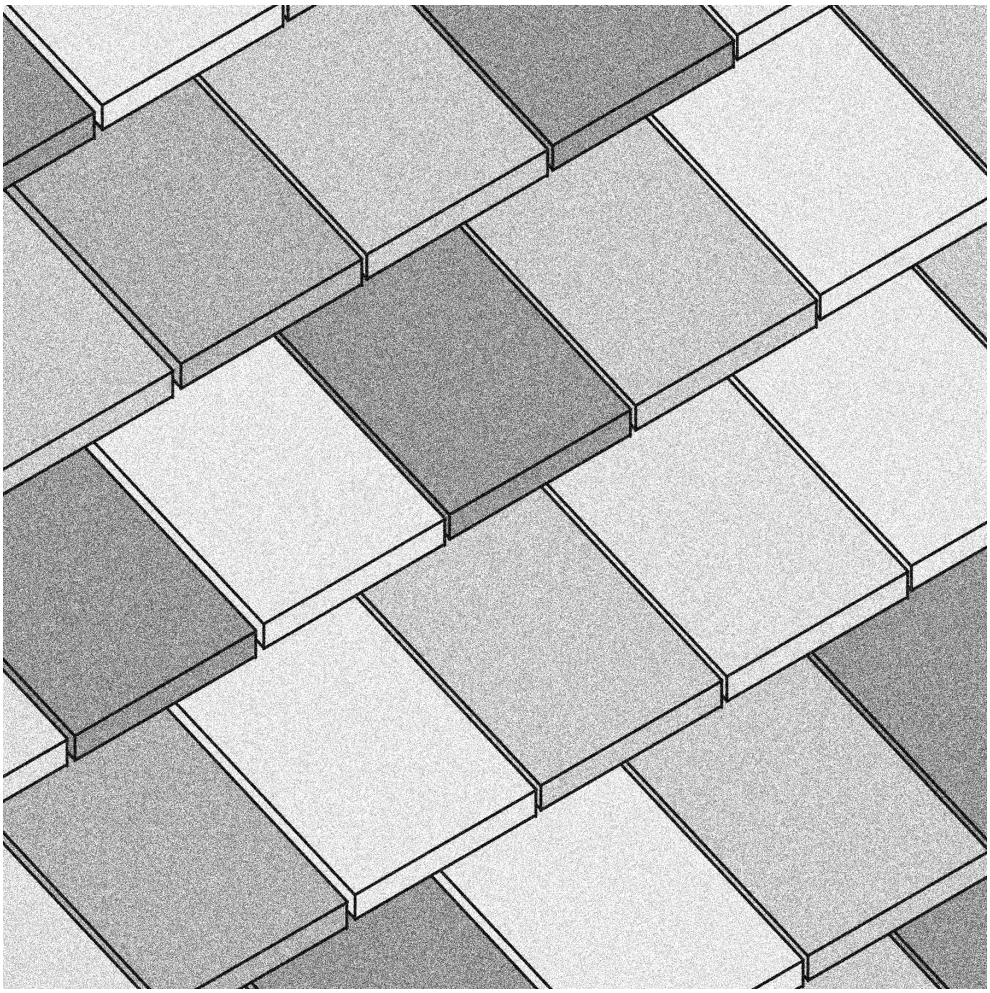
LUDOWICI®



Interlocking Tile Installation Manual

www.ludowici.com

CLAY TILE ROOFING

has been in existence for over a millennium. In the last few decades, clay tile roof installation techniques have been refined to protect your project while retaining the aesthetic, "of the earth", characteristics that make up the roof's appeal. The purpose of this manual is to provide technical information and installation instructions for Ludowici clay tile. It is intended to serve as a guide for proper techniques for typical installations. Ludowici clay tile is a versatile roofing material and can be applied on complex, original designed roofs. Installers are encouraged to contact Ludowici representatives for any question not covered in this manual. Some techniques may vary from region to region and other sound installation techniques may also be acceptable.

A Ludowici roof installed today will last over 100 years, be sure that all other roof components and installation techniques are just as durable.

Table of Contents

4 **Physical Characteristics**
4 Field Tile
5 Fittings
6 Hip & Ridge
8 Field Tile - Lexington Slate & Century Shake
9 Hip & Ridge - Lexington Slate & Century Shake

10 **Before Getting Started**
10 Roof Slope
10 Weight
10 Roof Deck
11 Underlayment
12 Fastening Methods

14 **Getting Started**

15 **Preparing the Roof**
15 Inspecting the Deck
15 Installing the Underlayment
16 Concrete Deck
16 Ice Dam Protection
17 Applying Wood Nailers and Battens
18 Measuring and Chalking the Roof
20 Tile Distribution Over Deck
21 Cutting, Notching and Drilling
22 Blending

24 **Installing Flashing**
24 Eave
25 Rake
26 Valley
28 Side Walls
29 Dormer
30 Head Wall
31 Chimney
32 Skylights and Plumbing Vent
33 Pitch Change and Built In Gutters

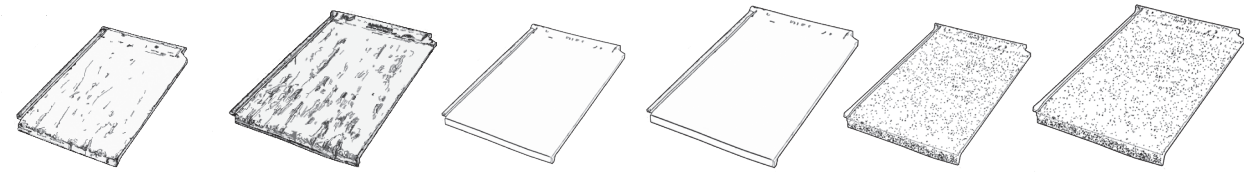
34 **Tile Installation — Morando 14" & 16"**
35 Eave
35 First and Succeeding Courses
36 Valley Tiles
37 Hip
38 Ridge
44 Vertical Wall
45 Snow Guards and Staggering
46 Repair

47 **Tile Installation — Ludoslate & LudoShake**
48 Eave
48 First and Succeeding Courses
49 Valley Tiles
50 Hip
51 Ridge
57 Vertical Wall
58 Snow Guards and Staggering
59 Repair
60 Measuring and Chalking the Roof

62 **Tile Installation — Lexington Slate® & Century Shake®**
63 Eave
63 First and Succeeding Courses
64 Valley Tiles
65 Hip
67 Ridge
69 Vertical Wall
70 Snow Guards / Repair
71 Measuring and Chalking the Roof

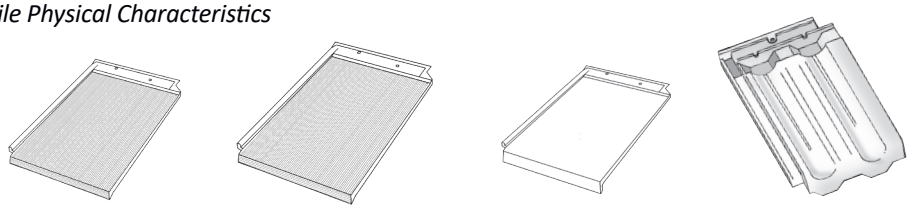
Field Tile Physical Characteristics — Morando 14" & 16"

Chart 4.1 Interlocking Tile Physical Characteristics



	Americana 14"	Americana 16"	Classic 14"	Classic 16"	Lanai 14"	Lanai 16"
Weight/Square	800 lbs.	750 lbs.	800 lbs.	750 lbs.	800 lbs.	750 lbs.
Pieces/Square	158	109	158	109	158	109
Overall Size	9" x 14" x 7/8"	10-3/4" x 16" x 7/8"	9" x 14" x 7/8"	10-3/4" x 16" x 7/8"	9" x 14" x 7/8"	10-3/4" x 16" x 7/8"
Exposure	8-1/4" x 11" x 7/8"	10-1/8" x 13" x 7/8"	8-1/4" x 11" x 7/8"	10-1/8" x 13" x 7/8"	8-1/4" x 11" x 7/8"	10-1/8" x 13" x 7/8"
Minimum Slope	3:12	3:12	3:12	3:12	3:12	3:12

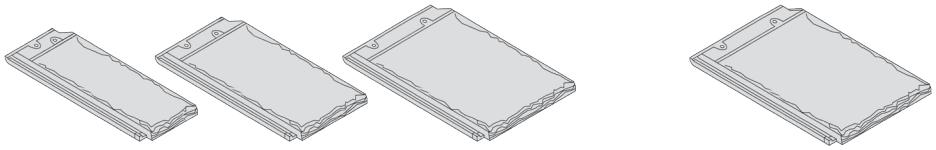
Chart 4.2 Interlocking Tile Physical Characteristics



	Williamsburg 14"	Williamsburg 16"	Morando Closed Shingle	French
Weight/Square	800 lbs.	750 lbs.	1160 lbs.	1,025 lbs.
Pieces/Square	158	109	225	133
Overall Size	9" x 14" x 7/8"	10-3/4" x 16" x 7/8"	8-3/4" x 11" x 1-3/16"	9" x 16-1/4"
Exposure	8-1/4" x 11" x 7/8"	10-1/8" x 13" x 7/8"	8" x 8" x 1-3/16"	8-1/8" x 13-3/8"
Minimum Slope	3:12	3:12	3:12	3:12

Field Tile Physical Characteristics — LudoSlate & LudoShake

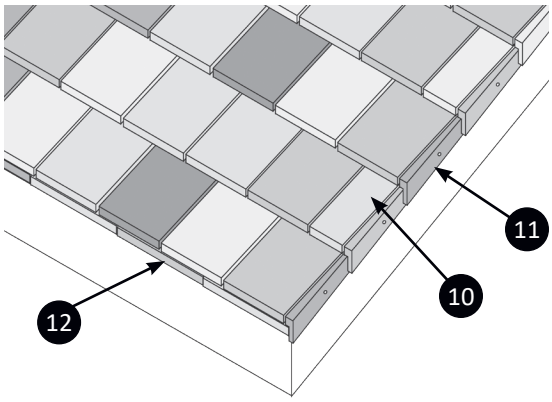
Chart 4.3 LudoSlate™ and LudoShake™ Tile Physical Characteristics



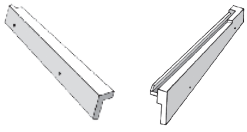
	LudoSlate/LudoShake Premier	LudoSlate/LudoShake
Nominal Widths	5", 7" & 10"	10"
Weight/Square	676 lbs.	598 lbs.
Pieces/Square	119 pcs. (10 pcs. 5", 9 pcs. 7" & 100 pcs. 10")	111
Overall Size	5-3/4", 7-3/4" & 10-3/4" x 16"	10-3/4" x 16"
Exposure	5", 7" & 10-1/8" x 13"	10-1/8" x 13"
Minimum Slope	3:12	3:12

Fittings Physical Characteristics

Chart 5.1 Interlocking Tile Fittings Physical Characteristics



10

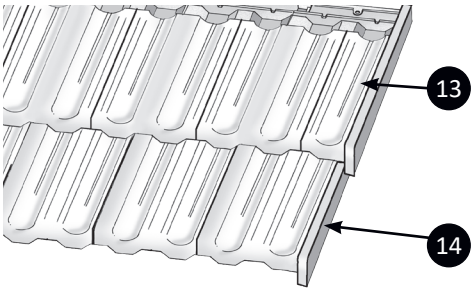


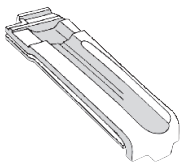
11

12

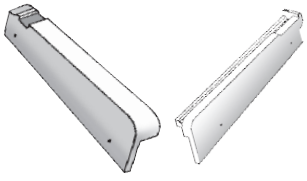
		End Band	Detached Gable Rake	Under Eave
Americana 14", Classic 14", Lanai 14" & Williamsburg 14"	Overall Size	14"	14"	12"
	Exposure	11"	11"	12"
	Weight/Pc.	3.3 lbs.	2.0 lbs.	2.3 lbs.
Americana 16" Classic 16", Lanai 16" & Williamsburg 16"	Overall Size	16"	16"	12"
	Exposure	13"	13"	12"
	Weight/Pc.	5.5 lbs.	2.8 lbs.	2.3 lbs.
Morando Closed Shingle	Overall Size	11"	11"	12"
	Exposure	8"	8"	12"
	Weight/Pc.	4.1 lbs.	2.0 lbs.	2.3 lbs.
LudoSlate™ & LudoShake™	Overall Size	16"	16"	12"
	Exposure	13"	13"	12"
	Weight/Pc.	5.5 lbs.	2.8 lbs.	2.3 lbs.

Chart 5.2 French Tile Fittings Physical Characteristics





13

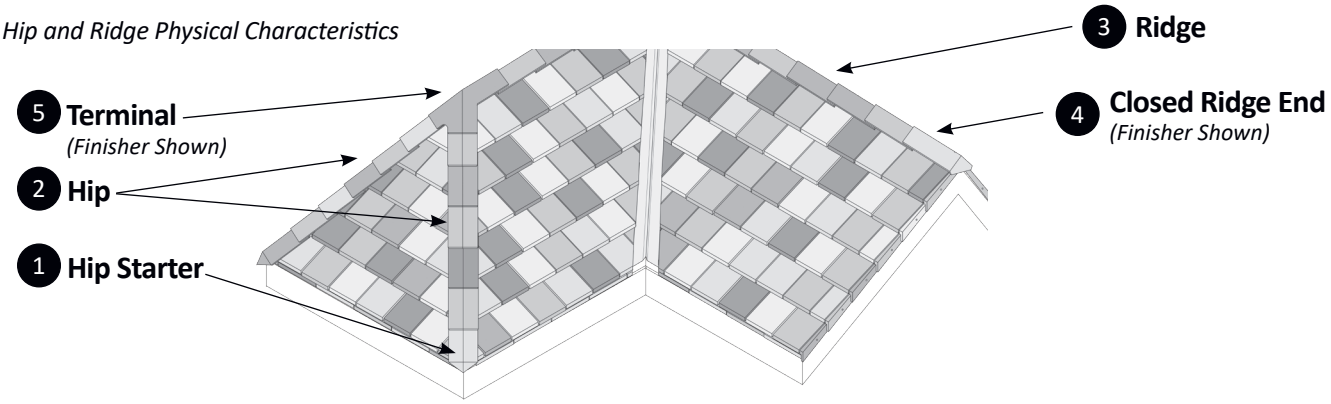


14

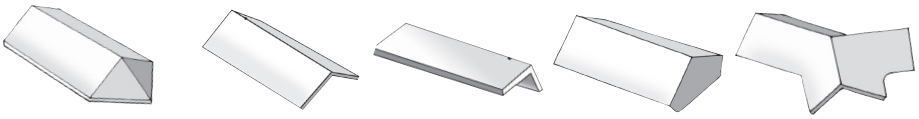
French	Overall Size	16-1/4"	16-1/4"
	Exposure	13-3/8"	13-3/8"
	Weight/Pc.	5.7 lbs.	2.9 lbs.

Hip and Ridge Physical Characteristics

Chart 6.1 Hip and Ridge Physical Characteristics



V-Hip and Ridge Trim Group



	1 Hip Starter	2 V-Hip	3 V-Ridge	4 V-Closed Ridge End	5 V-Terminal*
Overall Size	15-1/2"	14-1/4"	14-1/4"	14-1/4"	-
Exposure	12"	12"	12"	12"	-
Weight/Pc.	8 lbs.	8.8 lbs.	8.8 lbs.	8 lbs.	15 lbs.

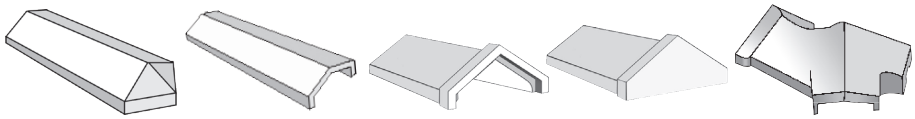
V-Ridge Angles

Description	Degree	Roof Pitch
Regular	116°	3:12 to 10:12
Intermediate	90°	11:12 to 20:12
Steep	75°	20:12 +

V-Hip Angles

Degree	Roof Pitch
116°	3:12 to 18:12

118/211 Hip and Ridge Trim Group



	1 Hip Starter	2 118 Hip Roll	3 211 Ridge	4 211 Closed Ridge End *(Starter Shown)*	5 118/211 Terminal* *(Finisher Shown)*
Overall Size	14"	14"	13-1/4"	13-1/4"	-
Exposure	12"	12"	12"	12"	-
Weight/Pc.	5 lbs.	4.8 lbs.	9.7 lbs.	14 lbs.	20 lbs.

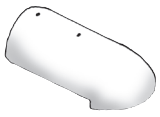
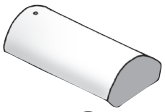
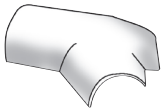
211 Ridge Angles

Description	Angle	Roof Pitch
Regular	116°	3:12 to 10:12
Intermediate	90°	11:12 to 20:12
Steep	75°	20:12 +

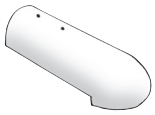
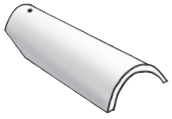
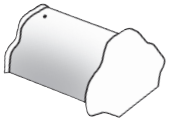
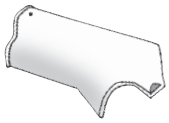
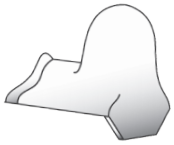
**Ludowici makes ridge and hip terminals to fit any roof geometry. Contact your Ludowici representative for assistance.*

Chart 7.1 Hip and Ridge Physical Characteristics

Circular Cover Hip and Ridge Trim Group

	 1 **CC-Hip Starter**	 2 **CC-Hip**	 3 **CC-Ridge**	 4 **CC-Closed Ridge End**	 5 **CC-Terminal***	 5 **CC-Low Bump Terminal***
Overall Size	15-1/2"	16"	16"	14-1/4"	-	-
Exposure	12"	13"	13"	12"	-	-
Weight/Pc.	9 lbs.	5.8 lbs.	5.8 lbs.	9.8 lbs.	15 lbs.	25 lbs.

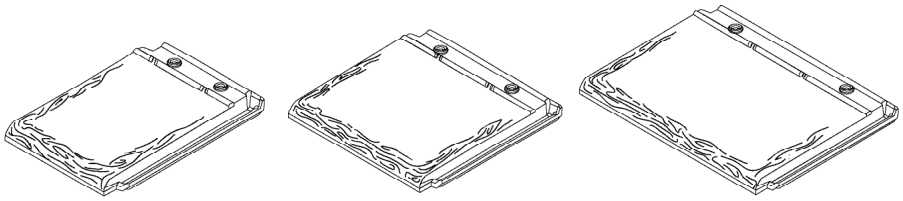
102/206 Hip and Ridge Trim Group

	 1 **152 Hip Starter**	 2 **102 Hip Roll**	 3 **206 Ridge**	 4 **206 Closed Ridge End** *(Starter Shown)*	 5 **102/206 Terminal*** *(Starter Shown)*	 5 **405 High Bump Terminal*** *(Finisher Shown)*	 4 **406 High Bump Gable Terminal** *(Finisher Shown)*
Overall Size	14"	14"	13-1/4"	13-1/4"	-	-	-
Exposure	12"	12"	12"	12"	-	-	-
Weight/Pc.	6.3 lbs.	6.2 lbs.	11.5 lbs.	18 lbs.	17 lbs.	35 lbs.	30 lbs.

**Ludowici makes ridge and hip terminals to fit any roof geometry. Contact your Ludowici representative for assistance.*

Field Tile Physical Characteristics

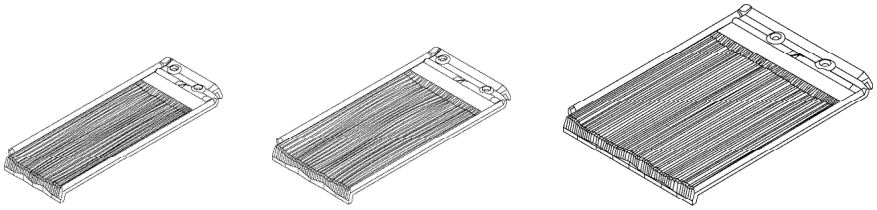
Chart 8.1 Lexington Slate® Tile Physical Characteristics



	Lexington Slate®
Nominal Widths	7", 10-1/2" & 14"
Weight/Square	783 lbs.
Pieces/Square	152 pcs. (110 pcs. Full, 28 pcs. 10-2/3" & 14 pcs. 7")
Overall Size	7-5/8" x 10-1/2" x 1", 11-3/8" x 10-1/2" x 1", 14-3/4" x 10-1/2" x 1"
Exposure	7" x 7-1/2", 10-1/2" x 7-1/2", 14" x 7-1/2"
Minimum Slope	3:12

*Note: The locking channel for Lexington Slate® is on the right side of the tile and installation will be left to right.

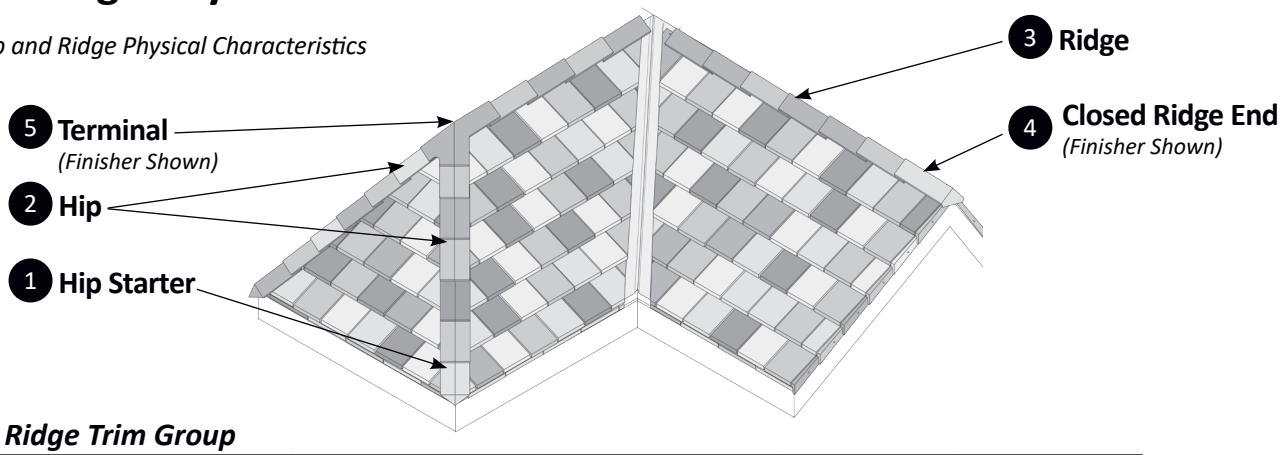
Chart 8.2 Century Shake® Tile Physical Characteristics



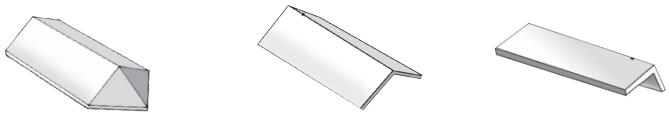
	Century Shake®
Nominal Widths	5", 6-2/3" & 10"
Weight/Square	679 lbs.
Pieces/Square	141 pcs. (100 pcs. Full, 28 pcs. 6-2/3" & 14 pcs. 5")
Overall Size	5-1/2" x 14-1/2" x 1", 7-3/16" x 14-1/2" x 1", 10-1/2" x 14-1/2" x 1"
Exposure	5 x 11-1/2", 6-11/16" x 11-1/2", 10" x 11-1/2"
Minimum Slope	3:12

Hip and Ridge Physical Characteristics

Chart 9.1 Hip and Ridge Physical Characteristics



V-Hip and Ridge Trim Group



	1 Century/Lexington Hip Starter	2 Century/Lexington V-Hip	3 Century/Lexington V-Ridge
Overall Size	15-1/2"	16"	16"
Exposure	12"	13"	13"
Weight/Pc.	8 lbs.	8.8 lbs.	8.8 lbs.
			90° Century V-Ridge is 14-1/4"

V-Ridge Angles		
Description	Degree	Roof Pitch
Regular	116°	3:12 to 10:12
Intermediate	90°	11:12 to 20:12
Steep	75°	20:12 +

V-Hip Angles	
Degree	Roof Pitch
116°	3:12 to 18:12

Before Getting Started

Roof Slope

Ludowici Roof Tile's recommended minimum slope requirements for Interlocking tile is 3:12. ***No clay tile roofs are to be installed below a roof slope of 3:12.***

There is no maximum slope requirement for tile roofs. However, on extremely steep (above 19:12) or vertical applications, wind current may cause the tiles to rattle. To avoid this, set the butt of each tile with a bead of sealant where it will not be seen.

Weight

Proper roof framing is required to carry the weight of a tile roof. The weight of one square (100 sq. ft.) of Interlocking tile will range from 598 pounds to over 1,025 pounds. The weight of the roof tile is determined by the type and size of the tile and the exposure of each course of tile. Reducing the exposure of the tile will increase the roof load.

The weight of the underlayment, fastening system, roof accessories and trim tile also needs to be considered when determining the total weight. Check dead load allowances of the applicable local building codes.

It is recommended that the structural design of the roof be evaluated by a registered engineer to determine that it can support the load; most building codes require an engineering review. Getting a written letter of approval is suggested and may be required by local building codes.

If the installation is in a region of seismic activity or heavy wind load, local building codes must be consulted for additional requirements.

Roof Deck

A design standard for roofing decks is to have a **maximum deflection of L/240 between supports**. A deck will be exposed to live and dead loads. A live load is one that will only be exerting pressure on the roof deck for a short time. Example; Snow or wind loads. A dead load is one that will exert a constant pressure to the roof deck; i.e., underlayments, tile and battens.

Fastener Pullout Resistance: Minimum average fastener pullout resistance for clay roofing tile is 180 lbs. with no single value less than 170 lbs. Greater pullout values may be required depending upon the predicted aerodynamic moment expected for the tile shape, building shape and the proximity to the coastline. An engineer should be consulted to assure local building code compliance.

For Board Plank Deck: Use well-seasoned plank board (1" full thickness, maximum 6" nominal width) that is not prone to warping, cupping or twisting.

For Plywood Deck: APA rated plywood is required for a minimum of 3/4" thick wood decking and must be rated for structural use as roof sheathing. The expansion crack between panels shall be at least 1/16" but no greater than 1/8". H-clips are to be used when rafters are spaced greater than 16" on center to hold the side joints of the plywood together between supports. Unsupported end joints must be blocked.

Nailable Concrete Decks: Nailable concrete decks over time may lose their plastic nature, which allows direct nailing. For old decking material, a pullout test should be performed to determine the usefulness of the deck and the appropriate fastener. An engineer should be consulted to assure local building code compliance.

Non-Nailable Concrete Decks: For concrete decks that will not accept direct nailing, nailer boards are required. Attachment strips that allow the tile to be fastened to them should be pressure treated wood. These may be a board and batten system or pressure treated wood strips. Other means

of attaching tile to a concrete deck include wire-tie systems, foam adhesive and expanding nail-in anchors.

NOTE: Ludowici does not recommend applying tile over spaced board sheathing or open battens.

Underlayment

Most problems with water-shedding roof installations occur from water that migrates through the joints of the tiles through capillary action, wind driven rain and runoff or ice damming. Because of this possibility, the underlayment is critical to the success of the roof. It is the architect or building owner's responsibility to select an underlayment product that is suitable to specific location, climate, roof pitch and attic ventilation. When selecting an underlayment remember that Ludowici roof tiles are expected to last over 75 years so the underlayment should be of a comparable lifespan and quality.

Ludowici recommends the following for minimum underlayment:

- All decks shall be covered with two layers of No. 30# asphalt-impregnated roofing felt or one layer of No. 43# coated base sheet or one layer of Ice and Water Shield.

NOTE: When using non-breathing Ice and Water Shield underlayments to cover the entire roof, the attic space MUST be properly ventilated to prevent moisture buildup.

- All hips, valleys, rakes and ridges shall be covered with a waterproof underlayment, example; Ice and Water Shield or two layers of No. 43# coated base sheet.

- For proper ice dam protection a layer of Ice and Water Shield underlayment should be installed from the eave to a point 24" beyond the inside of the exterior wall. See page 14 for more information on ice dam protection.

NOTE: Roofing felt should meet or exceed ASTM standards D226/D2626. Self adhered Modified should meet or exceed ASTM D1970.

Chart 11.1 Underlayment Characteristics

Type	Pros	Cons
Asphalt Roofing Felt	• Long track record • Well suited for most applications • Readily available • Breathable • Less expensive than Synthetics or Self Adhered	• Doesn't seal around the nail holes • Not as effective on lower pitches • Can tear • Not suitable for long duration exposure directly to the elements
Ice & Water Shield (Self Adhered Polymer-Modified Bituminous Sheet)	• Rubberized material seals around nail holes • Self adhering materials creates a more monolithic water barrier • Ideal for low slope applications	• More expensive • **Non breathing requires good attic ventilation** • Can be damaged by UV if exposed for 180+ days
Synthetic Underlayments	• Purported life span and durability • Some Synthetics are breathable	• Unproven. Most products have been on the market less than 20 years. • Two to three times cost of felt

Fastening Methods

Attachment requirements and fastener length are referenced in Chart 13.1

Nails or Screws: Nails are the most commonly used fastener for attaching clay tiles. Nails for tiles and cleats must be copper or stainless steel, 11 gauge minimum, .285"-.312" head minimum and proper length to give good penetration. Screws must be stainless steel or brass, #8 or #9, with a minimum .285"-.312" diameter head.

NOTE: The use of Galvanized, Ceramic coated or any other fastener not mentioned above is not acceptable to Ludowici. All components of the roof should have an expected lifespan of 75+ years.

NOTE: Each flat Interlocking field tile is provided with (2) two fastening nail holes and French field tile with (1) one. When installing field tiles, care should be taken to fasten each tile with nails or screws in every provided fastening hole.

- For a plywood deck, use ring shank copper nails of the specified length to assure good penetration through under side of deck (see Chart 13.1).

- For board plank deck, use smooth shank copper nails of the specified length. Fasteners should penetrate deck board 3/4". Do not penetrate underside of deck.

- For gypsum plank or nailable concrete deck, use stainless steel or silicon bronze screw shank nails of length to penetrate half to three-quarters the thickness of the deck. Never penetrate underside of deck.

- When insulation is applied over the deck, observe the following:
  - Minimum slope 3:12 - The tile can be nailed through underlayment and insulation into the deck with a sufficient length fastener.
  - On 6:12 or greater, a tile-tie system should be used.

- For metal decks, use sheet metal screws and the proper mastic.
- For fibrous cement decks, use a tile-tie system.

NOTE: When using stainless steel screws, tile replacement will require the use of a hack saw to remove the screws. A slate ripper may be used with copper or brass fasteners.

Wire: On non-nailable surfaces or some insulated decks or where fastening through the metal flashing needs to be avoided or if underlayment cannot be penetrated, such as special low slope applications, wire and strapping systems are sometimes used. Wire must be 13 gauge stainless steel or 10 gauge solid copper, with or without insulation. Wire-tieing is also usually specified in areas prone to earthquakes. Consult newportfastener.com for specific design and installation assistance.

Clips: Wind clips are often specified and/or required in high wind and seismic areas. They aid in holding the tiles in place and reduce stress at the preliminary fastening point. Refer to local building codes in such areas.

NOTE: In high wind regions, install each tile with #8 or #9 stainless steel or brass flathead Phillips or square drive screws and/or use a hurricane clip. Hurricane clips and sealants may be required by the local building codes.

Bedding Tile: Where freeze-thaw cycles are not an issue, tile may be laid in a full or partial bed of mortar. This method is best used in combination with other means of attachment.

Foam Adhesive: This method of application is approved for use in Sun Belt non freeze-thaw areas and is being tested for use in other areas. Refer to local building codes. Do not use single part foam systems with Ludowici tile. Only two part systems such as Polyset® from Polyfoam are acceptable. Visit Polyfoam.cc for design and installation assistance.

IMPORTANT:
Before application of Ludowici tiles in alpine conditions, plans must be submitted to the Ludowici Technical Department for approval. Ludowici will not assume liability or responsibility for damage caused by the application of clay tiles in Alpine conditions.

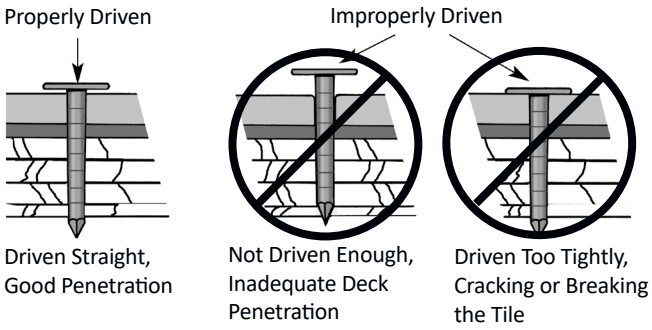


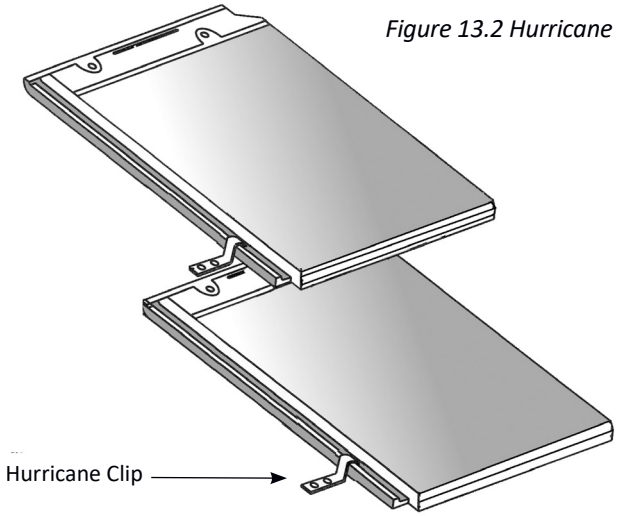
Figure 13.1 Proper Nailing Techniques for Plywood Decks

Chart 13.1 Attachment Requirements

Americana, Classic, Lanai, Williamsburg, Closed Shingle, LudoSlate & LudoShake					
Substrate	**Field Tile**	**Hip**	**Ridge**	**Quik-Tach™ Bracket**	**Hurricane Clip**
Boards	1-3/4"	2"	2-1/2"	Type C	1-1/4"
3/4" Plywood	2"	2"	2-1/2"	Type C	1-1/4"

French Tile					
Substrate	**Field Tile**	**Hip**	**Ridge**	**Quik-Tach™ Bracket**	**Hurricane Clip**
Boards	2"	2"	2-1/2"	Not Required	1-3/4"
3/4" Plywood	2-1/2"	2"	2-1/2"	Not Required	1-3/4"

Figure 13.2 Hurricane Clip



Getting Started

Assemble All Tools and Supplies

The following tools are needed for basic installation of clay roofs:

- Safety equipment as required by OSHA and other local and state agencies
- Rule or tape
- Mason's trowel and bucket
- Chalk line and chalk
- 4" diamond-tipped turbo blade on angle grinder
- Claw hammer
- Protective eye wear/dust mask
- Chipping hammer
- Caulking gun
- Felt knife
- Sheet metal shears
- Roof jacks
- Slate ripper
- Segmented diamond blade (8"to 10" diameter)
- Wet tub saw
- Tile nippers
- Marking pencil
- Sharp steel punch
- Battery-operated, clutch-driven drill (with extra batteries)
- Carbide spear point glass drill bits
- Small steel roller

IMPORTANT:
All roof work can be hazardous. Safety requirements are spelled out by OSHA and individual state Occupational Safety and Health Administration regulations. It is the responsibility of the installer to take all necessary precautions. Contact the Occupational Safety and Health Administration for complete information.

IMPORTANT:
All roofing components should be selected to be compatible with the long service life of a Ludowici roof.

In addition to tools, the following materials are needed:

- Flashing: use a minimum weight of 16 oz. copper, at least 24" wide with 1/4" edge turned over and fastened with cleats for valleys. Under special circumstances, such as unusual exposure to high wind or heavy snow, this flashing weight should be increased. Lighter weight copper flashings are undesirable because they can puncture too easily and they will not provide the wear life required for a long-life roof system.

- Underlayment: two layers of No. 30# asphalt-impregnated roofing felt or one layer of No. 43# coated base sheet, doubled on rough surfaces, hips, valleys and ridges, or one layer of Ice and Water Shield.

- Roofing cement: roofing cement for gable rakes, hip rolls, ridges, stringers and other conditions should be non-running, heavy-body flashing cement composed of mineral ingredients to meet the requirements of ASTM D-4586.

- Cant strips, wood nailers and field tile nailer strips: all should be foundation grade wood.

- Mortar and mortar color to match tiles: Ludowici defines mortar as one part Portland cement and four parts sand (to ASTM specification C-270). Contact your local brick distributor to acquire colorant.

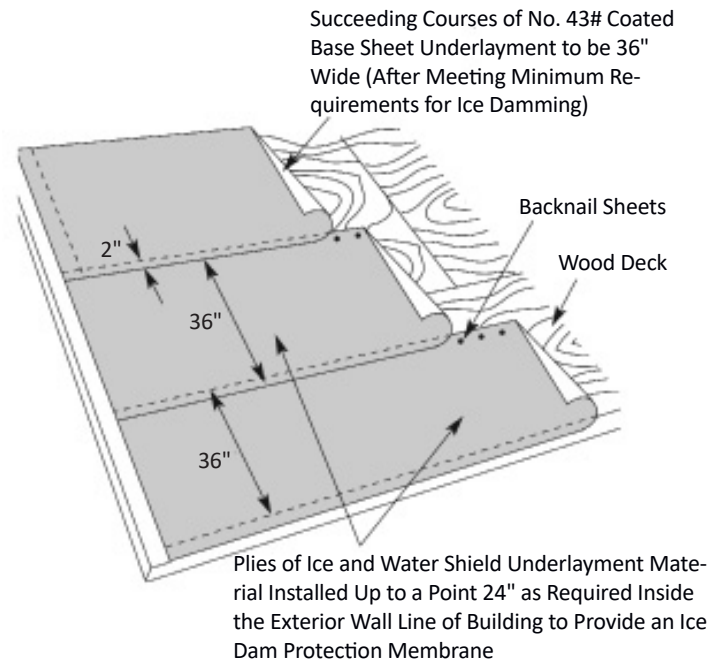
- Silicone sealant or adhesive: the recommended sealant for exposed caulking is Dow Corning® 790 Silicone Building Sealant™ or GE® SilProof™ (ASTM C-920, low modules). These sealants may be used as hidden adhesives. NP1 or other adhesives may be suitable as well; however, care should be taken to select for maximum durability and also for compatibility with adjacent materials. Some sealants are available in different colors to match tiles.

Preparing the Roof

Inspecting the Deck

- Ensure that the roof deck is clean, smooth and dry before roof tiles are applied.
- Verify that there is no significant delamination, warpage, bowing or separation from the rafters or trusses. Check for deck rot.
- If deck is APA 3/4" rated plywood, check that panels are spaced approximately 1/16" to a maximum of 1/8" apart for expansion and H-clips are used between supports when the rafter spacing exceeds 16" O.C. Unsupported end joints must be blocked.
- Make repairs to the deck as necessary.

NOTE: Prior to applying any roofing material, all contractor work above the roofline must be completed.



NOTE: All dimensions are approximate

Figure 15.1 Single Sheet Underlayment

Installing the Underlayment

Most problems with water-shedding roof installations occur from water that migrates through the joints of the tiles through capillary action, wind-driven rain and runoff or ice damming. Because of this possibility, the underlayment is critical to the success of the roof.

At a minimum, all decks must be covered with two layers of No. 30# asphalt-impregnated roofing felt or one layer of No. 43# coated base sheet.

NOTE: Underlayment materials must be covered with tile as soon as possible to prevent degradation from exposure.

If wood cant strips and nailers are nailed directly to the deck, they must be covered with waterproof underlayment. If nailed on the underlayment, they should be pressure treated wood.

NOTE: All roofing underlayment materials should be carried 6" up all vertical surfaces.

For single layer of No. 43# coated base sheet:

Lay base sheet parallel to eave. Side lap - 2" and end lap - 6".

For Double Layers, follow these steps:

First apply a starter sheet of 1 layer of Ice and Water Shield underlayment per manufacturer's instructions.

Then completely cover the starter sheet with a full-width sheet of No. 43# roofing felt. Lap succeeding sheets 19" over the preceding sheets, leaving a 17" exposure (2" lap). End laps should be a minimum of 6" (see Figure 13.2).

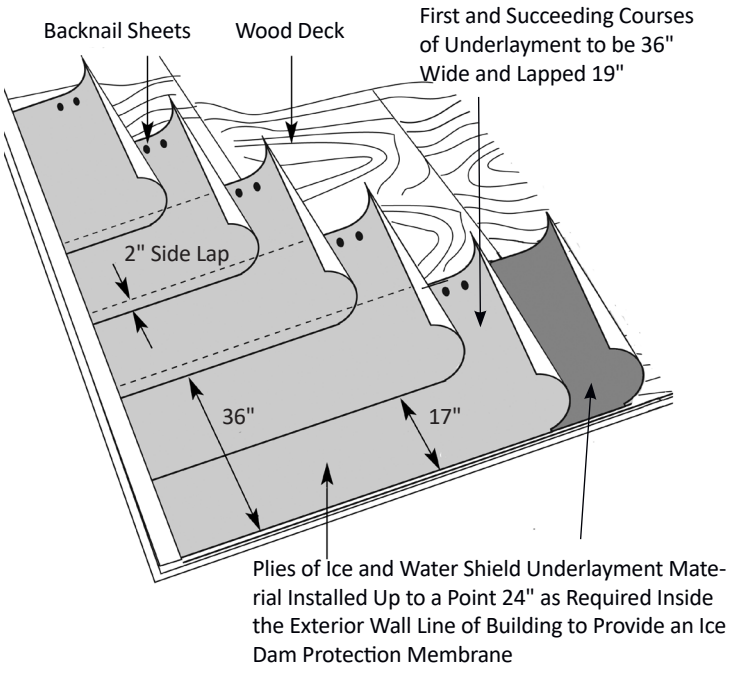


Figure 15.2 Double Sheet Underlayment

Concrete Deck

For Ice and Water Shield underlayments follow the manufacturer's installation instructions for attachment to concrete. Or, if using asphalt felt, apply No. 43# coated base sheet and fasten per the architect's instructions. For non-nailable concrete decks a counter batten system will be necessary. Over the underlayment fasten a standard pressure treated 1" x 2" furring strip vertically 20" O.C., apply pressure treated 1" x 2" wood strips horizontally across lath spaced to accommodate the correct tile exposure and proceed as directed for a sheathed roof (see Figure 16.1).

NOTE: Flashing dimensions will have to be adjusted to accommodate the thicker assembly.

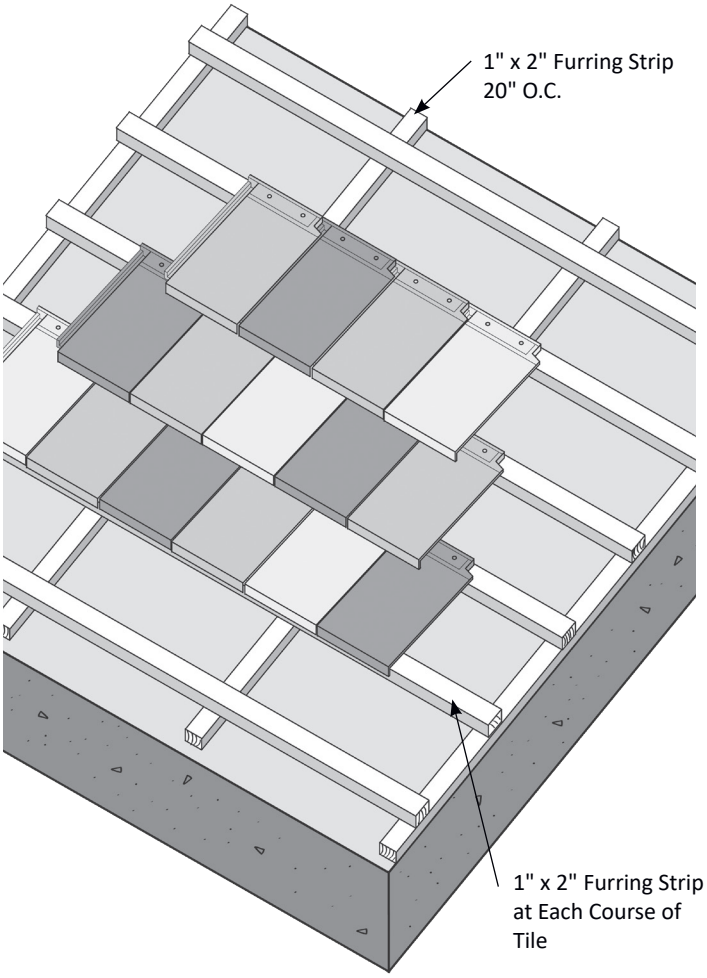


Figure 16.1 Batten System of Attachment for Concrete Deck

Ice Dam Protection

Ice dam protection is recommended in areas where the January mean temperature is 30° F. or less and on all pitches below the standard minimums. This protection must be installed wherever there is a possibility of ice forming along the eaves which will cause a back-up of water and may cause building and interior damage. Consider your local weather conditions.

Apply self-adhering Ice and Water Shield, or equivalent, directly to the deck according to application instructions provided with the product. Self-adhering underlayment must extend up the roof to a point at least 24" beyond the interior wall line and in areas of severe icing at least up to and above the highest water level expected to occur from ice dams (see Figure 16.2).

Please note that the 24" point beyond the interior wall line is a minimum recommendation. Self-adhering Ice and Water Shield underlayment should be applied to all roof decking, which past history and professional experience suggest, might be subject to ice dam back-up. If considering using ice dam protection on the entire surface of the roof deck, insure that adequate ventilation is present to prevent the development of damaging condensation on the underside of the roof deck.

If a wide eave overhang requires flashing wider than 36", the necessary 6" minimum horizontal lap must be located on the overhang outside the structure walls. End laps must be a 6" minimum. Underlayment should meet ASTM D-1970.

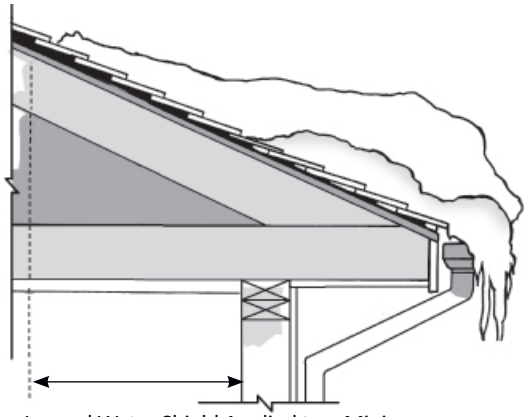


Figure 16.2 Ice Dam Protection

Applying Cant Strips, Wood Nailers and Battens

After lining the roof with underlayment, install wood stringers for ridges and hips, cant strips at eaves if required and battens as field tile nailer strips (required for certain applications). The heights of the stringers, battens and cant strips are determined by the tile pattern and the type of fittings to be used.

Cant Strips for French, LudoSlate™ and LudoShake™
Apply a properly sized cant strip (see Chart 17.2) 48" long and pressure treated directly to the underlayment, with 1/2" gap every 96" to allow drainage. Cover with copper flashing drip edge and a 6" Strip of Self Adhering Ice and Water Shield.

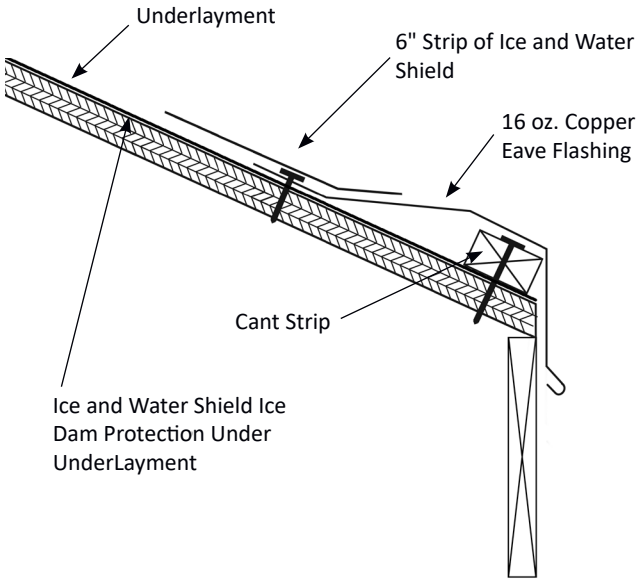


Figure 17.1 Copper Flashing Eave Detail

Chart 17.2 Proper Sizing for Cant Strips

Tile Style	Nominal Size of Cant Strip
LudoSlate™ and LudoShake™	3/4" x 2"
French	1-1/2" x 2"

Stringers for Hip and Ridge
Attached Ridge and Hip Stringers with corrosion resistant fasteners 2’ O.C. (see Figure 17.1).

All wood stringers must be covered with two layers of coated base sheet or a self-adhesive Ice and Water Shield. Stringers must be pressure treated and foundation grade wood. The sizes for stringers vary with tile and Ridge Cap type. Wood stringers must be a minimum of 1-1/2" thickness and of proper height to carry hip and ridge pieces.

Stringer height for hip and ridge vary depending on the tile profile, hip and ridge type and roof pitch. To determine proper stringer heights for your application lay field tile and hip on the roof deck in the correct configuration and measure the gap between the underside of the hip tile to the apex of the hip on the roof deck, this will be your stringer height.

NOTE: Hip caps should just rest on the bottom edge of the field tile and run in a straight line parallel to the roof slope.

Follow the same procedure for the ridge stringer. For Vented Ridge adjust Ridge Riser Bracket to correct height.

Even on conditions where the stringer height is minimal it is important to install them to provide a straight surface for the hip tile to rest. Do not eliminate the stringer and just let the hip tile rest on the field tile. This will produce an irregular hip that snakes up and down.

Battens
For applications where Battens are specified, use nominal 1" x 2" pressure treated wood. Vertical battens should be spaced no further than 20" on center. Horizontal battens are applied one per course of tiles (see Fig 17.1).

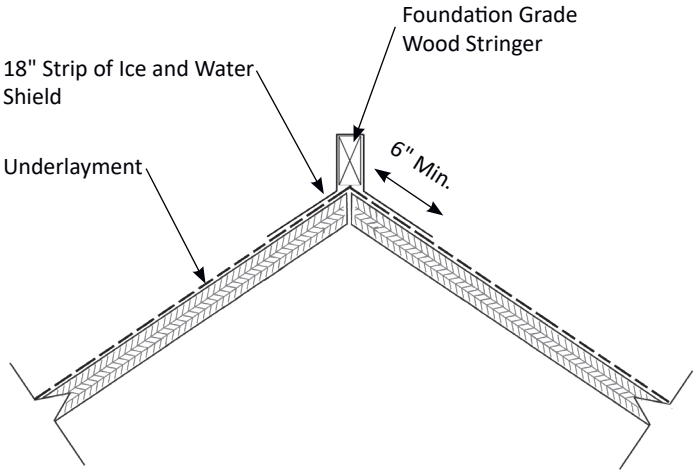


Figure 18.1 Ridge and Hip Stringer Detail

Measuring and Chalking the Roof

Layout and chalking the roof accurately are critical to the roof's performance and appearance. If the eaves are straight and level, all horizontal lines must be parallel to the eaves and all vertical lines must be perpendicular to the eaves. Check the roof deck to determine if the deck is square prior to layout.

Step 1: *Determine Width and Length Exposure*
Clay tiles, depending on the style and profile, vary in exposure and recommended head lap. Ludowici Interlocking tiles are laid with a minimum headlap of 3". Before chalking the roof the installer should verify the tile pattern being installed, and measure, noting average length and width exposures of the tile shipped.

The width exposure should also include the spacing gap between tiles. Interlocking tiles are typically laid with a gap of 1/8"; however, this can be compressed or expanded slightly. The usual overhang at the eave is 2"; however, this can be compressed slightly to accommodate full courses.

Step 2: *Chalking Vertical Lines*
Vertical lines are chalked first. In the case of a hip roof, the first line is struck in the center of the roof equidistant from each hip. The remaining vertical lines are then struck to the right and left at intervals equal to your average width exposure x 5. Care must be taken to ensure that all vertical lines are parallel to the water flow. For roofs with gables at both ends the horizontal exposure should be adjusted to work out to full tile or half tile to reduce cutting.

NOTE: Vertical lines are not needed with random width LudoSlate™ Premier or LudoShake™ Premier.

Step 3: *Chalking Horizontal Lines*
Horizontal lines are struck after the vertical lines are struck.

Strike a line for the under eave tile. Subtract 2" (for overhang) from the under eave to determine distance.

For Interlocking tile the first field tile line will equal the average length of the tile minus the overhang (typically 2").

Successive lines are then struck at intervals equal to your average length of exposure. Length exposure of Interlocking tile is determined by subtracting 3" (for headlap) from the tile length.

Your eave to ridge measurement may determine the average length exposure rather than the size of the tile itself.

NOTE: Do not adjust exposure to a headlap less than 3".

Care must be taken to ensure that all horizontal lines are perpendicular to the water flow.

IMPORTANT:
Tile dimensions can vary because of clay firing temperatures. Be sure to measure tiles in your shipment to determine their average width and length dimensions, so you can chalk your roof properly.

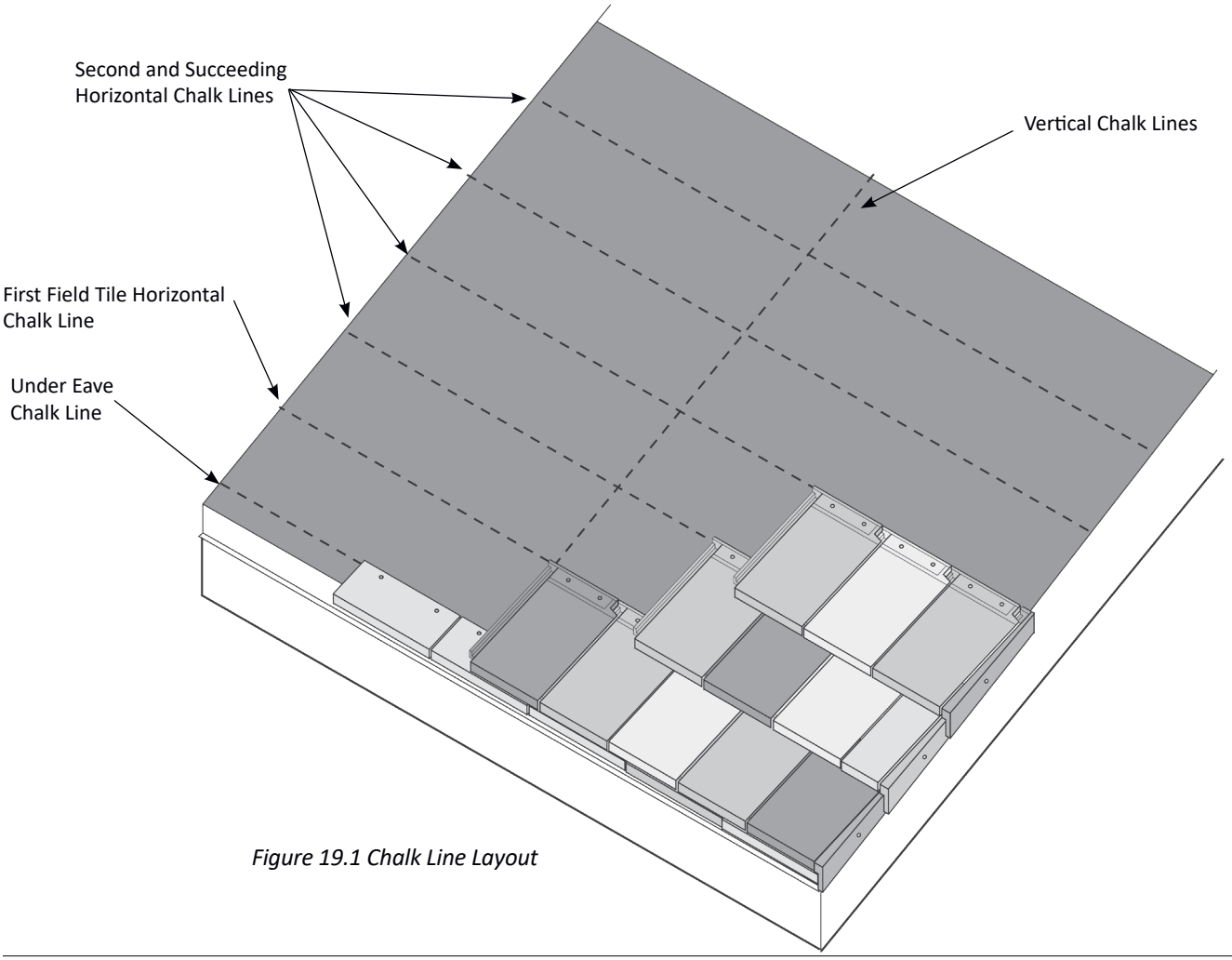


Figure 19.1 Chalk Line Layout

Tile Distribution Over Deck

After all roof preparation has been completed, the tiles are evenly distributed on the roof, if pitch permits.

NOTE: Stacking distribution will depend on the number of tiles per square and the number of tiles per stack.

Spacing of the tiles is determined by the width of the exposed tile times the number of courses being fed per stack. If the tiles are stacked 8 tiles high and the tile exposure is 10" and the stack feeds 2 courses, then the stacks would be placed 40" O.C.

Tile stacks normally start at the third course from the eave and continue with alternate courses.

The important aspect of tile loading is to evenly spread the load across all surfaces of the roof using the proper spacing to assure the proper amount of tile is loaded on the roof.

Remember to utilize the color blending instructions

WARNING:

Do not leave stacked tiles on the roof for extended periods of time. The concentrated load can begin to slide on the heated underlayment sheet. This sliding could cause injury to persons or damage to nearby property.

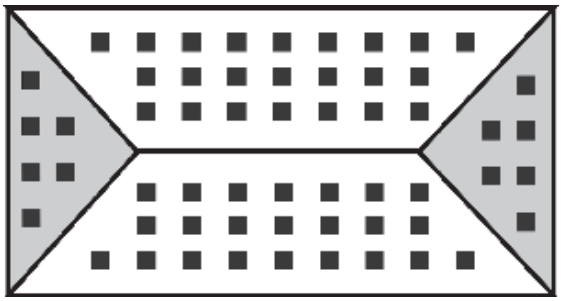


Figure 20.1 Distribution of Tile Over Roof

WARNING:
Roof Loaded Tile During Severe Weather

It is possible that strong winds could lift tiles off the piles and send them flying off the roof, resulting in injury to persons or damage to nearby property.

- If tiles have been pre-loaded onto the roof deck and strong winds or severe storms are predicted, remove the tiles and place them on ground level.

- If tiles have not yet been loaded, then it is recommended not to do so until the threat of bad weather has disappeared.

Pre-loading the roof deck with tiles prior to starting the actual installation will provide convenience and faster installation, but should only be done if weather conditions permit. Use common sense so that you do not become liable for damage or personal injury.

Cutting, Notching and Drilling

Cutting

NOTE: Unnecessary cutting and drilling time can add substantial cost to the job. Carefully consider tile layout before starting the work to minimize cutting and drilling.

Tiles should be cut wet on the job with a masonry or tile saw equipped with a diamond blade. Segmented blades will be the most efficient. Slight surface chipping will occur during the cutting operation. The sliding saw table and tub should be as large as possible to accommodate cutting the tiles diagonally.

Ludowici tiles are extremely hard, which provides the tiles with low moisture absorption and long life. Dry cutting techniques used on softer tile products will not work as fast with Ludowici's hard tile. Dry cutting with a good segmented "turbo" diamond blade is possible. Best results have been obtained using a 4" diamond tipped segmented blade mounted on a small right angle grinder motor.

Notching

One time saving option to drilling through the tiles is to notch it with the small 4" diamond blade saw and then nail or wire in place. If using a field tile for the starter course or ridge, "dovetail" notches are cut. Make sure cuts are wide enough for a nail or screw (see Figure 23.1).

Drilling

Additional nail holes may also be drilled if necessary. High torque electric drills may snap the carbide bits in the extremely hard Ludowici tile. Drills should be battery-powered, adjustable clutch-driven types. To drill out holes, the tile should be set in a pan with water to extend bit life and avoid the risk of eye injury due to fragments. Expect to drill only about 6 holes per carbide bit.

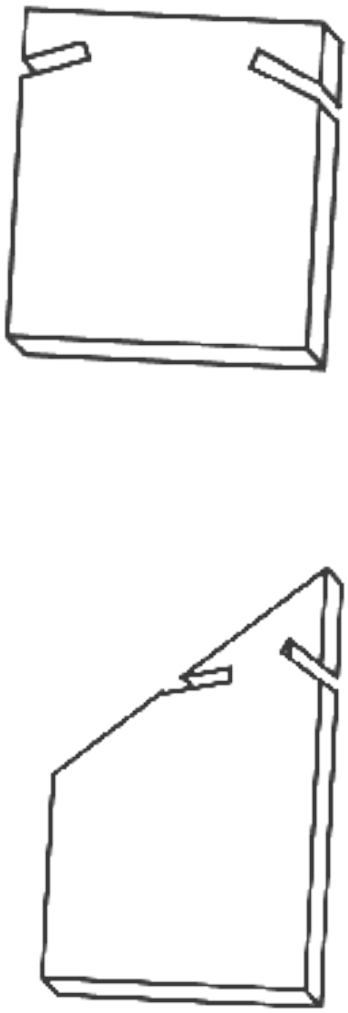


Figure 21.1 Examples of Cut and Notched Tile

WARNING:

Dry drilling may result in serious eye injury. Always use protective eye and face wear when drilling tile or operating a masonry saw.

Never use 115-240 volt AC-operated drills in water. Electrical shock could result.

Blending

Blending is one of the most important aspects of correctly installing a Ludowici tile roof.

Whether installing a single color or multiple colors ALL LUDOWICI ROOFS MUST BE BLENDED.

Colors within a given shipment of Ludowici clay roof tile will vary slightly due to subtle changes in clay composition and kiln firing temperatures. Such color variances are not a defect but a natural desirable feature that gives roofs depth and character.

Unless the architect or owner specifies a pattern, there should be no visible pattern or hot spots on the roof.

Ludowici does not pre-blend the tile. It is the roofers responsibility to evaluate the tiles for color shade and range and then properly blend them to achieve a harmonious color roof without blotches, hotspots or patterns.

The person responsible for the blending of the shades of color should randomly select tiles from at least four different pallets.

After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.

NOTE: When nearing the end of the project if its determined that additional material will be needed to complete the roof, reserve several pallets of the initial shipment to blend with later shipments to maintain a consistent range.

Color Blending with Different Color Tile

Blending different tile colors can provide a unique and aesthetically pleasing roof.

Make a drawing to detail the layout and to help determine the proper number of tiles of each color.

In order to maintain the correct color blend, pull tiles from the different pallets of each color. Premix these piles in the desired percentage and load the roof one square at a time. This will provide even distribution. Additional care should be taken by the roofer laying the tiles to avoid clumping of a single color or range.

After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good color blend, this inspection must be done at regular intervals.

NOTE: It may be helpful to lay the tile blend out on the ground so the installer has a visual example. Make one person responsible for the ongoing and end result of the blending.

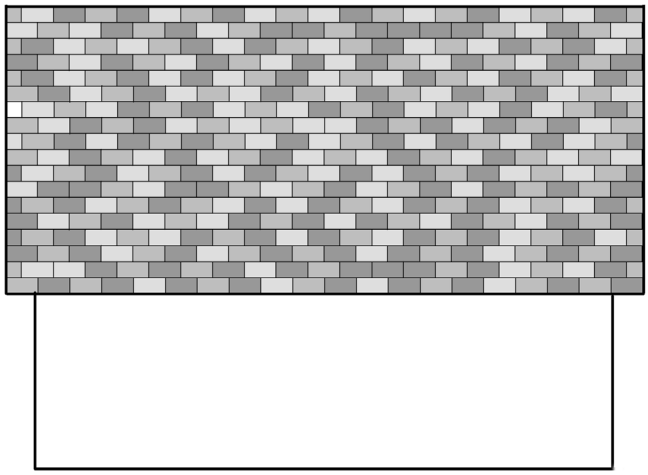


Figure 23.1 Properly Blended Tile

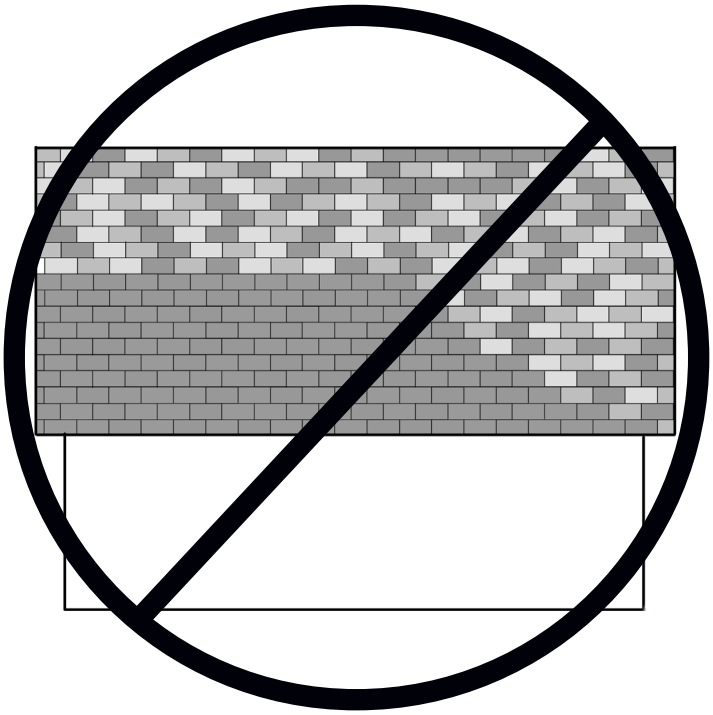


Figure 23.2 Improperly Blended Tile. There Should be No Hotspots or Diagonal Patterns Visible.

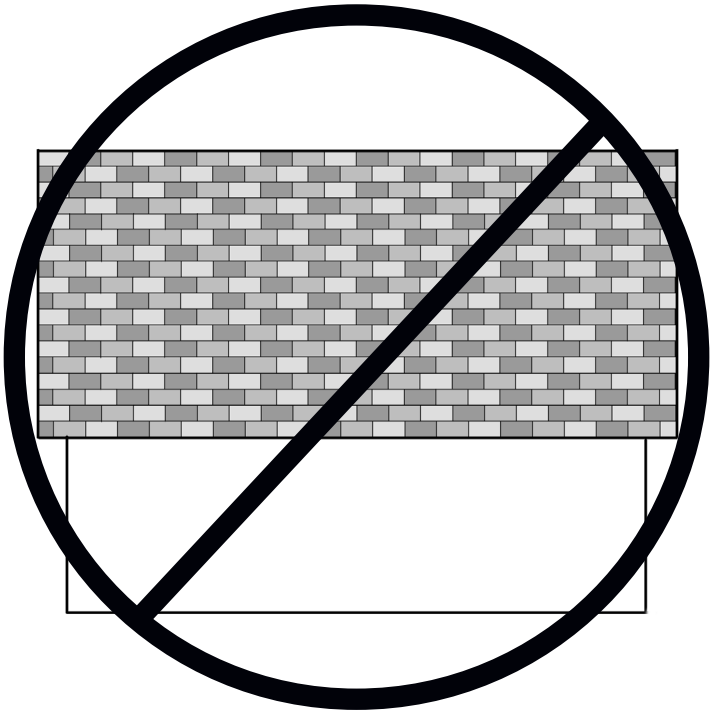


Figure 23.3 Improperly Blended Tile. Do Not Install the Tiles In a Repetitious Pattern.

Installing the Flashing

IMPORTANT:
Where roofs intersect other roofs, parapet walls, chimneys, ventilators, vent pipes and similar projections, flashings are required. There is a natural weakness at these intersections and properly installed flashings are required to make the intersection watertight. Expansion and Contraction due to temperature changes contribute to the weakness, so it is extremely important to correctly design and install the flashings and to use durable flashing material (a minimum of 16 oz. sheet copper is recommended).

General flashing details are shown in this section but many more exist for each particular situation which cannot be covered in the context of this tile installation manual. Proper flashing installations are critical for a watertight roof.

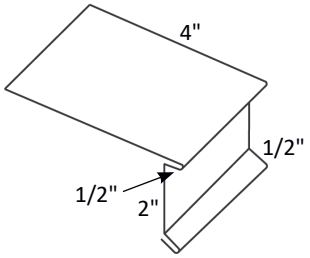


Figure 24.2 Eave Flashing Dimensions

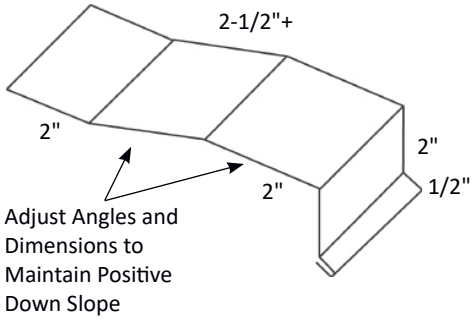


Figure 24.3 Eave Flashing with Cant Strip Dimensions

Eave Flashing

Where eave metal flashing is used, it should be formed using a minimum of 16 oz. sheet copper with a drip edge along the bottom to allow water to drip off the edge of the roof (see Figure 24.2).

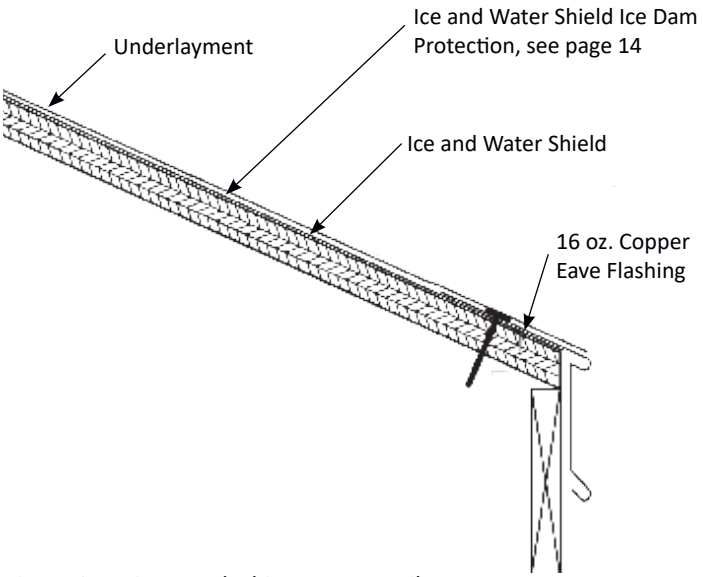


Figure 24.1 Copper Flashing Eave Detail

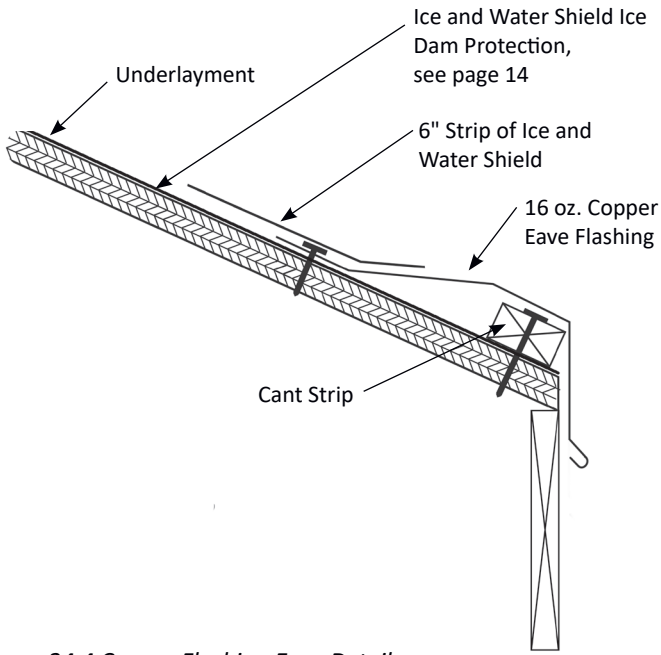


Figure 24.4 Copper Flashing Eave Detail for LudoSlate™ and LudoShake™

Rake Edge Flashing

For rake flashing, 16 oz. or heavier copper flashing should be installed to serve as a drip edge and as a finished edge.

The gable flashing is to be installed over the waterproof underlayment. For an open rake design the flashing must extend 5" onto the deck and 2" down over the fascia with a 1/2" hemmed edge (see Figure 25.1). For a Closed Rake design the flashing should extend 5" across the roof deck with V diverter and a hem at the edge. At the edge of the roof deck, the flashing is to extend up (perpendicular to the deck) 2" and back down at least 1-1/2" along the gable fascia board with a 1/2" crimp at the bottom edge to serve as a drip edge. The gable flashing pieces are to lap each other to form an overlap of at least 4". If using attached gable rake tile no flashing is required.

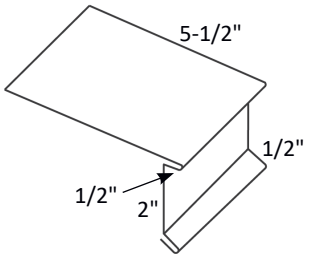


Figure 25.1 Open Rake Flashing Dimensions

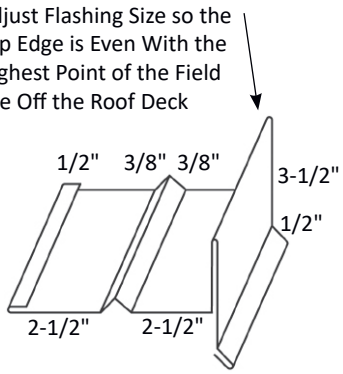


Figure 25.2 Closed Rake Flashing Dimensions

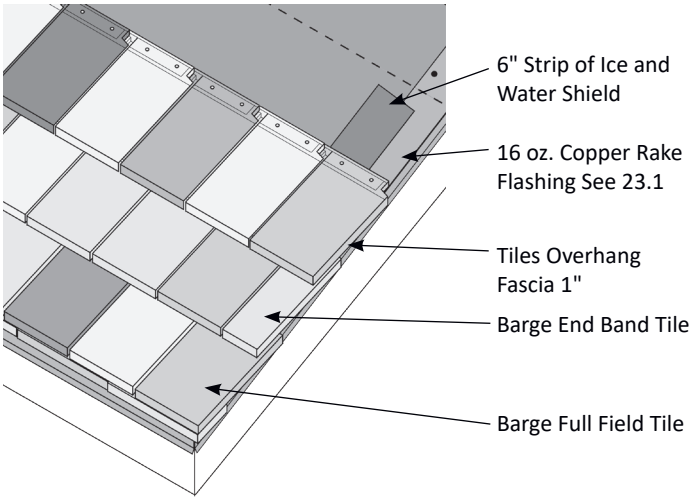


Figure 25.4 Open Rake Detail

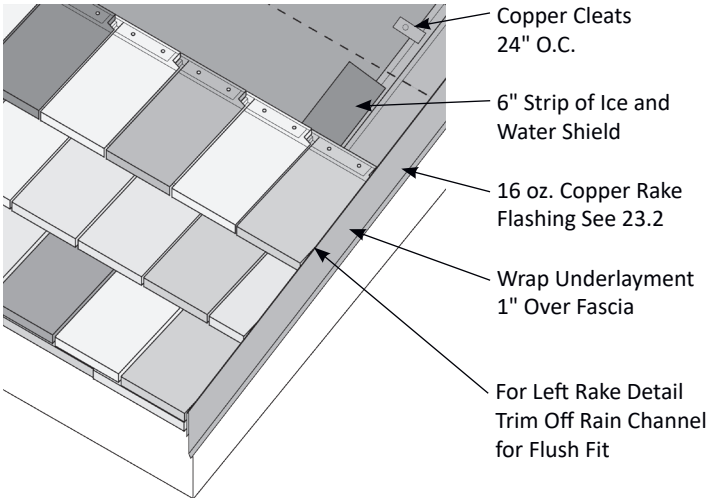


Figure 25.5 Closed Rake Detail

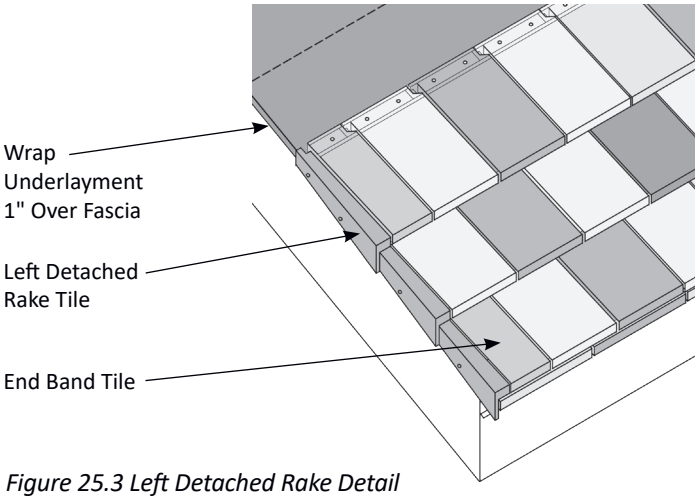


*Figure 25.3 Left Detached Rake Detail No Flashing Required **

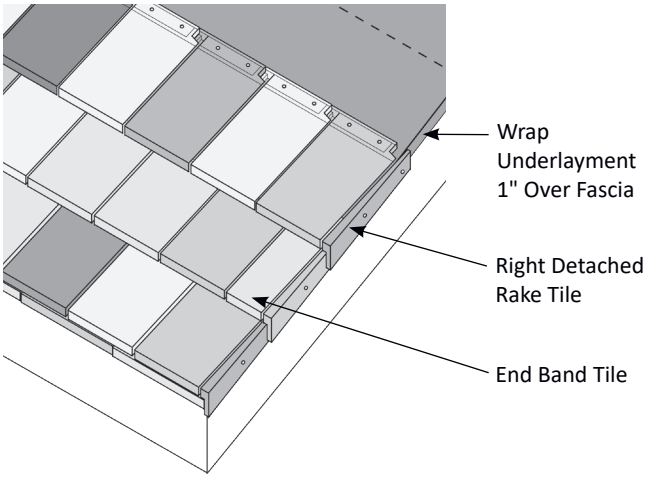


Figure 25.6 Right Detached Rake Detail No Flashing Required

Flashing at Valleys

Valleys, since they collect the water runoff from the portions of the roof sloping into them, are particularly prone to water migration and leakage. A clear and unobstructed pathway for quick water drainage is essential in valleys. There are two basic types of valleys in tile roof installation: open and closed valleys. Open valleys are the standard and preferred choice as they reduce debris collection and potential water infiltration.

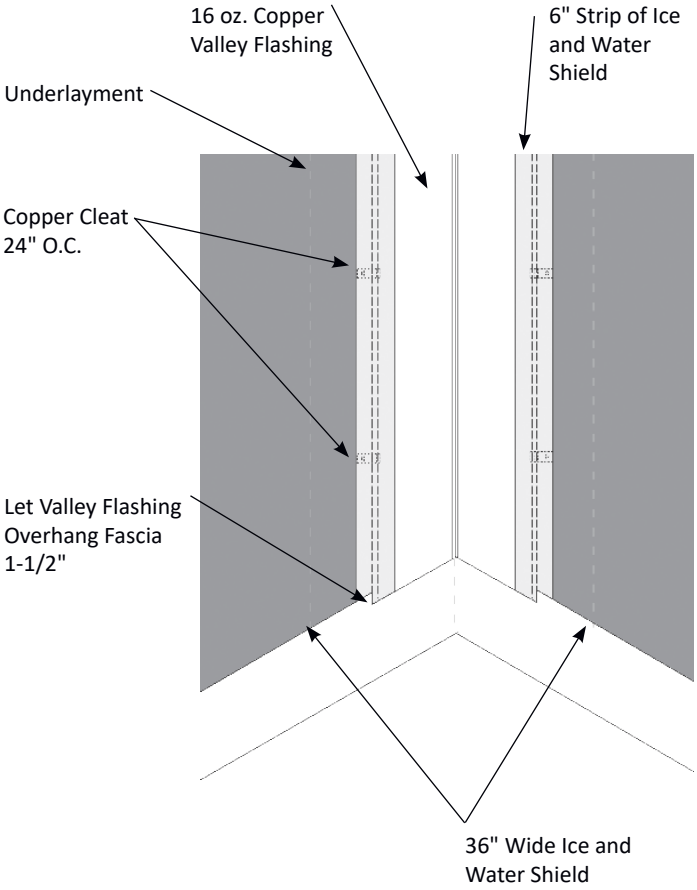


Figure 26.2 Open Valley Flashing Detail

Open Valleys

In an open valley construction the tiles are held back from the center of the valley to expose the copper flashing. The advantage of an open valley is that it permits unobstructed drainage. Open valleys are recommended in areas with surrounding foliage where the leaves, needles and other debris can fall on the roof and potentially slow or block the runoff of water from the roof (see Figure 26.2).

The valley metal is to be secured with approved fasteners. At no time are nails to be placed in the area of the valley that will be carrying water.

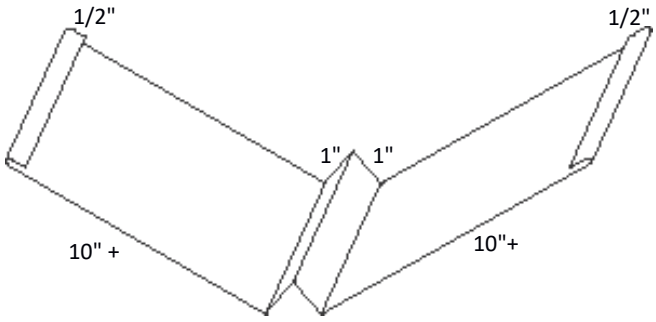


Figure 26.1 Valley Flashing Dimensions

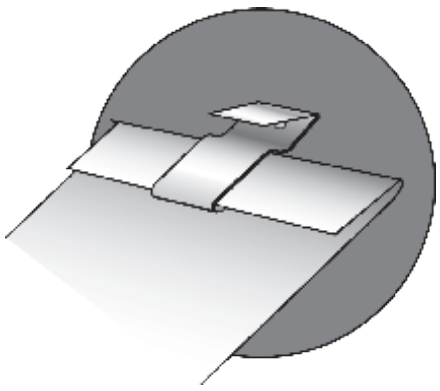


Figure 26.3 Copper Cleat Detail

Closed Valleys

In a closed valley, the tiles from the adjoining roof are mitered and abutted. Since water migrates through a closed valley onto the sheet copper flashing which carries the runoff, this type of construction is considered decorative.

NOTE: Underlayment for all valleys must be a full width sheet (36") of two layers of No. 43# coated base sheet or a layer of self-adhesive modified bitumen membrane. Each course from the adjoining fields must overlap the valley underlayment by at least 12".

NOTE: Closed valleys should not be used where foliage debris can fall onto the roof, accumulate and cause water backup in the valley.

Closed valleys should not be used where the rafter length or pitch varies on adjacent roof planes. It is important that corresponding courses align coming into the valley.

Ludowici strongly discourages the use of closed valleys in areas with snow fall. Snow accumulation in a closed valley can cause ice dams, damaging the roof tile and creating potential leaks.

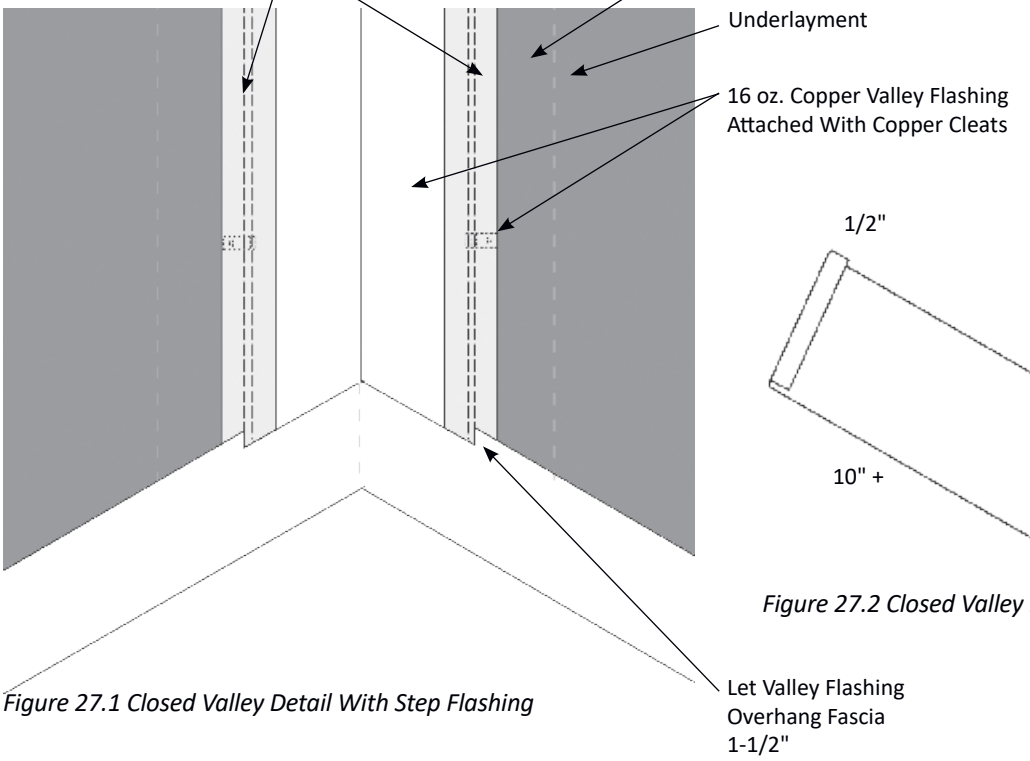


Figure 27.1 Closed Valley Detail With Step Flashing

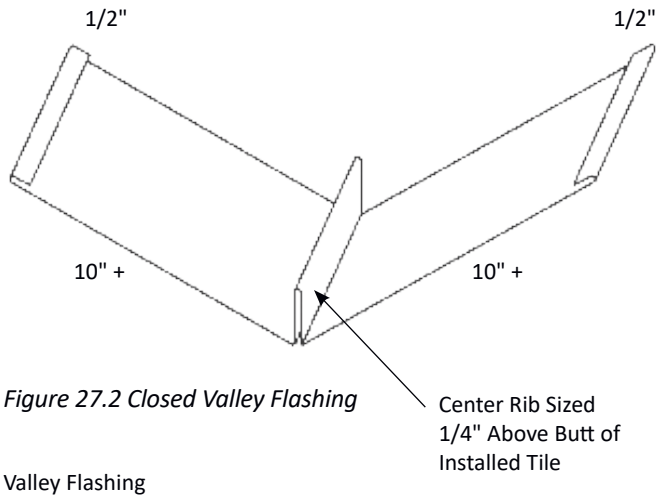


Figure 27.2 Closed Valley Flashing

Flashing at Side Walls

The transition from roof to side wall is flashed with step flashing.

Step Flashing

In the step method of flashing, individual 16 oz. sheet copper flashing is applied between each course of tile. A minimum head lap of 3" must be provided from step flashing to step flashing.

The following criteria should be used to determine the appropriate size for step flashing:

1. The step flashings should be the length of the filed tile plus 1".

2. The step flashing should extend up the vertical surface a minimum of 4" and a minimum of 2" overlap of the siding, cladding or copper counterflashing.

3. The step flashing should extend a minimum of 5" onto the roof so that there is at least a 5" overlap of the underlying tile.

4. The flashing should be at least 16 oz. sheet copper.

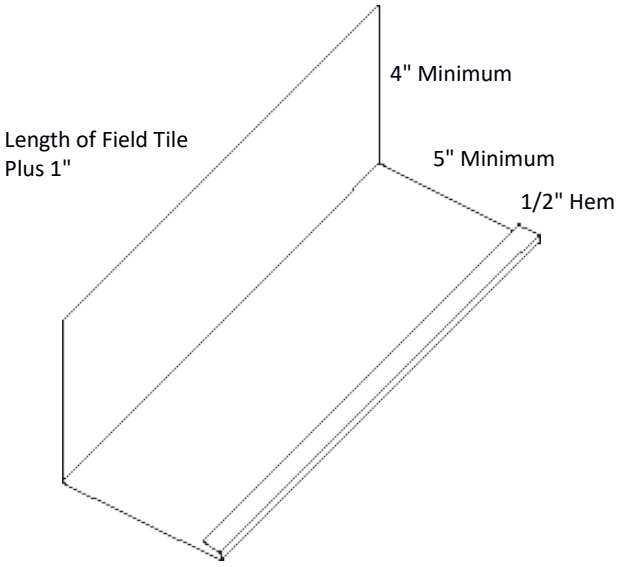


Figure 28.1 Side Wall Copper Step Flashing

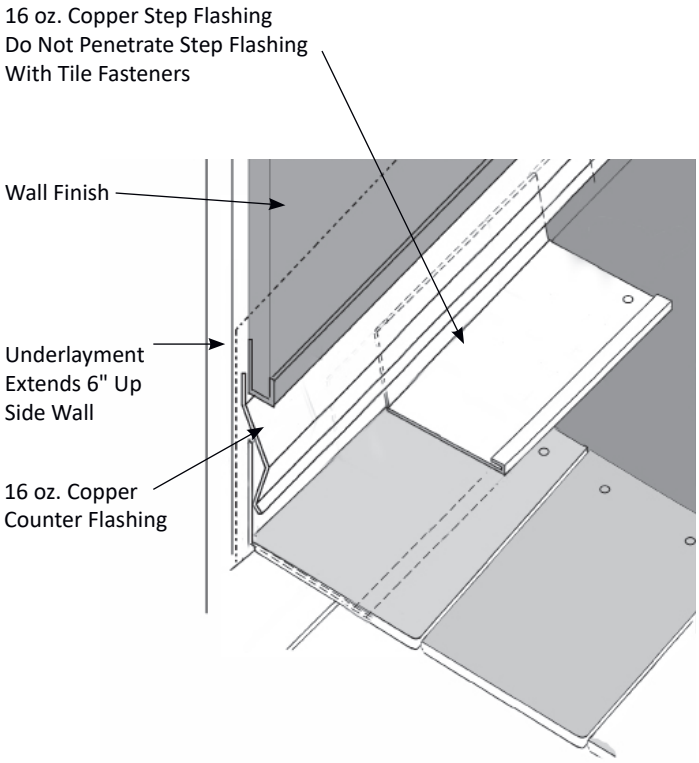


Figure 28.2 Side Wall Copper Step Flashing With Counter Flashing

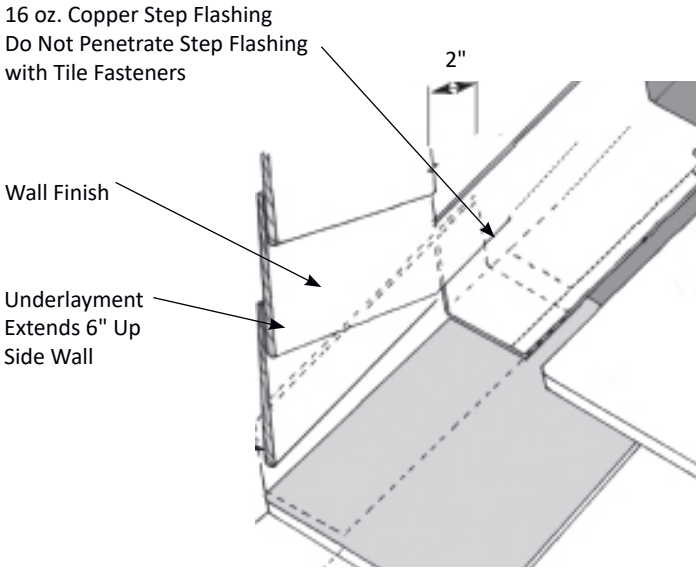


Figure 28.3 Side Wall Copper Step Flashing for Siding

Flashing at Open Valley at Main Roof to Dormer Juncture

For flashing where an open valley occurs at the intersection of a dormer roof and the main roof, the following steps should be taken.

1. The main roof tiles should be installed to just above the lower end of the valley, where the valley and the main roof intersect. Along the roof and wall juncture, step or channel flashing must be used and the last tile in the course should fit closely against the wall of the dormer (see Figure 29.1).
2. The bottom end of the copper valley flashing should be cut so that it extends 1/2" below the down-slope edge of the dormer roof deck at the bottom of the valley. This lower cut edge should project a minimum of 2" below the intersection of the dormer and main roof.

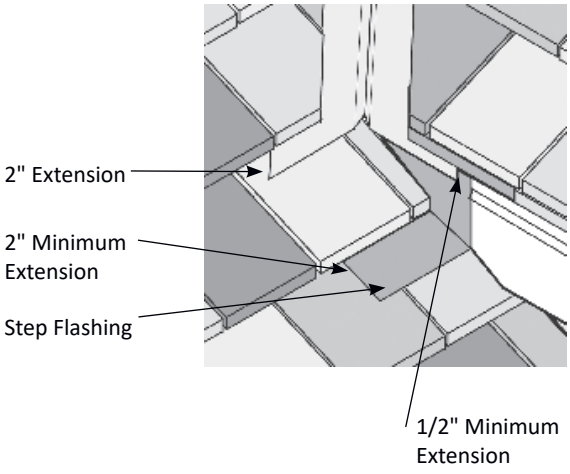


Figure 29.2 Open Valley at Main Roof to Dormer Juncture Close-up

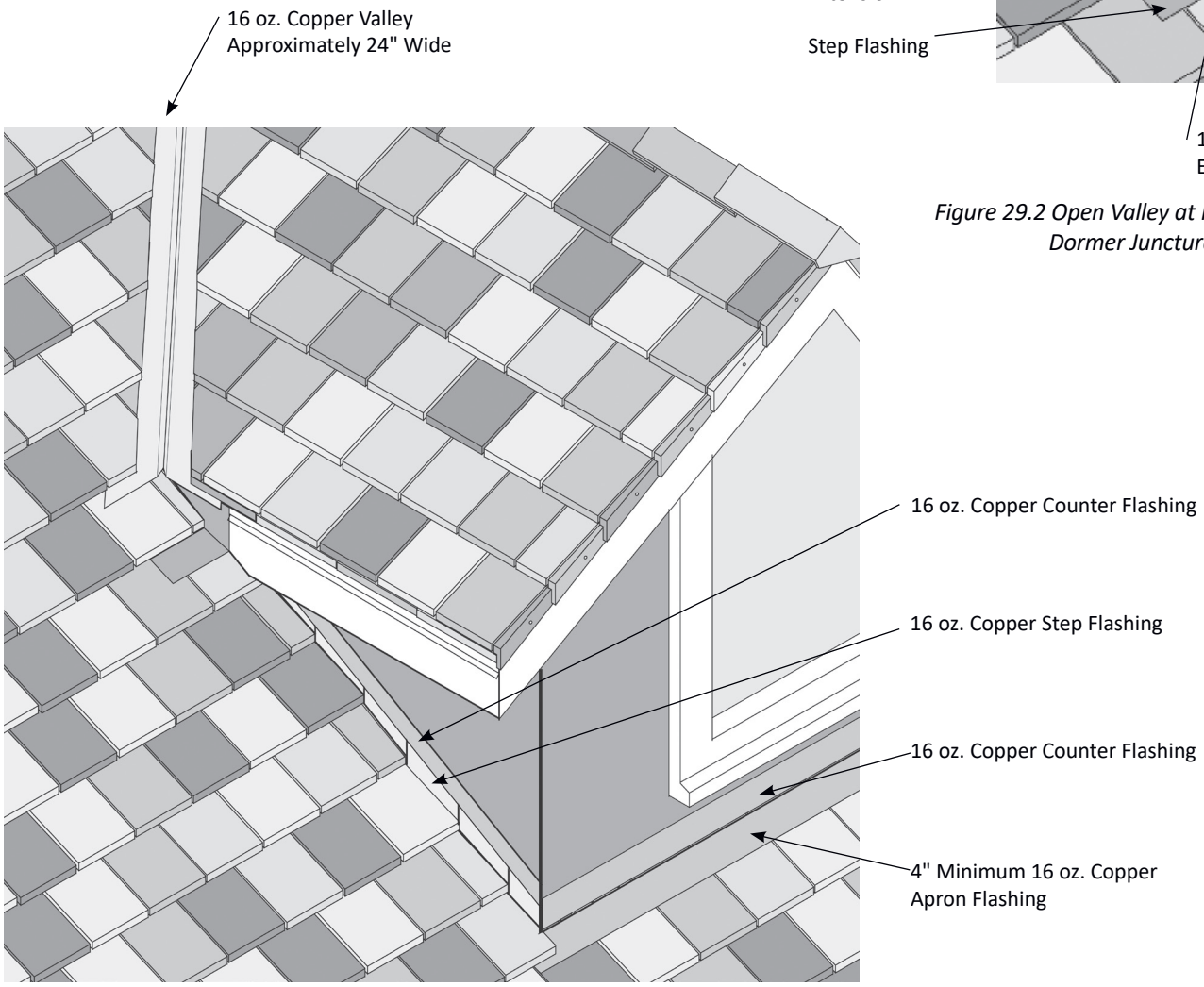


Figure 29.1 Open Valley at Main Roof to Dormer Juncture

Flashing at Head Wall

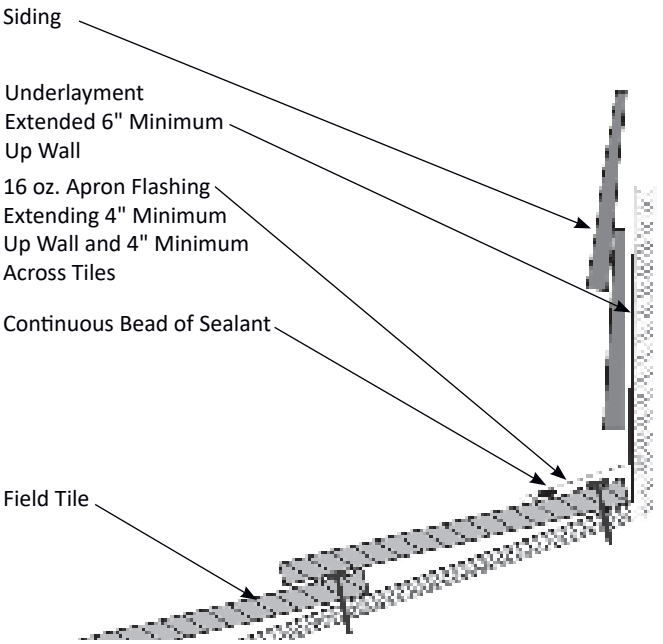


Figure 30.1 Apron Flashing at Siding Head Wall Detail

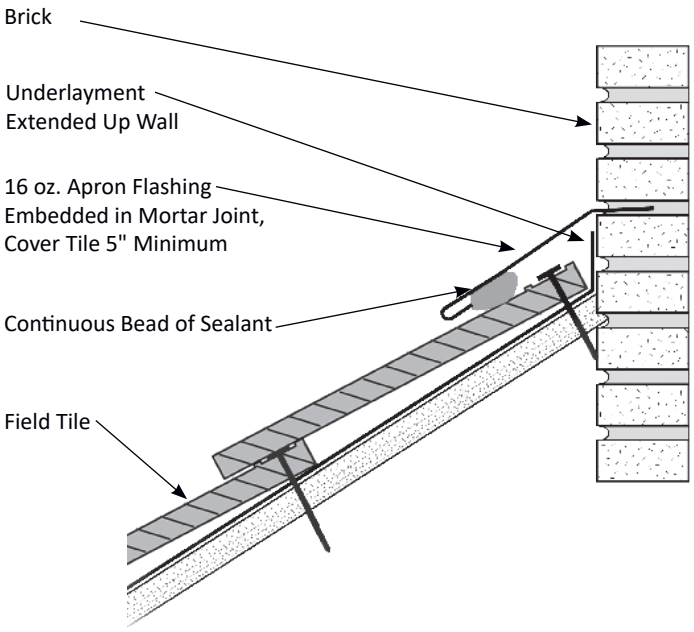


Figure 30.3 Apron Flashing at Brick Head Wall Detail

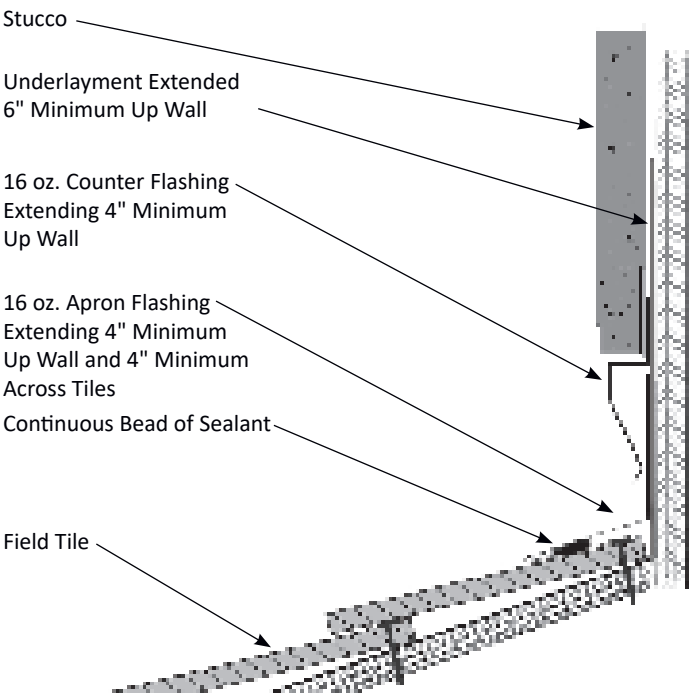


Figure 30.2 Counter Flashing & Apron Flashing at Stucco Head Wall

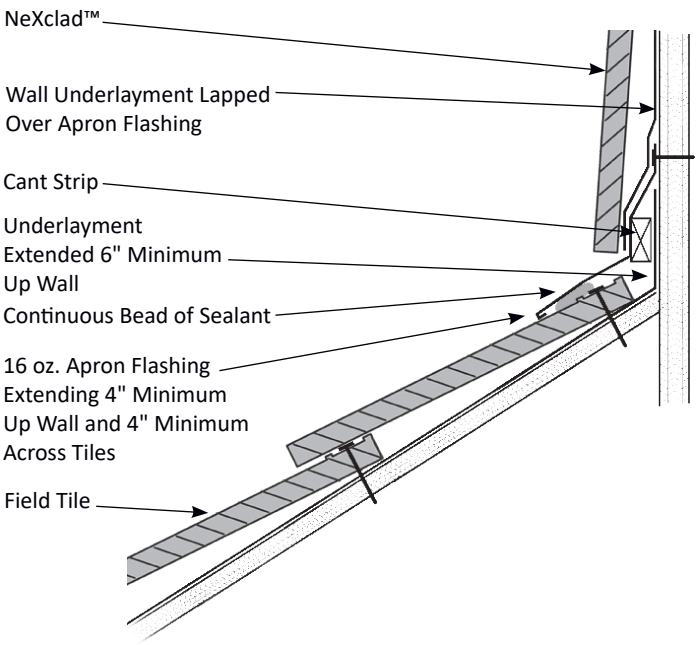


Figure 30.4 Apron Flashing at NeXclad Head Wall

Flashing at Chimney

Since the foundations of chimneys are usually structurally separate, the flashing around chimneys needs to be able to accommodate movement from differential settlement without compromising the watertightness of the roof. Regardless of the climate, install self-adhering Ice and Water Shield membrane around the base of the chimney before the underlayment is applied as a protection against ice dams. Four types of flashing are required to properly flash around chimneys.

1. Apron flashing at the down slope face over the installed tiles – 4" minimum exposed width, 6" up the face of the chimney and continuously counterflashed.
2. Step flashing along the sides of the chimney.
3. Cricket or backer flashing on the upslope side or back.
4. Continuous counterflashing embedded in masonry joints.

Counterflashing

Sheet copper counterflashing should be installed to overlap all vertical flashing flanges extended up the sides of chimneys. This is best accomplished by the mason during construction.

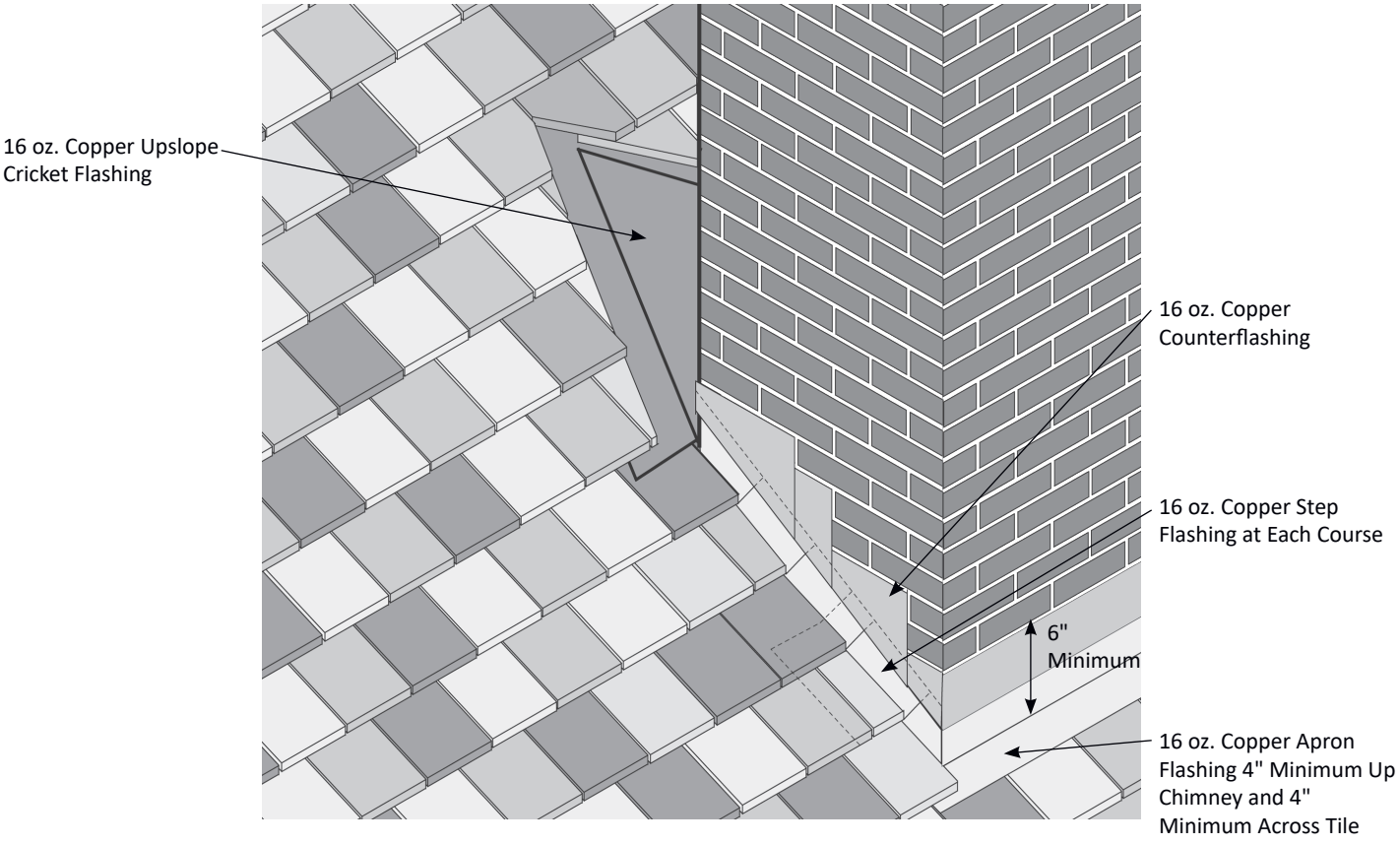


Figure 31.1 Chimney Flashing

Additional Flashing Details

Plumbing pipe vents and stacks, skylights, roof-to-roof transition and other penetrations all require special flashing.

NOTE: Be sure to order Skylights with a flashing package specifically designed for tile roofs and to accommodate the combined thickness of the layers of Interlocking tile specified.

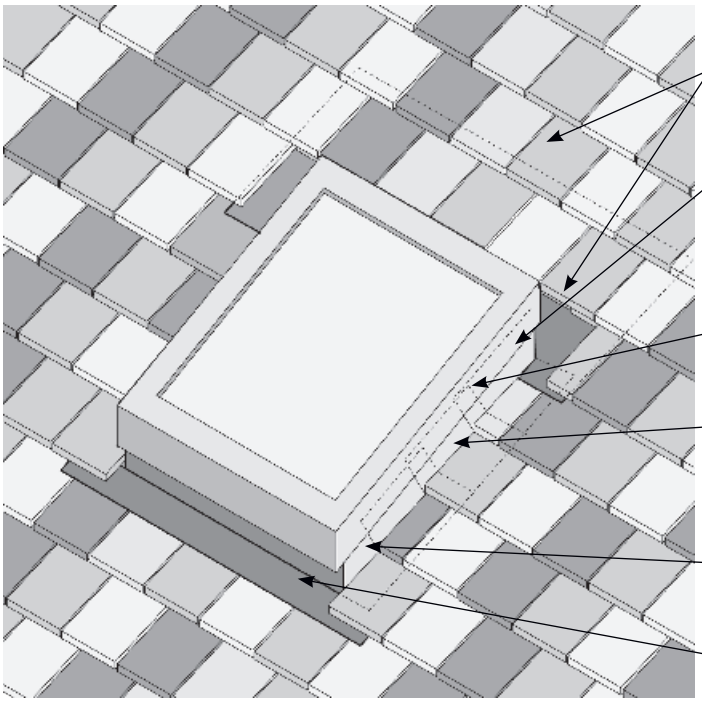


Figure 32.1 Flashing at Skylights

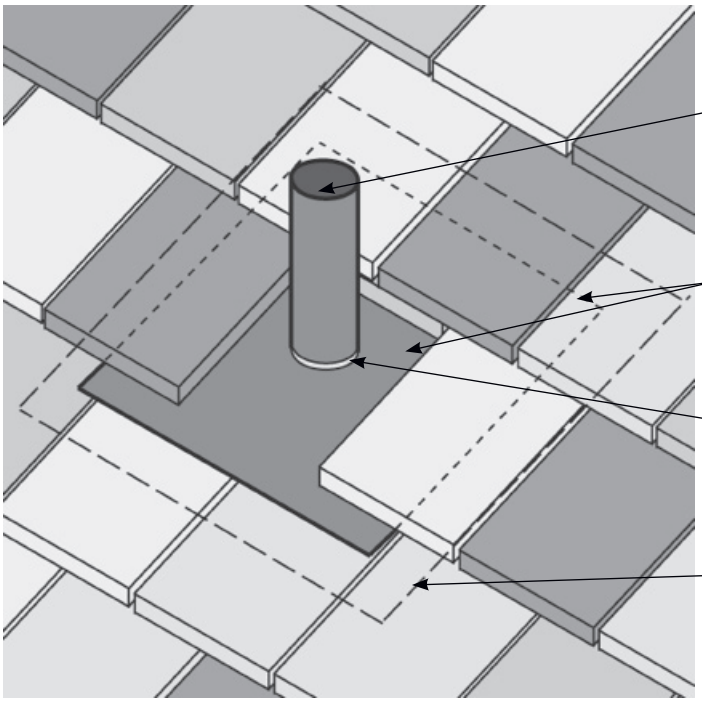


Figure 32.2 Flashing at Vents

Flashing at Pitch Change and Built In Gutter

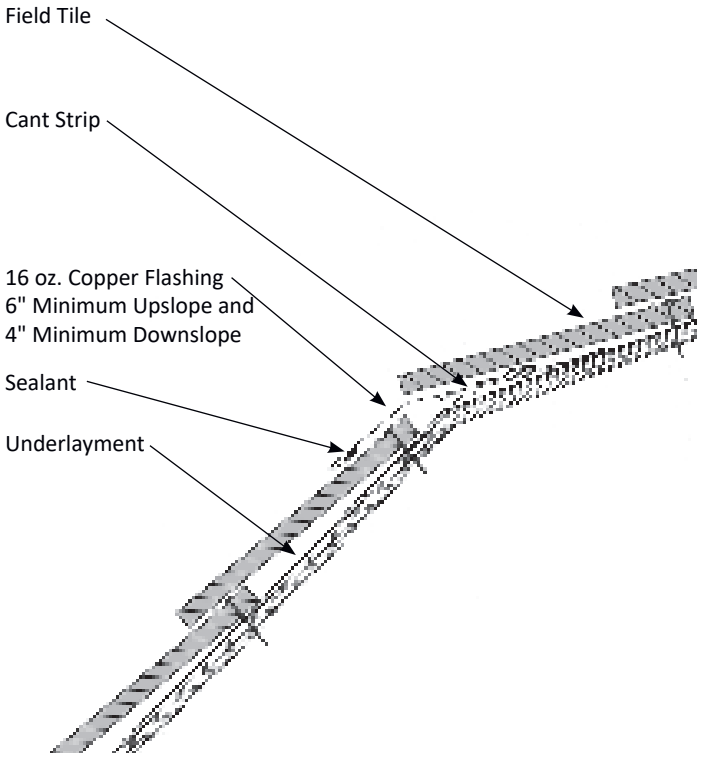


Figure 33.1 Flashing at High Slope to Low Slope Transition

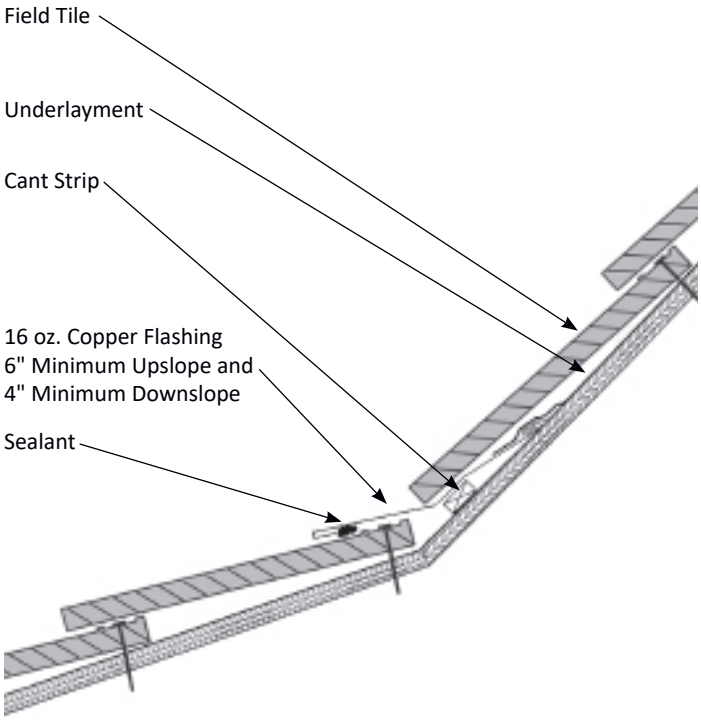


Figure 33.2 Flashing at Low Slope to High Slope Transition

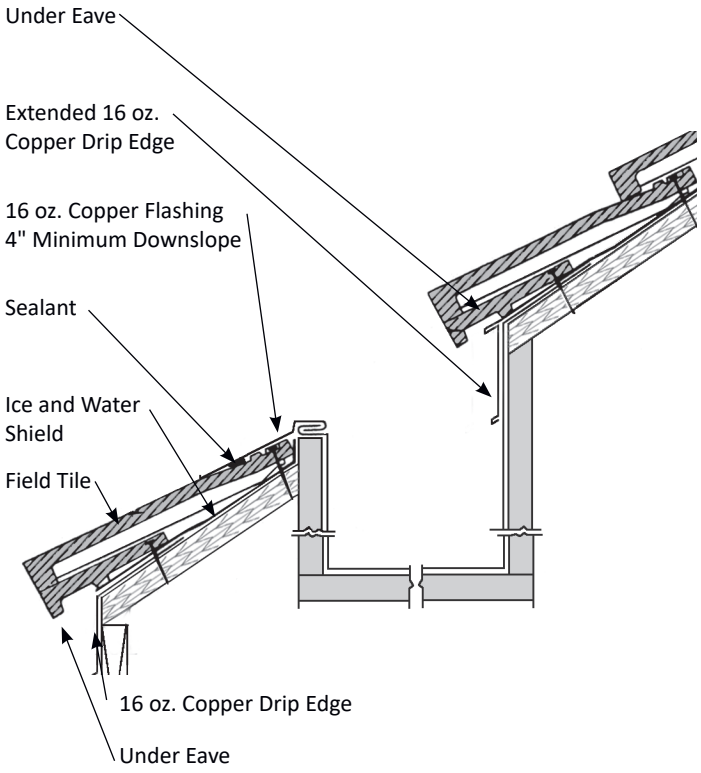


Figure 33.3 Built in Gutter Detail for Flat Interlocking Tile

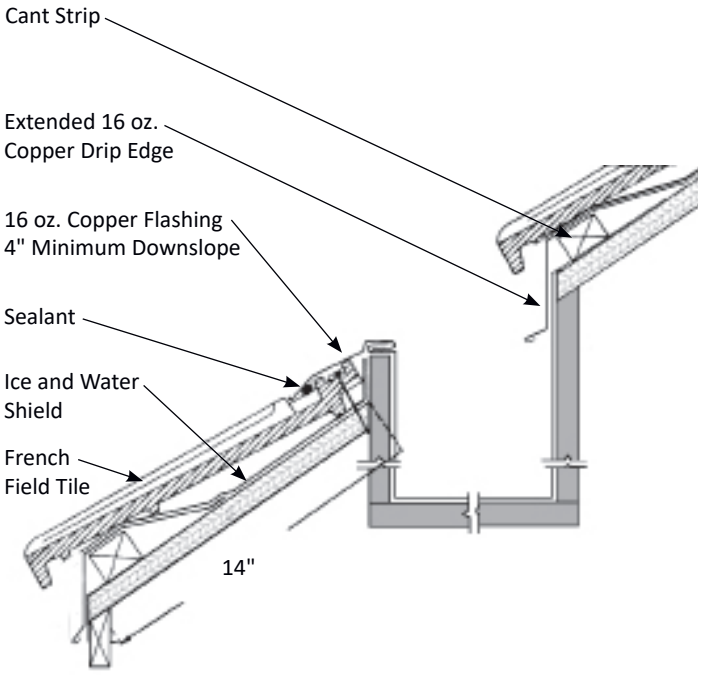
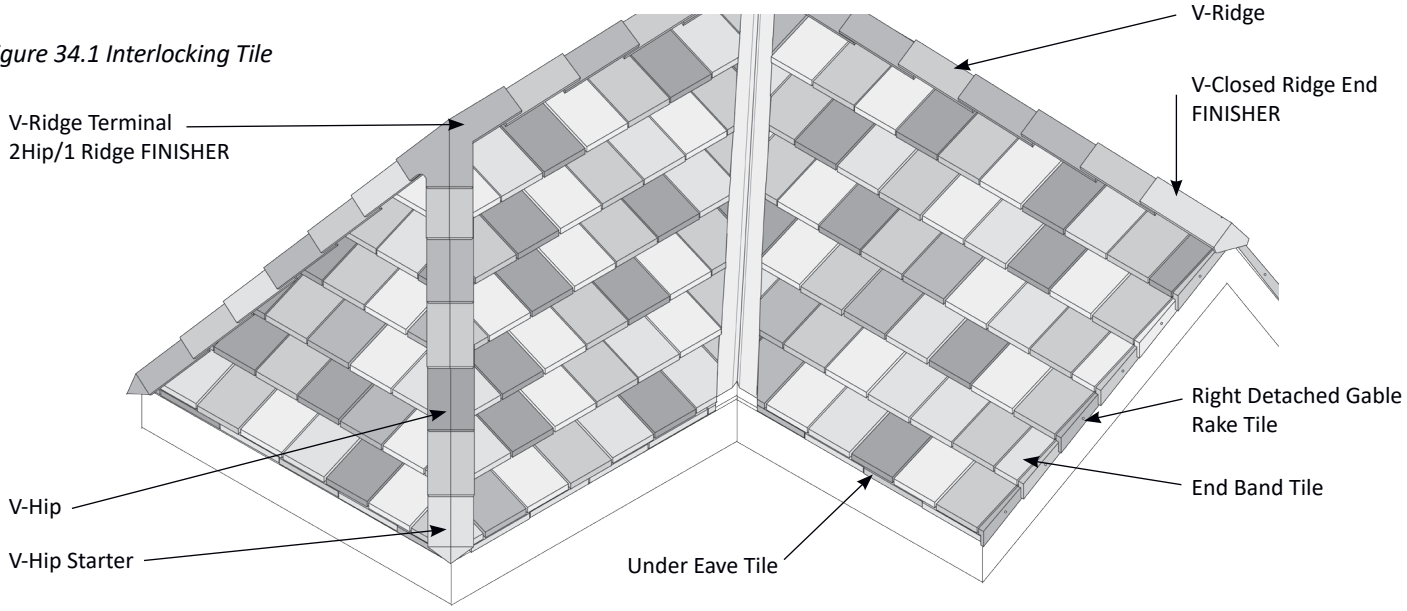


Figure 33.4 Built in Gutter Detail for French Interlocking Tile

Morando 14" & 16" Tile Installation

Figure 34.1 Interlocking Tile



The following roof preparations must be completed before installing any roof tile.

For detailed information on these items refer to the previous sections in this manual or the NRCA Manual on Steep Roofing.

- Install the flashings required for ensuring watertightness:
  - Eave Flashing
  - Rake Edge Flashing (if required)
  - Valley Flashing
  - Dormer and Sidewall Flashing, Skylight Flashing, Chimney and Cricket Flashing
  - Vent Flashing
- Underlayment for the entire roof deck, including the appropriate waterproof underlayments required for all flashing and, where required, the ice dam membrane
- All cant strips and Hip and Ridge stringers should be installed and covered in underlayment.
- Roof surface chalked with vertical and horizontal lines
- ***To avoid damaging the new roof adjoining walls, chimneys and other above the roof line components of the structure should be complete prior to installing the tile to minimize other trades traversing the completed roof.***

Points to Remember During Field Tile Installation

Tile installation will generally progress in a diagonal fashion, moving from the starting point of the under eave tile.

- Use the chalk lines as a guide.
- Watch for any irregularities in the roof deck construction.
- After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.
- When each course is 10 to 12 tiles from the terminating end, compare the remaining distance to the width of the tiles to determine if a slight crowding or stretching of the tile may be required to ensure the last piece in the course is an end band (1/2 tile) or a full tile. DO NOT crowd or pull to the extreme any more than 5 or 6 pieces positioned side by side.

NOTE: Each flat Interlocking field tile is provided with two fastening nail holes and French field tile with one. When installing field tiles or accessories care should be taken to fasten each tile with nails or screws in every provided fastening hole.

Eave

Installation of most Ludowici Interlocking tile patterns require the use of an Under Eave Tile. This under eave tile provides the proper cant angle for the starter course. The under eave tiles are normally laid right to left, or laid from the gable end to a valley. Normal practice requires the under eave tile to be laid with a 2" overhang at the eave and flush at the rake. Lay the under eave course loose across the slope to determine what adjustments, if any, are needed in the course before nails or screws are installed. Once layout is established, install these under eave tile in the normal right to left fashion. French tiles are installed with a cant strip in lieu of an under eave tile. LudoSlate™ and LudoShake™ can be installed with under eave tiles or a cant strip.

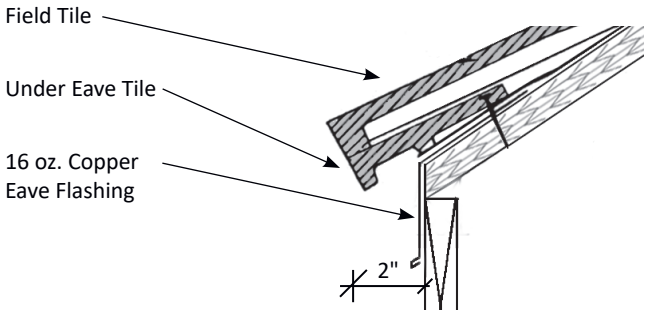


Figure 35.1 Flat Interlocking Eave Detail With Under Eave

First and Succeeding Courses of Tile

Interlocking clay tile are normally laid from right to left starting with the right detached gable rake. The detached gable rake serves as a flashing detail for the rake edge and is available in left and right hand versions. These tile shall be installed with the fasteners typical to the field tile installation, but they will also require flashing cement (meeting requirements of ASTM D-4586) to be applied between the contact areas of the field tile and the gable rake. When looking at the eave courses of the field tiles, the gable rakes to the right are called the rights and vise-versa.

After installing the right detached gable rake, the starter course will begin with a full tile placed directly over the first under eave tile. The second course will be started with an end band tile and will be laid to provide the proper vertical exposure with the normal head lap of 3". This exposure is continued through each successive course. All joints of the second course and succeeding courses should be at the center line of the previous course. If the Interlocking tile are to start at a valley it is suggested to lay the tile loose across the slope to determine what adjustments, if any, are needed.

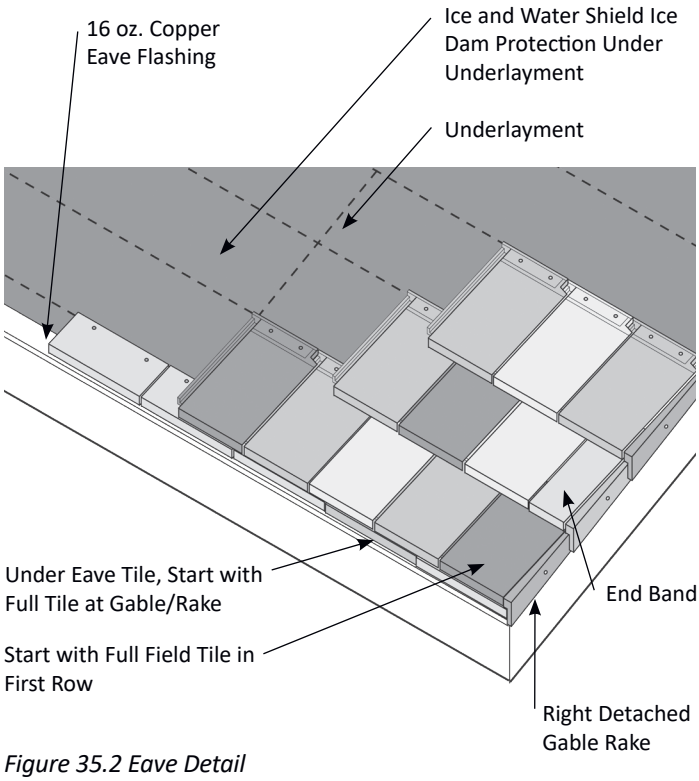


Figure 35.2 Eave Detail

Valley Tiles

Tile to be installed in valleys can be mitered in the field or by ordering and using special factory tile. Whether field miter cut or factory tile are used, the tile fasteners should never penetrate the valley flashings. Tile to be installed over the copper valley flashing should be drilled or notched and wired with solid 16 gauge wire to fasteners driven into the deck beyond the flashing.

NOTE: Notching and drilling was addressed previously on Page 19. In situations where valley tile pieces are so small that it is not practical to notch or drill, use the adhesive RT600 (an OSI product) or its equivalent.

If special factory valley tile are being applied prior to installation, it will be beneficial to loose lay the entire eave field tile course including the valley tile. This loose laying process of the valley's left side will advance as a typical installation would, from right to left. But, when loose laying the valley's right side, it will advance from left to right.

The installation of the Interlocking tiles will slow the process initially. Each tile, when spaced on the deck, will require a slightly upward lifting to allow for the proceeding tile to be laid into the Interlocking channel. Once the spacing is approved, the space can return to the standard. The tiles can be fastened in the typical right to left pattern.

The loose laying process becomes vitally important when the roof deck runs from valley-to-valley. The focus must be to space the eave course so it consists of all full field tile and is finished on both ends with the special cut valley tiles or so it consists of all full field tile, one end band (half tile) and is finished, as stated above, with the special cut valley tiles. Keep in mind not to allow any more than 5 pieces pulled to the extreme or crowded together. When the distance between valleys is so minimal it does not allow for the above mentioned spacing, one field tile per course will require field cutting to allow for proper lay up. If field mitered valley tiles are applied, they should be trimmed to provide a clean, even, continuous edge along the entire valley length.

To encourage leaves and snow to slide down the valley, the gap between the Valley Tiles and the center line of the valley should be tapered from 3" at the top to 4" at the bottom. This can be increased for long valleys or heavy snow locations.

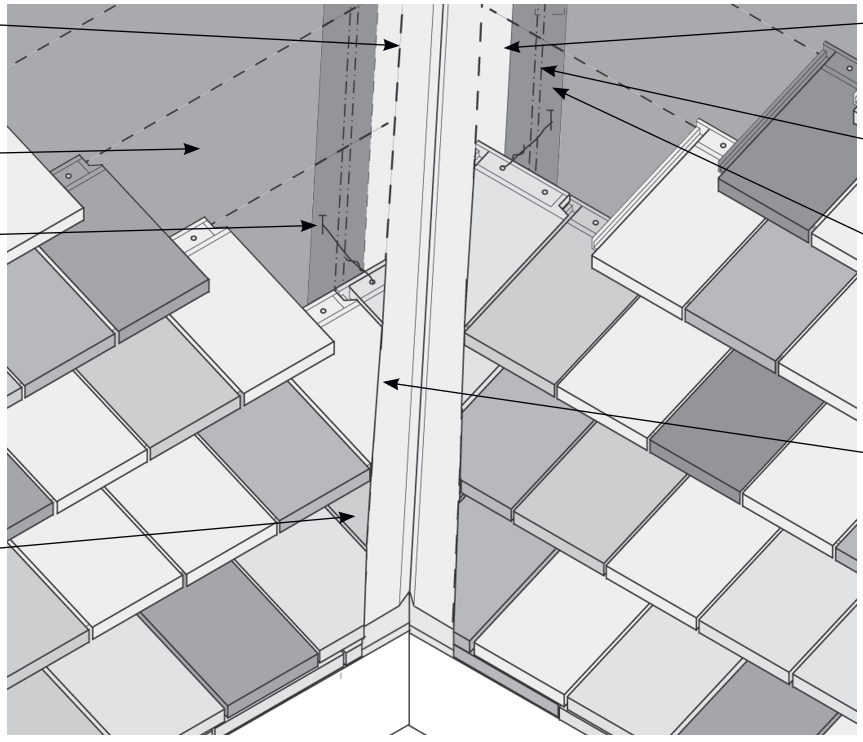


Figure 38.1 Valley Detail

Hip Tiles

There are a number of methods to finish the hips of Interlocking tile roof depending on the design aesthetics desired. These methods are flushed mitered, V-Hip tile or one of Ludowici's other trim groups.

Tiles to be installed at hips are field mitered.

V-Hip and Other Cap Type Hip Rolls

Hips are started with a special V-Hip Starter tile which should cover the field tile approximately 3" on both sides. The regular V-Hip tile is then installed by creating an approximate 2" head lap on the V-Hip starter tile. This 2" head lap is continued up the hip and roofing cement is applied at each hip tile's overlap. The last fastener on the upslope end of the hip is typically covered with a V-Hip and Ridge Terminal. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative for the project's special roof requirements.

Chart 39.1

Roof Pitch Rise:Run	V-Hip	118 Hip	102 Hip	CC Hip
4:12	2 1/4"	2 7/8"	4 3/4"	2 1/4"
5:12	2 1/4"	2 7/8"	4 5/8"	2 1/4"
6:12	2"	2 7/8"	4 5/8"	2"
7:12	2"	2 3/4"	4 1/2"	2"
8:12	1 3/4"	2 3/4"	4 1/2"	1 3/4"
9:12	1 3/4"	2 3/4"	4 3/8"	1 3/4"
10:12	1 1/2"	2 5/8"	4 3/8"	1 1/2"
11:12	1 1/2"	2 5/8"	4 1/4"	1 1/2"
12:12	1 1/4"	2 5/8"	4 1/4"	1 1/4"
13:12	1 1/4"	2 5/8"	4 1/8"	1 1/4"
14:12	1 1/4"	2 5/8"	4 1/8"	1 1/4"

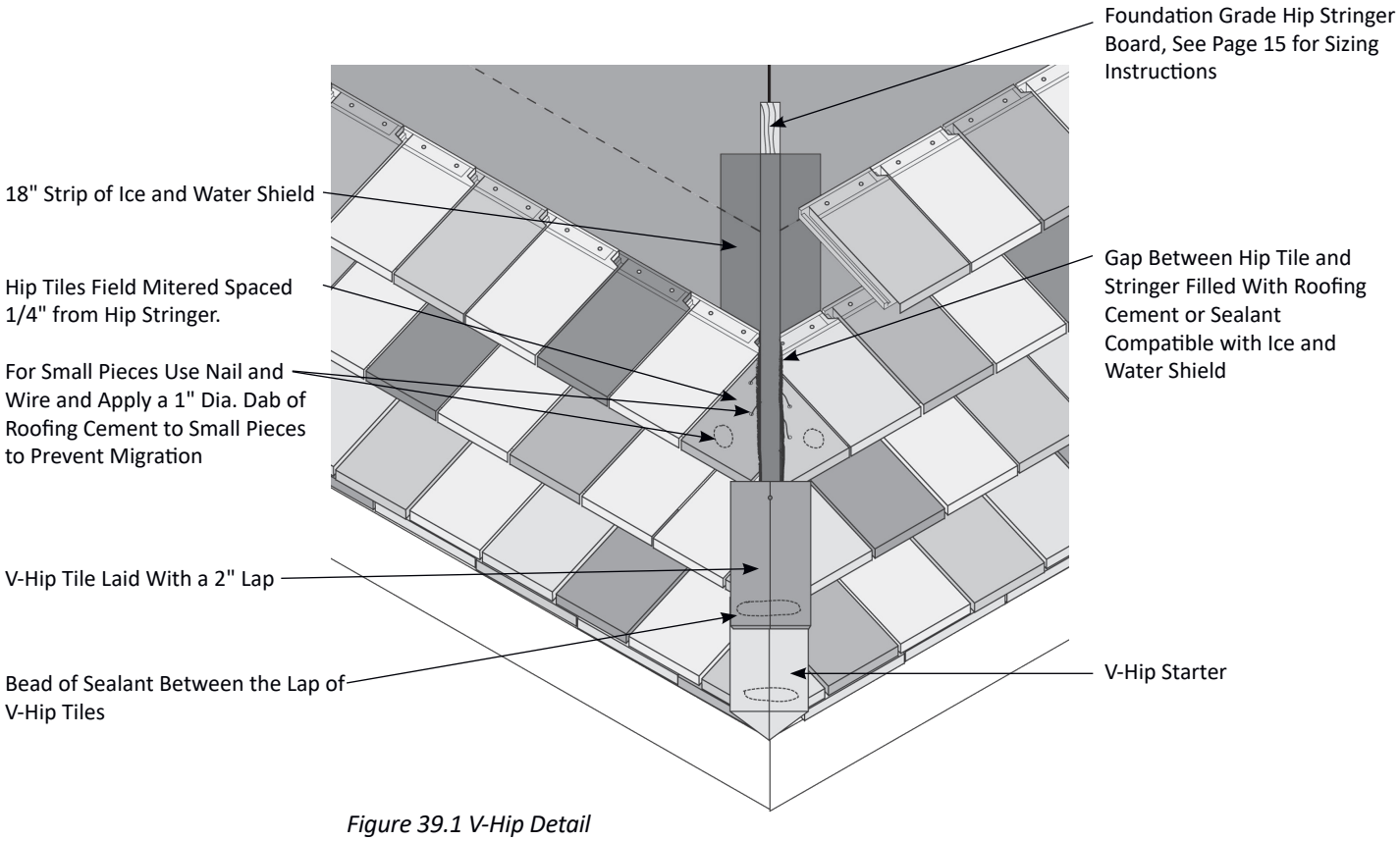


Figure 39.1 V-Hip Detail

Mitered Hip

A flush mitered hip can be done by accurately miter-cutting the field tile and sealing the finished joint with an approved sealant, meeting the requirements of ASTM D-4586. Mitred hips require the use of copper step flashing on every course.

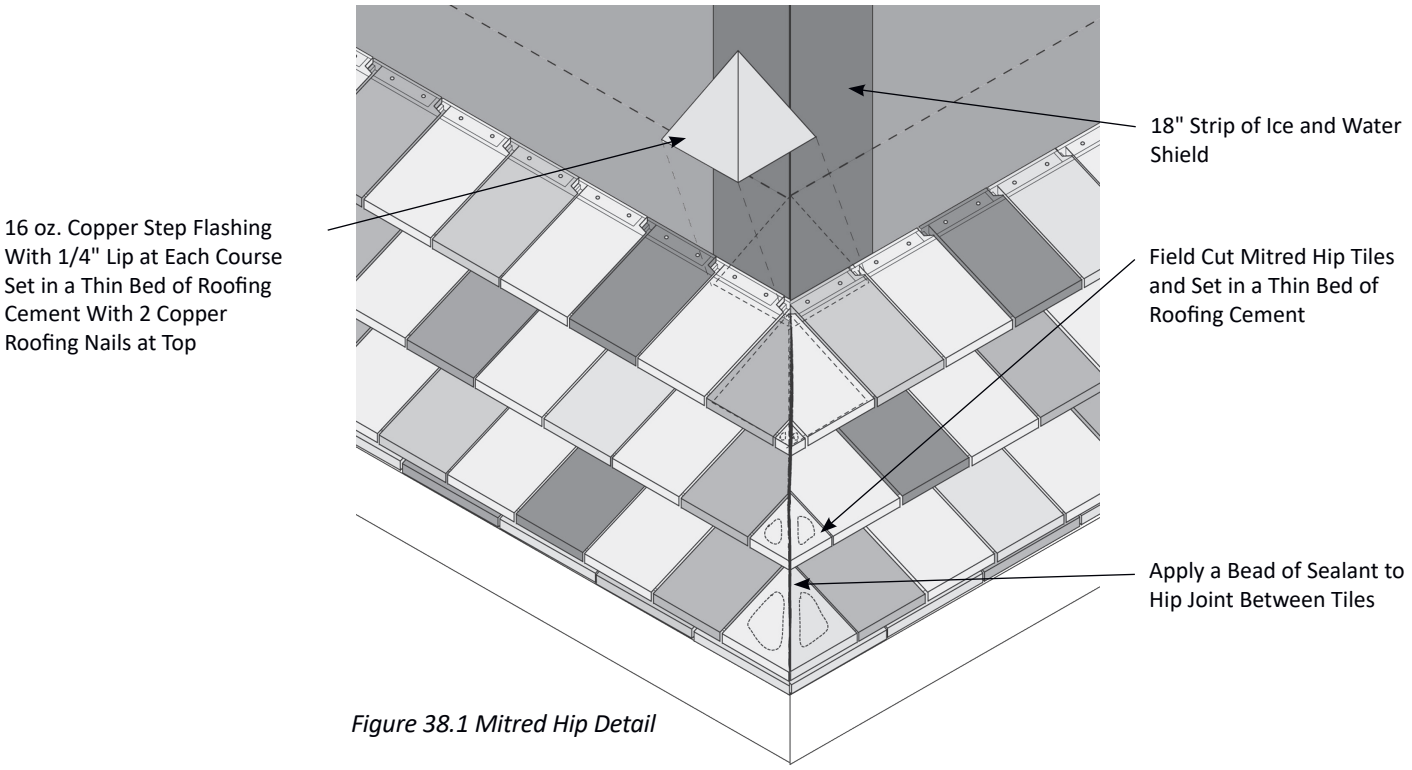
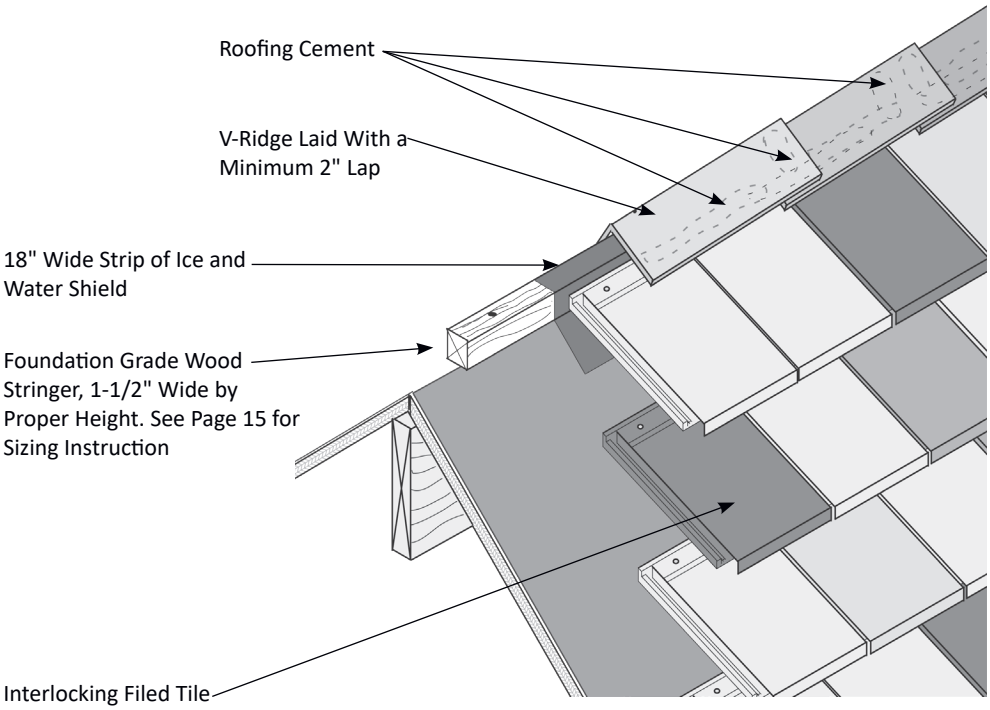


Figure 38.1 Mitred Hip Detail

Figure 38.2 V-Ridge Detail

Ridge

V-Ridge



Circular Cover Ridge

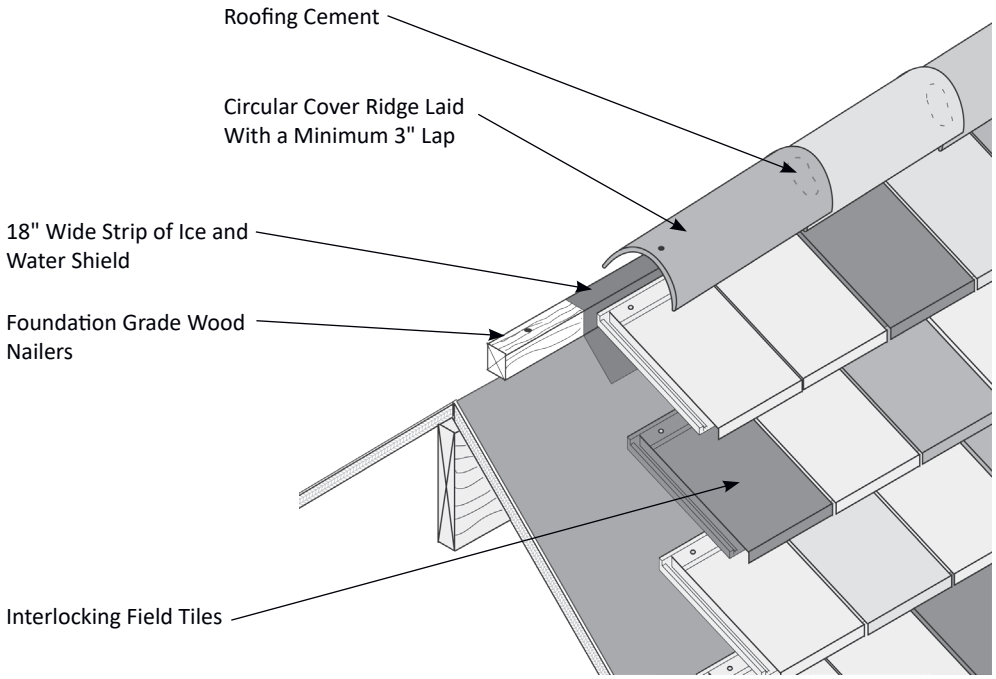


Figure 39.1 Circular Cover Ridge Detail

Roof Pitch Rise:Run	V-Ridge	211 Ridge	206 Ridge	CC-Ridge
4:12	1 1/4"	3 1/8"	5 1/4"	1 1/4"
5:12	1"	2 7/8"	5"	1"
6:12	13/16"	2 5/8"	5 3/4"	13/16"
7:12	9/16"	2 3/8"	4 1/2"	9/16"
8:12	3/8"	2 1/8"	4 1/4"	3/8"
9:12	1/4"	1 7/8"	4"	1/4"
10:12	3/16"	1 5/8"	3 3/4"	3/16"
11:12	9/16"	1 3/8"	3 1/4"	9/16"
12:12	7/16"	1 1/8"	3 1/2"	7/16"
13:12	1/4"	7/8"	3"	1/4"
14:12	1/8"	5/8"	2 7/8"	1/8"

Chart 39.1

Mitered Ridge

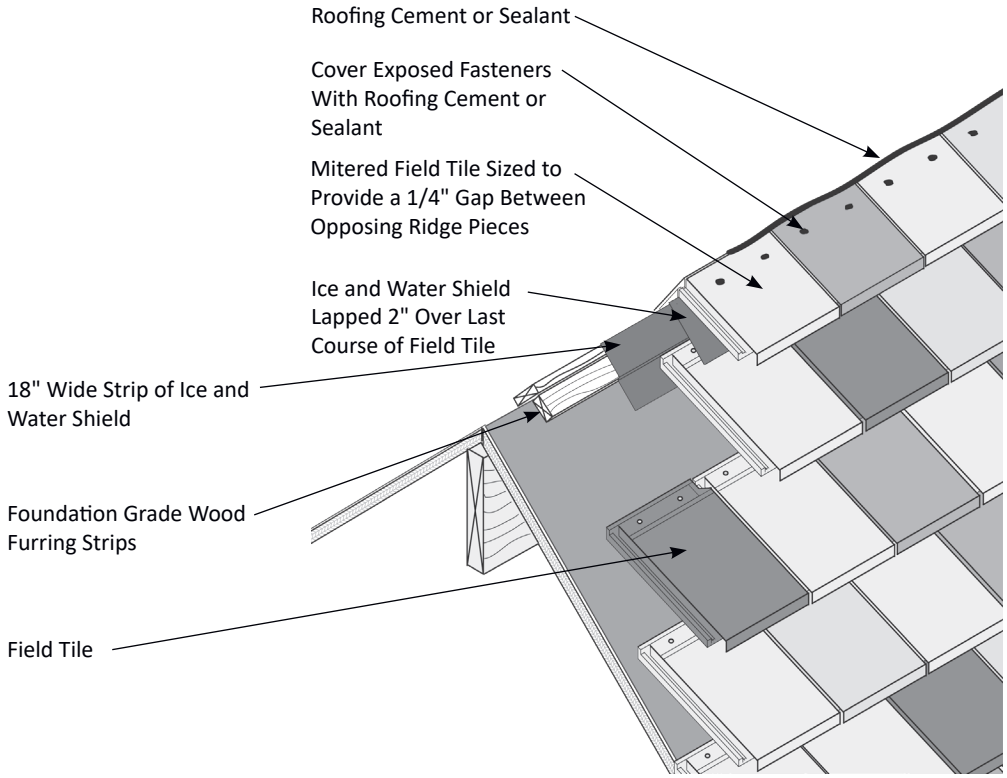


Figure 40.1 Mitered Ridge Detail

Circular Cover Ridge Vented

This Ridge Vent allows 5 square inches of ventilation per foot of ridge.

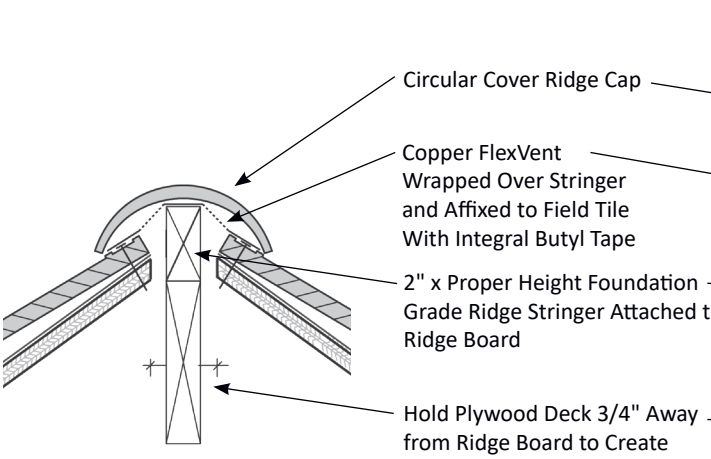


Figure 40.2 Vented Circular Cover Section

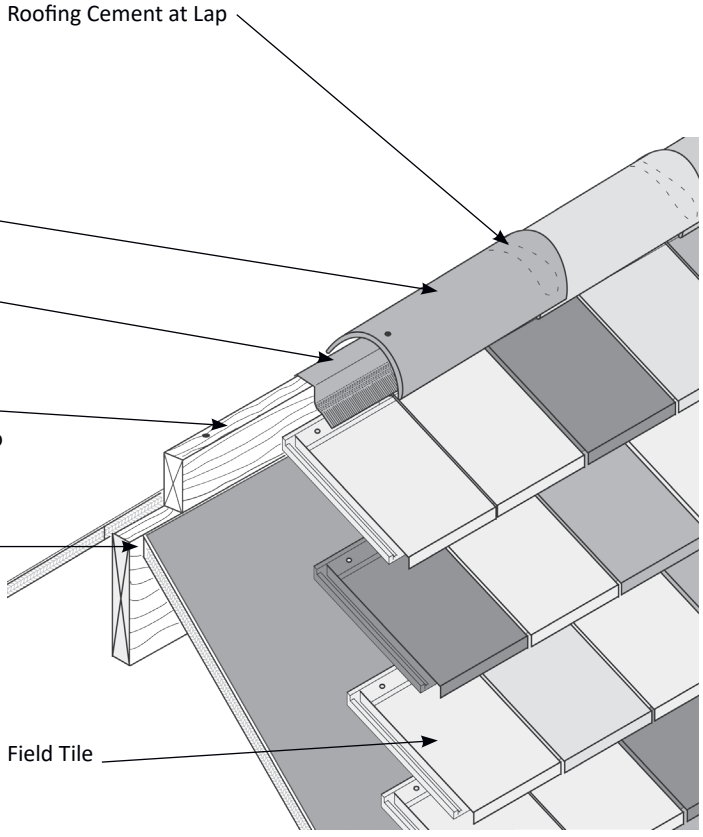


Figure 40.3 Vented Circular Cover Ridge Detail

211 Ridge Vented

This ridge vent allows 6.27 square inches of ventilation per foot of ridge.

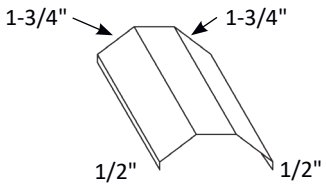


Figure 41.1 #211 Vented Ridge Cap Flashing

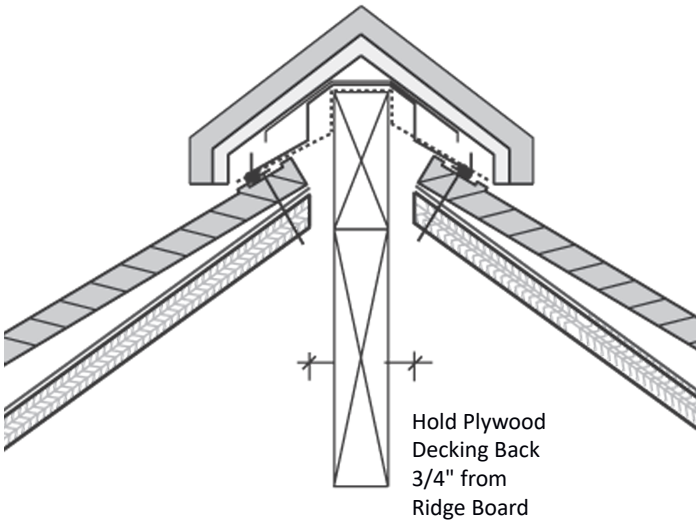


Figure 41.3 #211 Vented Ridge Section

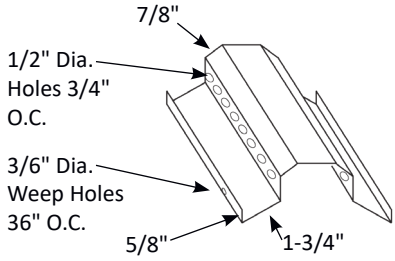


Figure 41.2 #211 Vented Ridge Vent Flashing

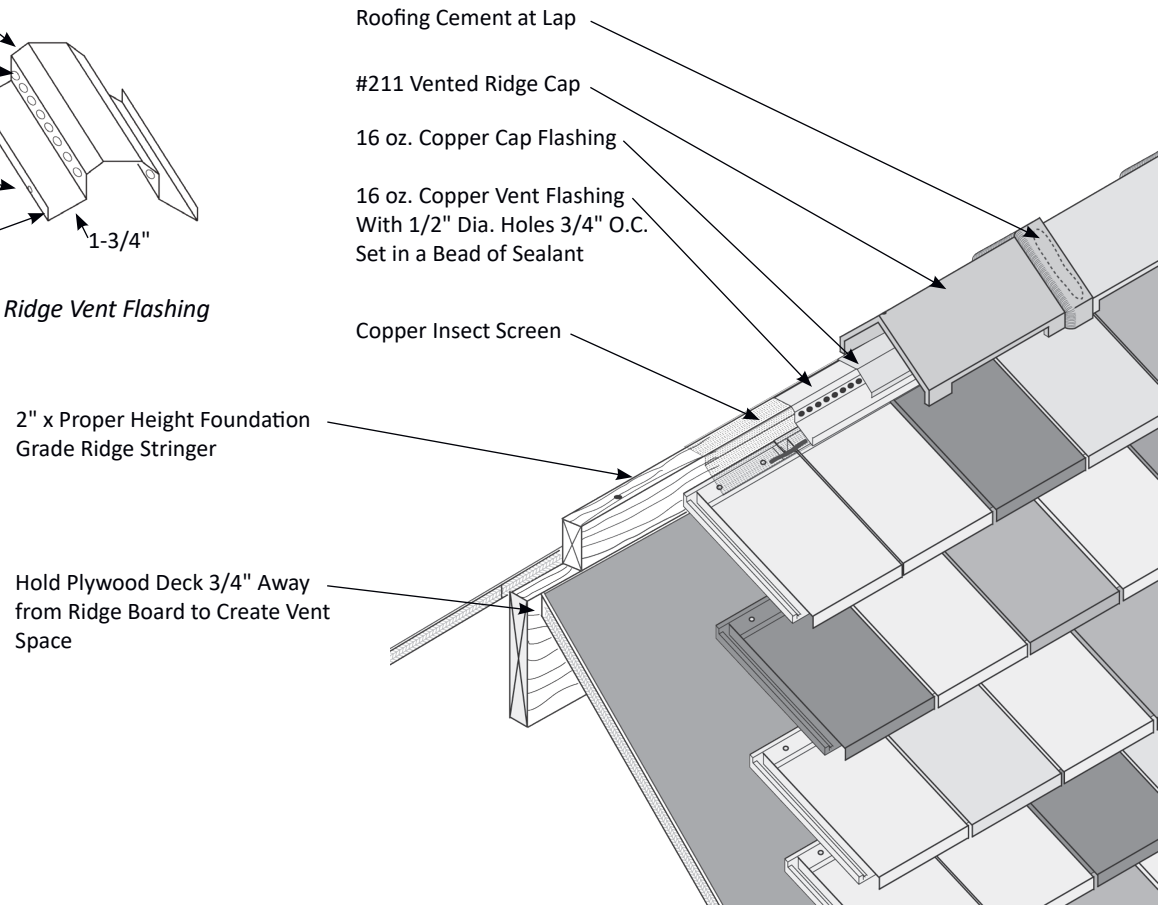


Figure 43.4 #211 Vented Ridge Detail

206 Ridge Vented

This ridge vent allows 6.27 square inches of ventilation per foot of ridge.

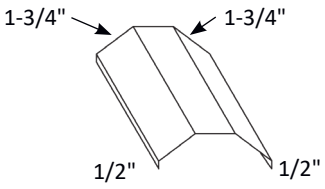


Figure 42.1 #211 Vented Ridge Cap Flashing

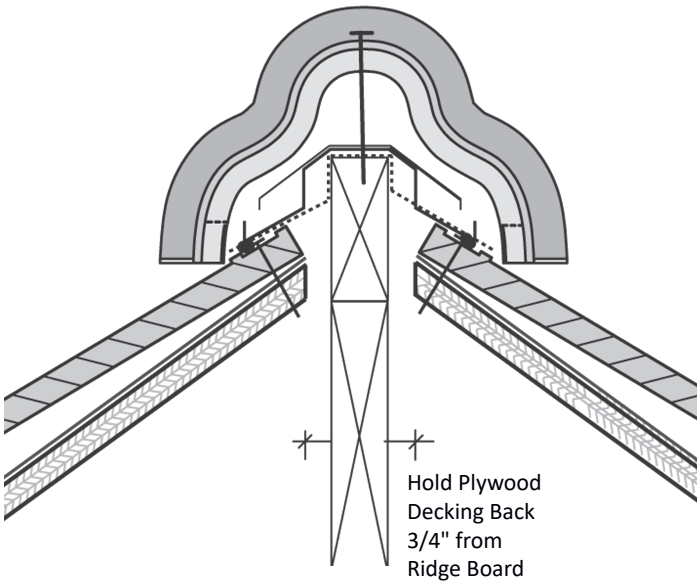


Figure 42.3 #211 Vented Ridge Section

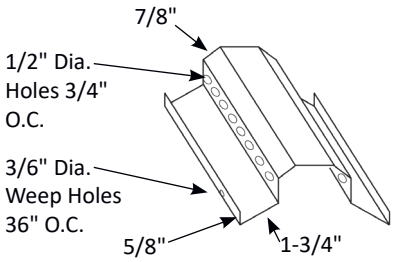


Figure 42.2 #211 Vented Ridge Vent Flashing

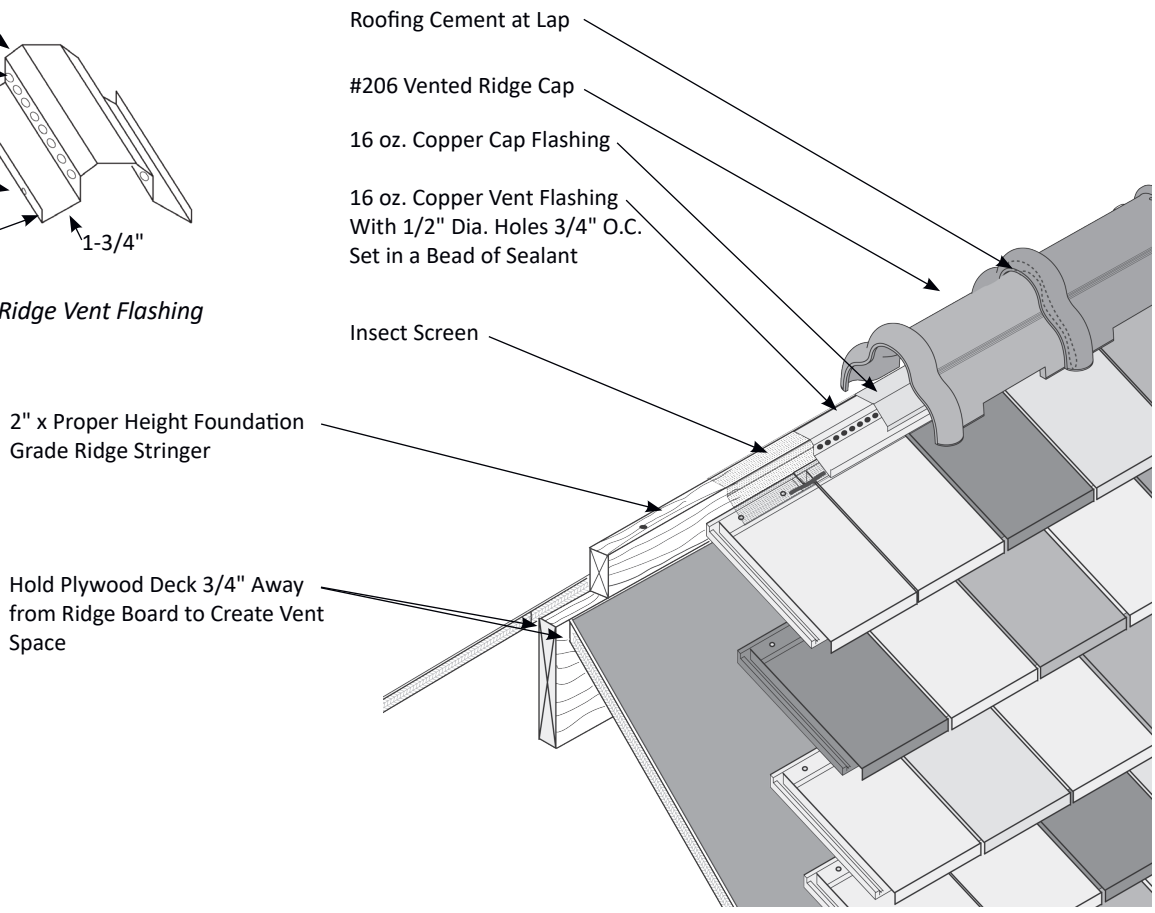


Figure 44.4 #206 Vented Ridge Detail

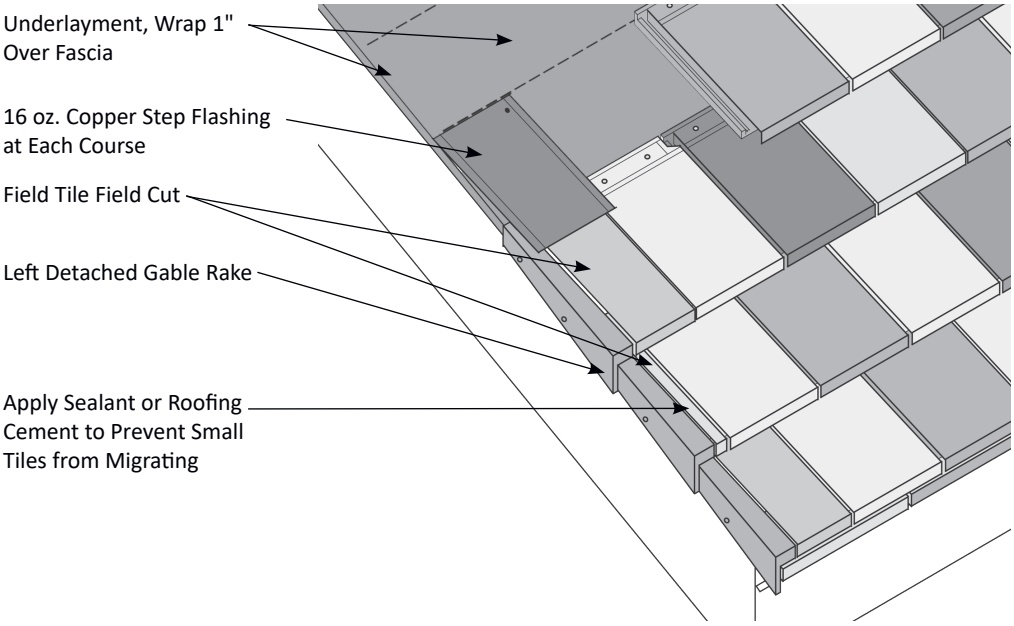


Figure 43.1 Left Rake Step Flashing for Field Cut Field Tiles

Figure 45.1 For conditions where inadequate spacing doesn't allow for the use of full field tiles and end bands.

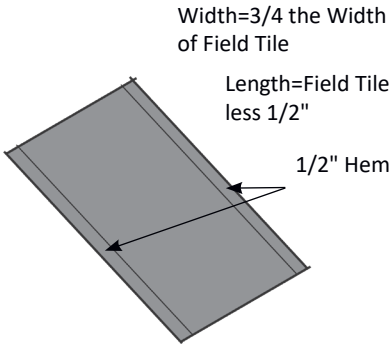


Figure 43.2 Left Rake Step Flashing

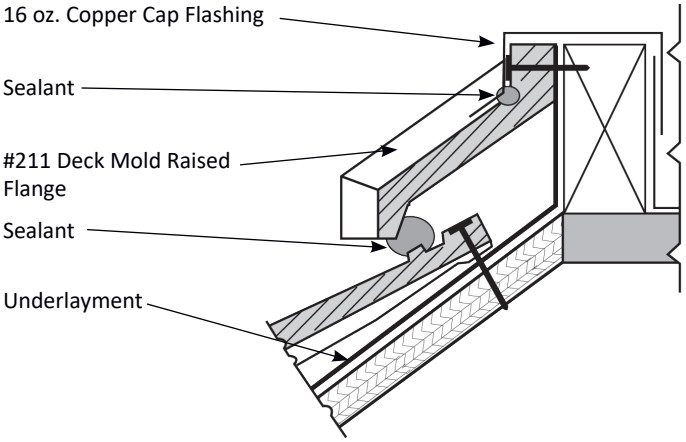


Figure 43.3 Deck Section with #211 Deck Mold Raised Flange

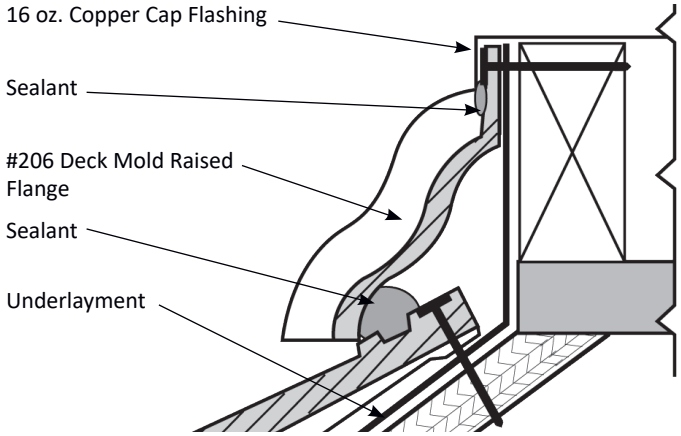


Figure 43.4 Deck Section with #206 Deck Mold Raised Flange

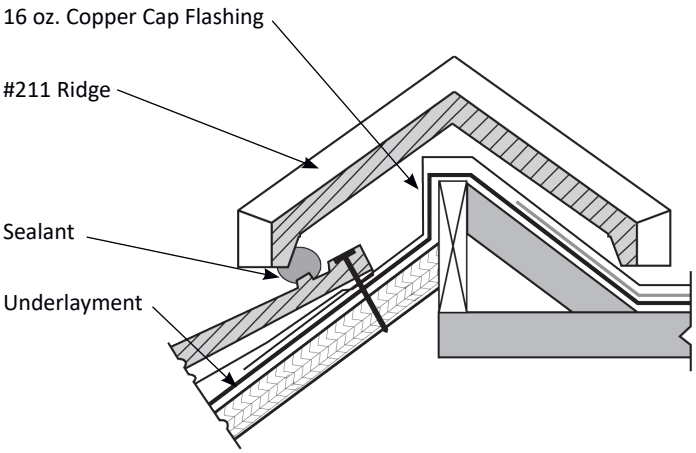


Figure 43.5 Deck Section with #211 Ridge

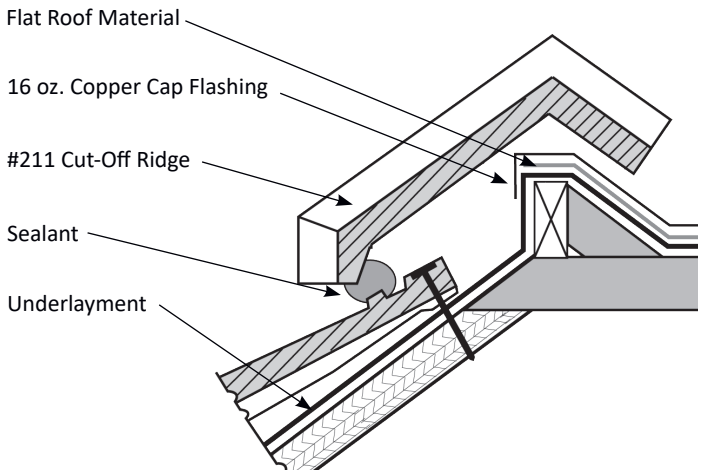


Figure 43.6 Deck Section with #211 Cut-Off Ridge

Terminals

Ludowici makes ridge end caps for all trim groups. Ridge end caps come as a starter or finisher, (a male/female lap). Care should be taken to determine correct orientation of the parts ordered and the proper installation sequence to accommodate the installation with minimal cutting.

Ludowici manufactures Terminals to accommodate Ridge and Hip transitions. These are the most effective way to waterproof the transition and finish it in an aesthetically pleasing manor. Terminals are also made with a starter and finisher.

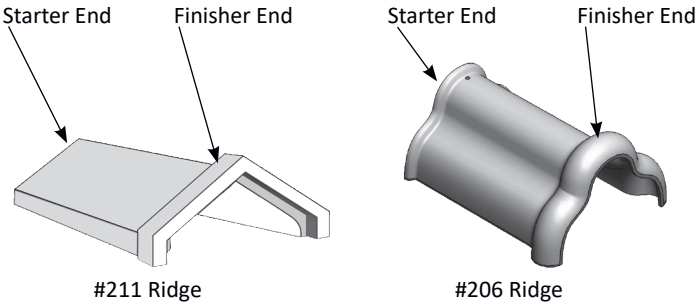


Figure 44.2 Ridge Starter Finisher Diagram

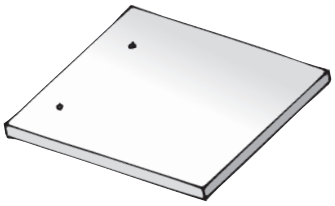


Figure 44.3 Typical 2 Hip/1 Ridge V-Terminal

Vertical Wall Application

Flat Shingle or Interlocking tile can be used on a vertical surface. For Shingle tile, short tops and long tops and under eave cant strips are used. For Interlocking tile, use cant strips where needed.

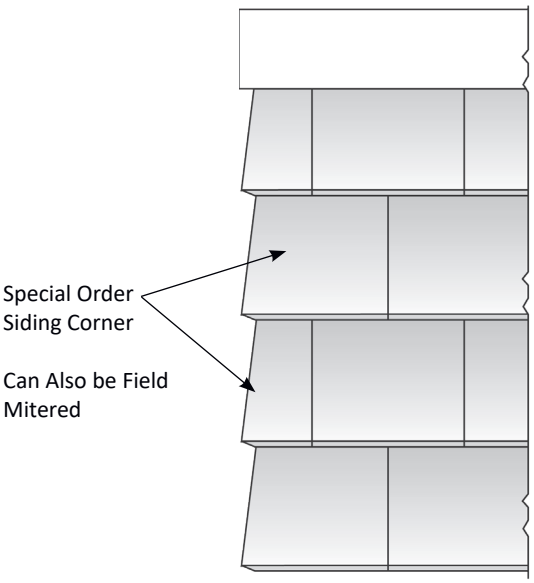


Figure 44.1 Vertical Wall Corner

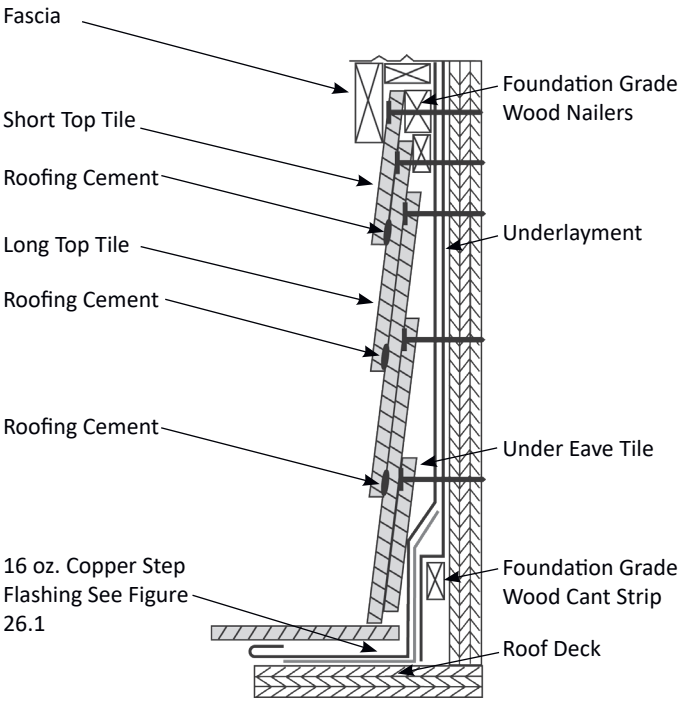


Figure 44.4 Vertical Wall Section

Snow Guards

Snow guards are generally required in areas where snow and ice may accumulate on the roof. Snow guards are sometimes used on sloped roofs to prevent a mass of snow or ice from sliding off the roofs and injuring persons, damaging gutters or plants and blocking walks and driveways. Snow guards hold the snow in place above the eaves until it can melt and the water runs off.

It is recommended that snow guards should be installed on at least 3 or 4 courses, offset from course to course, spaced in staggered interval rows. Begin with the third or fourth row. However, spacing and quantity of snow guards is a matter of judgement based on local weather conditions (see Figure 47.1).

Alpine conditions will require a professional engineer to design the required snow retainage system. Tile should not be exposed to ice and snow loads exceeding 100 pounds per square foot.

A snow guard must be made of nonferrous material to prevent possible rust stains.

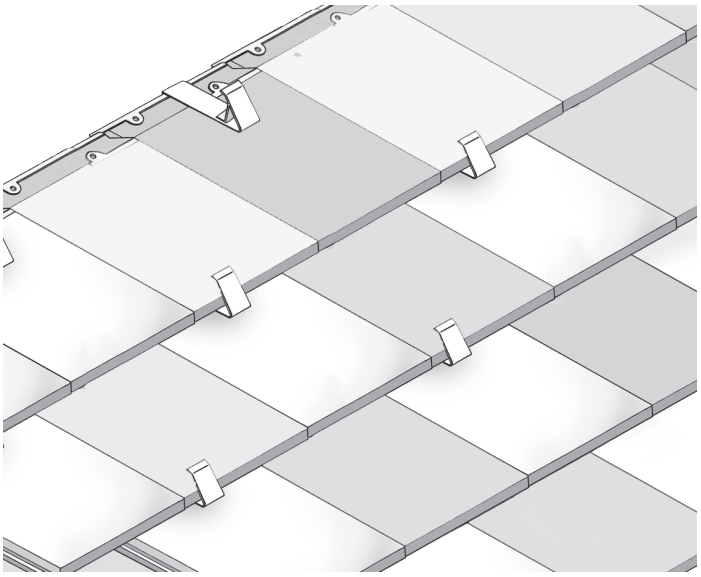


Figure 45.1 Snow Guard Spacing

Staggered Application

LudoSlate™ and LudoShake™ can be laid with staggered butts to achieve a more rustic appearance.

The roofer will need to snap off the waterlock knockouts on both the lower left corner and the upper right corner to allow the tiles to be laid staggered.

Strike the chalk lines in the same method as a standard installation. Lay the first course in a straight line. On the second and above courses lay the tiles on the chalk line and randomly drop some up to 3/4" below the chalk line to achieve the random staggered look.

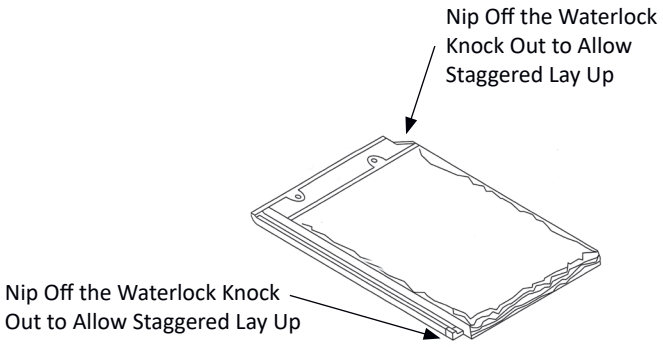


Figure 47.2 Staggered Tile Prep

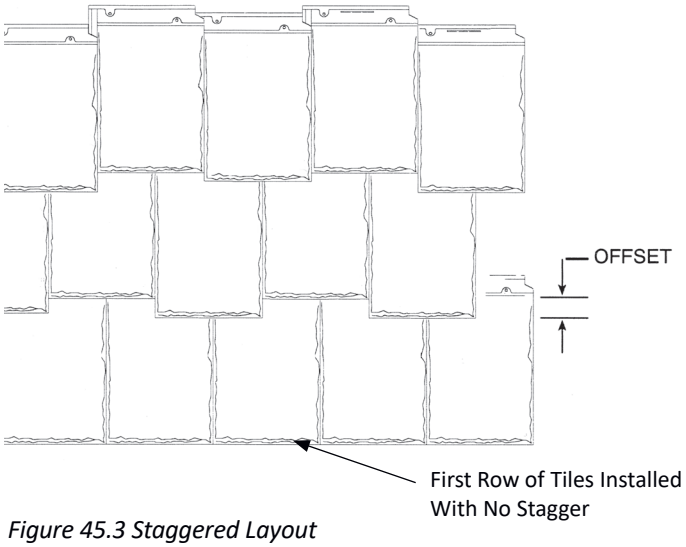


Figure 45.3 Staggered Layout

Repair

To replace a broken or damaged tile do not use an exposed Copper strap. These are unsightly and can work loose allowing the replacement tile to slide out.

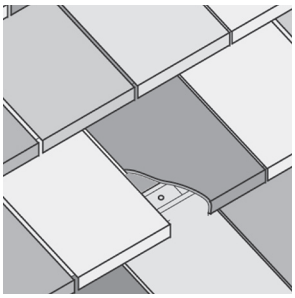


Figure 46.1 Damaged Tile

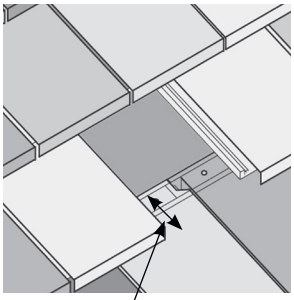


Figure 46.2 Remove Damaged Tile

Completely remove damaged tile and fasteners. A slate ripper will facilitate removal of fasteners. Measure the distance from the top of the course below to the bottom of the adjacent tile to the replacement.

Ludowici's Quik-Tach™ Brackets are a quick, efficient and concealed method for tile replacement. Follow these steps:

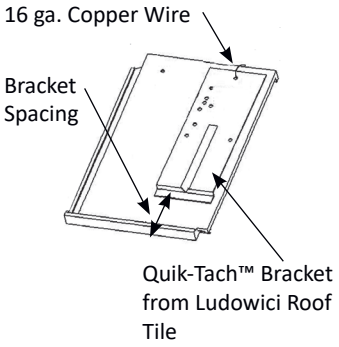


Figure 46.3 Replacement Tile with Quik-Tach™ Bracket

Align a Quik-Tach™ Bracket on the back of the replacement tile to the correct bracket spacing. Wire bracket to the replacement tile with 16 ga. Copper Wire.

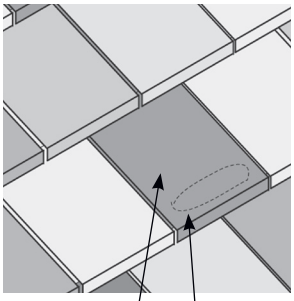
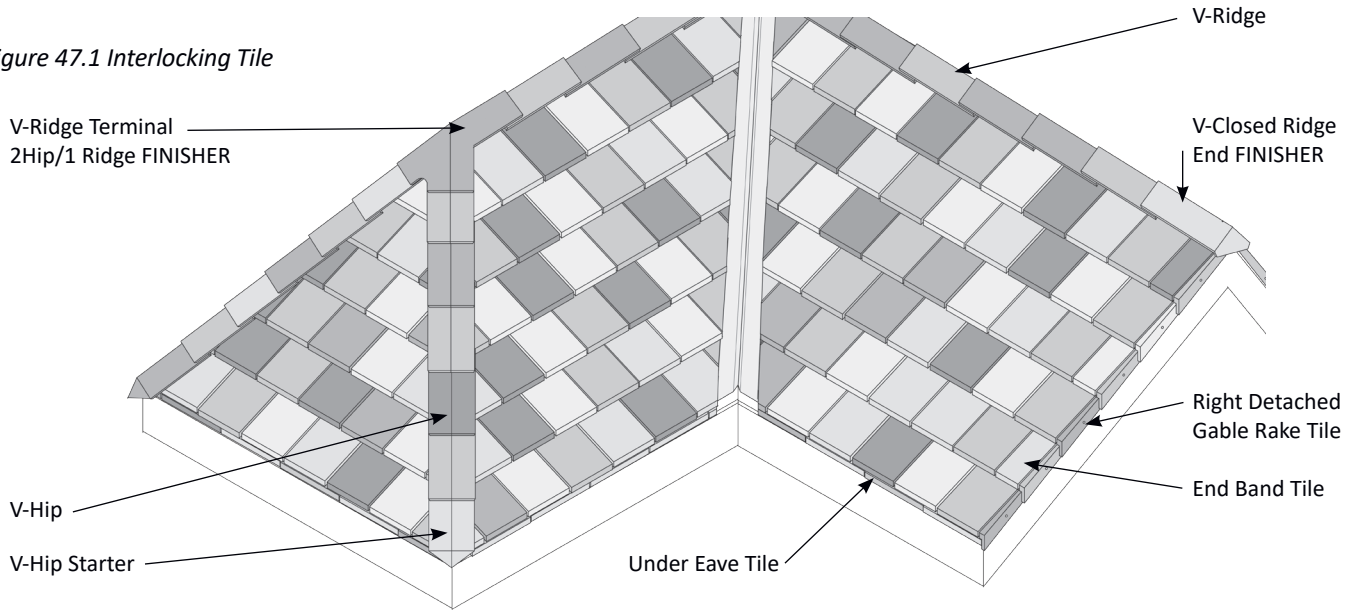


Figure 46.4 Finished Tile Replacement

Lift the tile in the course above and slide the replacement tile into place so the bracket engages the top of the tile below the replacement. Apply a small bead of Sealant or roofing Cement under replacement tile.

LudoSlate and LudoShake Tile Installation

Figure 47.1 Interlocking Tile



The following roof preparations must be completed before installing any roof tile.

For detailed information on these items refer to the previous sections in this manual or the NRCA Manual on Steep Roofing.

- Install the flashings required for ensuring watertightness:
  - Eave Flashing
  - Rake Edge Flashing (if required)
  - Valley Flashing
  - Dormer and Sidewall Flashing, Skylight Flashing, Chimney and Cricket Flashing
  - Vent Flashing
- Underlayment for the entire roof deck, including the appropriate waterproof underlayments required for all flashing and, where required, the ice dam membrane
- All cant strips and Hip and Ridge stringers should be installed and covered in underlayment.
- Roof surface chalked with vertical and horizontal lines
- ***To avoid damaging the new roof adjoining walls, chimneys and other above the roof line components of the structure should be complete prior to installing the tile to minimize other trades traversing the completed roof.***

Points to Remember During Field Tile Installation

Tile installation will generally progress in a diagonal fashion, moving from the starting point of the under eave tile.

- Use the chalk lines as a guide.
- Watch for any irregularities in the roof deck construction.
- After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.
- When each course is 10 to 12 tiles from the terminating end, compare the remaining distance to the width of the tiles to determine if a slight crowding or stretching of the tile may be required to ensure the last piece in the course is an end band (1/2 tile) or a full tile. DO NOT crowd or pull to the extreme any more than 5 or 6 pieces positioned side by side.

NOTE: Each flat Interlocking field tile is provided with two fastening nail holes and French field tile with one. When installing field tiles or accessories care should be taken to fasten each tile with nails or screws in every provided fastening hole.

Eave

Installation of most Ludowici Interlocking tile patterns require the use of an Under Eave Tile. This under eave tile provides the proper cant angle for the starter course. The under eave tiles are normally laid right to left, or laid from the gable end to a valley. Normal practice requires the under eave tile to be laid with a 2" overhang at the eave and flush at the rake. Lay the under eave course loose across the slope to determine what adjustments, if any, are needed in the course before nails or screws are installed. Once layout is established, install these under eave tile in the normal right to left fashion. French tiles are installed with a cant strip in lieu of an under eave tile. LudoSlate™ and LudoShake™ can be installed with under eave tiles or a cant strip.

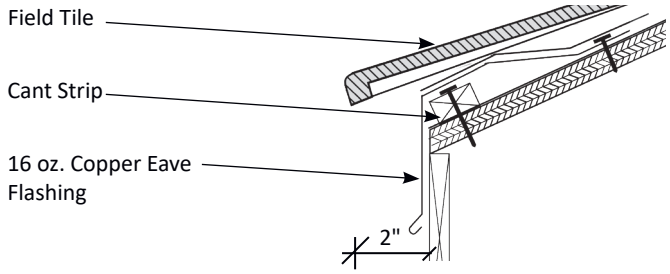


Figure 48.1 LudoSlate™ and LudoShake™ Eave Detail with Cant Strip

First and Succeeding Courses of Tile

Interlocking clay tile are normally laid from right to left starting with the right detached gable rake. The detached gable rake serves as a flashing detail for the rake edge and is available in left and right hand versions.These tile shall be installed with the fasteners typical to the field tile installation, but they will also require flashing cement (meeting requirements of ASTM D-4586) to be applied between the contact areas of the field tile and the gable rake. When looking at the eave courses of the field tiles, the gable rakes to the right are called the rights and vise-versa.

After installing the right detached gable rake, the starter course will begin with a full tile placed directly over the first under eave tile. The second course will be started with an end band tile and will be laid to provide the proper vertical exposure with the normal head lap of 3". This exposure is continued through each successive course. All joints of the second course and succeeding courses should be at the center line of the previous course. If the Interlocking tile are to start at a valley it is suggested to lay the tile loose across the slope to determine what adjustments, if any, are needed.

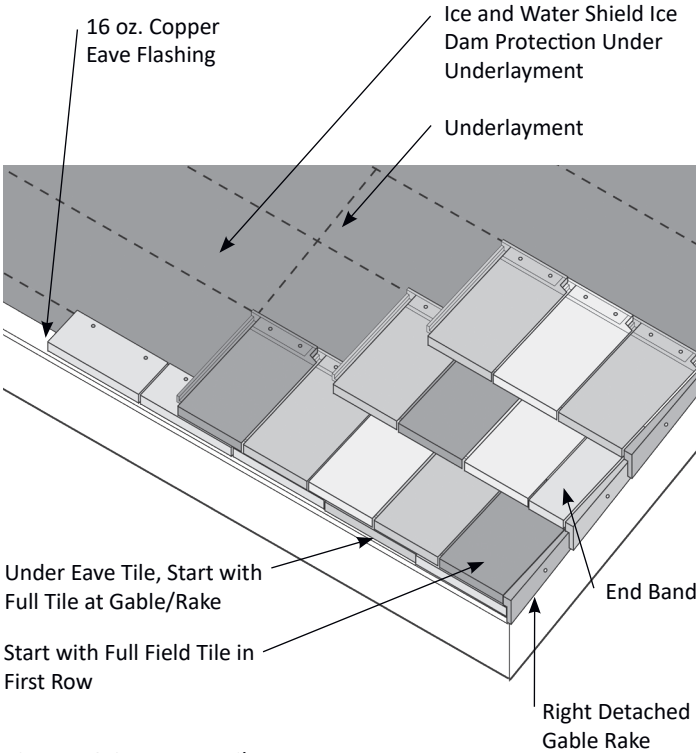


Figure 48.2 Eave Detail

Valley Tiles

Tile to be installed in valleys can be mitered in the field or by ordering and using special factory tile. Whether field miter cut or factory tile are used, the tile fasteners should never penetrate the valley flashings. Tile to be installed over the copper valley flashing should be drilled or notched and wired with solid 16 gauge wire to fasteners driven into the deck beyond the flashing.

NOTE: Notching and drilling was addressed previously on Page 19. In situations where valley tile pieces are so small that it is not practical to notch or drill, use the adhesive RT600 (an OSI product) or its equivalent.

If special factory valley tile are being applied prior to installation, it will be beneficial to loose lay the entire eave field tile course including the valley tile. This loose laying process of the valley's left side will advance as a typical installation would, from right to left. But, when loose laying the valley's right side, it will advance from left to right.

The installation of the Interlocking tiles will slow the process initially. Each tile, when spaced on the deck, will require a slightly upward lifting to allow for the proceeding tile to be laid into the Interlocking channel. Once the spacing is approved, the space can return to the standard. The tiles can be fastened in the typical right to left pattern.

The loose laying process becomes vitally important when the roof deck runs from valley-to-valley. The focus must be to space the eave course so it consists of all full field tile and is finished on both ends with the special cut valley tiles or so it consists of all full field tile, one end band (half tile) and is finished, as stated above, with the special cut valley tiles. Keep in mind not to allow any more than 5 pieces pulled to the extreme or crowded together. When the distance between valleys is so minimal it does not allow for the above mentioned spacing, one field tile per course will require field cutting to allow for proper lay up. If field mitered valley tiles are applied, they should be trimmed to provide a clean, even, continuous edge along the entire valley length.

To encourage leaves and snow to slide down the valley, the gap between the Valley Tiles and the center line of the valley should be tapered from 3" at the top to 4" at the bottom. This can be increased for long valleys or heavy snow locations.

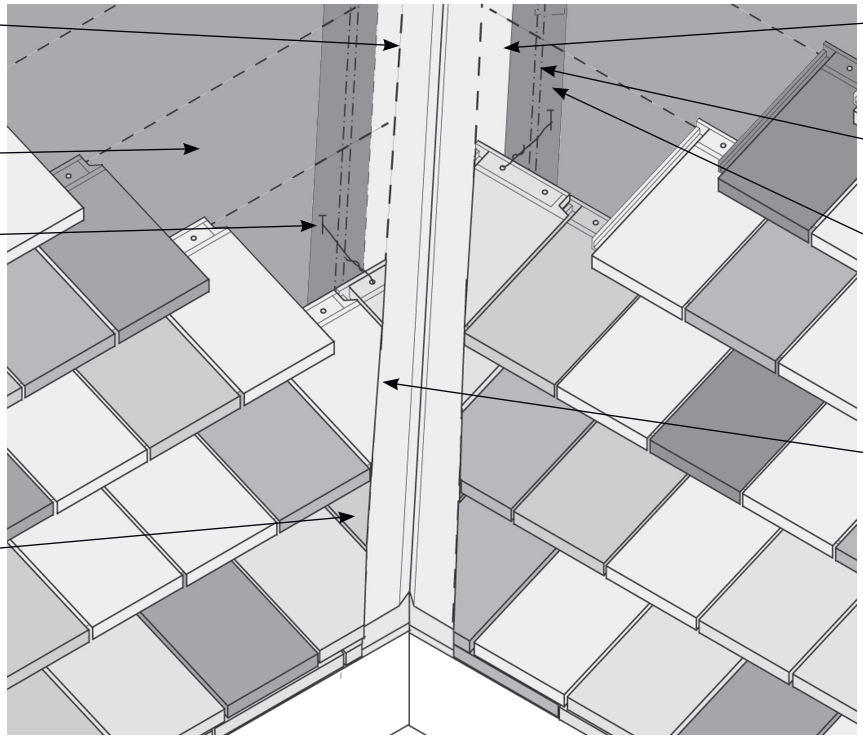


Figure 49.1 Valley Detail

Hip Tiles

There are a number of methods to finish the hips of Interlocking tile roof depending on the design aesthetics desired. These methods are flushed mitered, V-Hip tile or one of Ludowici's other trim groups.

Tiles to be installed at hips are field mitered.

V-Hip and Other Cap Type Hip Rolls

Hips are started with a special V-Hip Starter tile which should cover the field tile approximately 3" on both sides. The regular V-Hip tile is then installed by creating an approximate 2" head lap on the V-Hip starter tile. This 2" head lap is continued up the hip and roofing cement is applied at each hip tile's overlap. The last fastener on the upslope end of the hip is typically covered with a V-Hip and Ridge Terminal. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative for the project's special roof requirements.

Chart 50.1

Roof Pitch Rise:Run	V-Hip	118 Hip	102 Hip	CC Hip
4:12	2 1/4"	2 7/8"	4 3/4"	2 1/4"
5:12	2 1/4"	2 7/8"	4 5/8"	2 1/4"
6:12	2"	2 7/8"	4 5/8"	2"
7:12	2"	2 3/4"	4 1/2"	2"
8:12	1 3/4"	2 3/4"	4 1/2"	1 3/4"
9:12	1 3/4"	2 3/4"	4 3/8"	1 3/4"
10:12	1 1/2"	2 5/8"	4 3/8"	1 1/2"
11:12	1 1/2"	2 5/8"	4 1/4"	1 1/2"
12:12	1 1/4"	2 5/8"	4 1/4"	1 1/4"
13:12	1 1/4"	2 5/8"	4 1/8"	1 1/4"
14:12	1 1/4"	2 5/8"	4 1/8"	1 1/4"

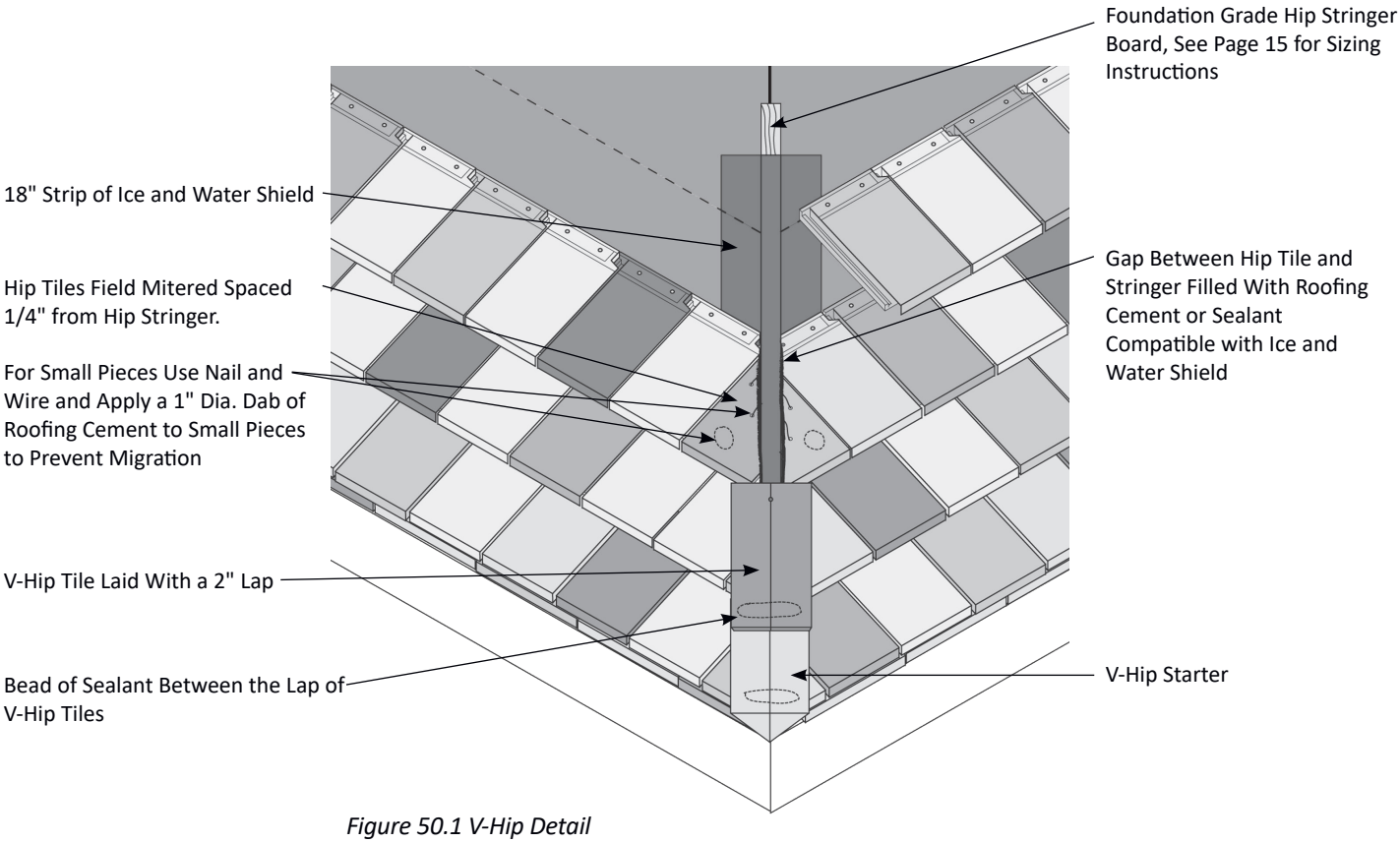


Figure 50.1 V-Hip Detail

Mitered Hip

A flush mitered hip can be done by accurately miter-cutting the field tile and sealing the finished joint with an approved sealant, meeting the requirements of ASTM D-4586. Mitred hips require the use of copper step flashing on every course.

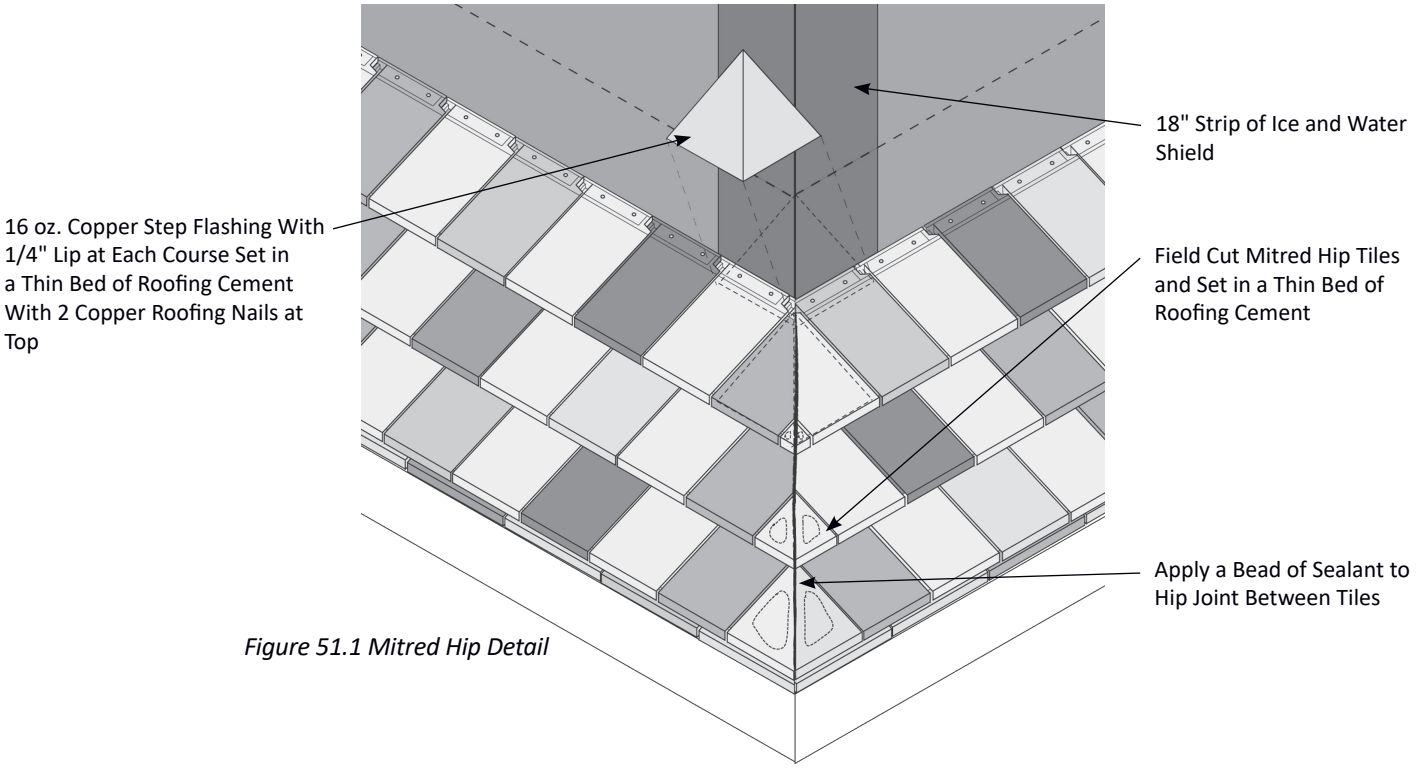
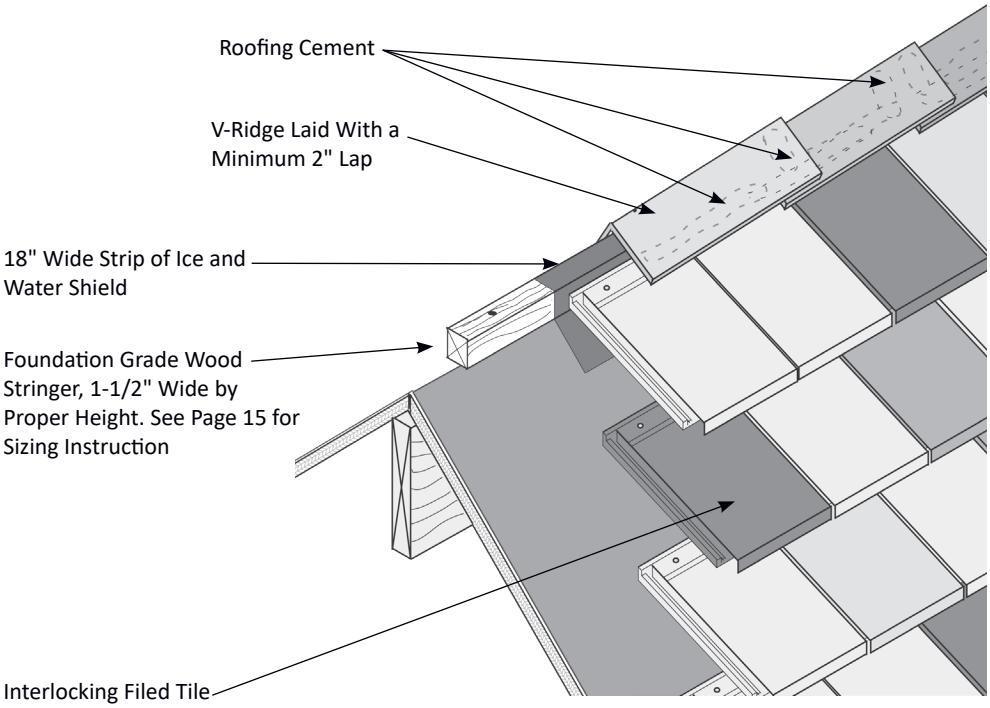


Figure 51.1 Mitred Hip Detail

Ridge

V-Ridge

Figure 51.1 V-Ridge Detail



Circular Cover Ridge

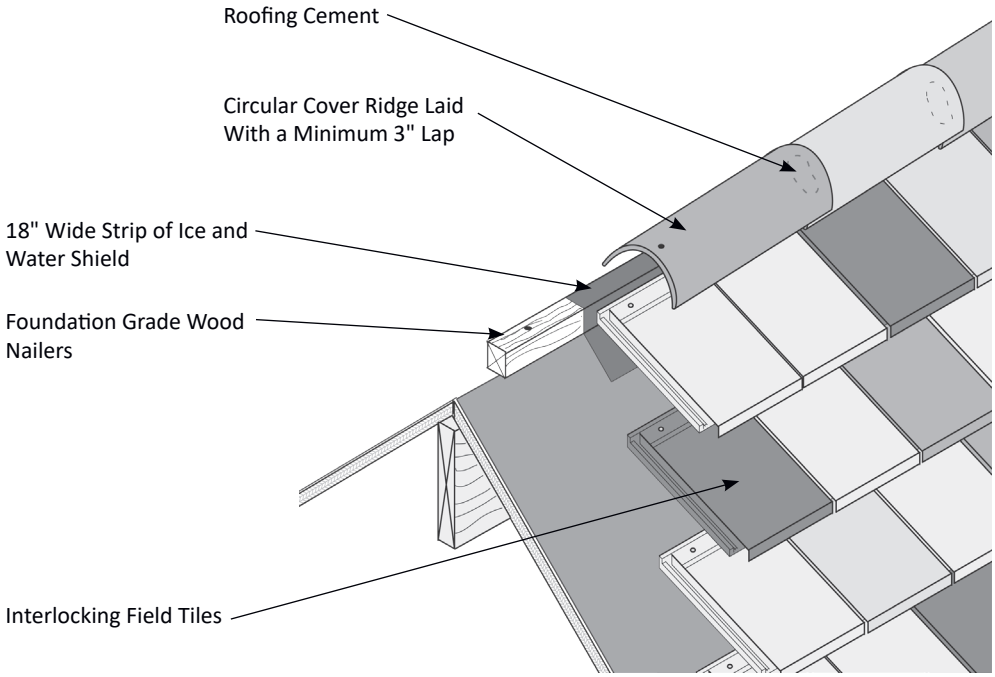


Figure 52.2 Circular Cover Ridge Detail

Roof Pitch Rise:Run	V-Ridge	211 Ridge	206 Ridge	CC-Ridge
4:12	1 1/4"	3 1/8"	5 1/4"	1 1/4"
5:12	1"	2 7/8"	5"	1"
6:12	13/16"	2 5/8"	5 3/4"	13/16"
7:12	9/16"	2 3/8"	4 1/2"	9/16"
8:12	3/8"	2 1/8"	4 1/4"	3/8"
9:12	1/4"	1 7/8"	4"	1/4"
10:12	3/16"	1 5/8"	3 3/4"	3/16"
11:12	9/16"	1 3/8"	3 1/4"	9/16"
12:12	7/16"	1 1/8"	3 1/2"	7/16"
13:12	1/4"	7/8"	3"	1/4"
14:12	1/8"	5/8"	2 7/8"	1/8"

Chart 52.1

Mitered Ridge

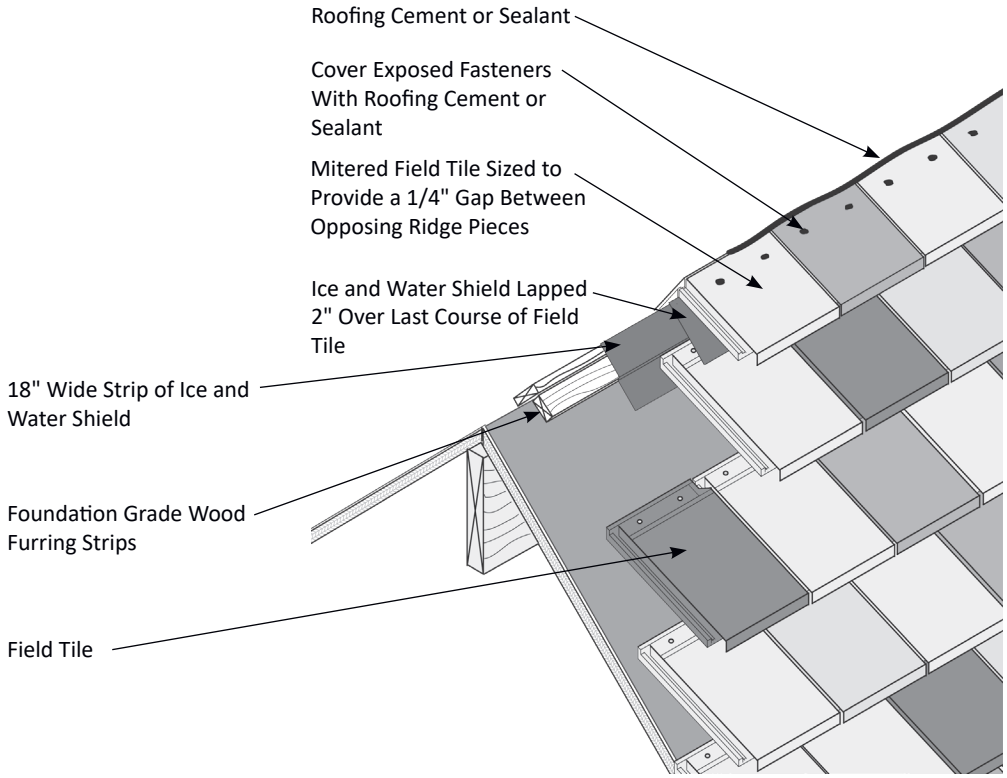


Figure 53.2 Mitered Ridge Detail

Circular Cover Ridge Vented

This Ridge Vent allows 5 square inches of ventilation per foot of ridge.

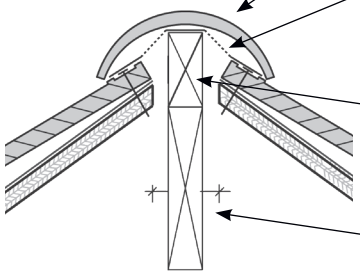


Figure 55.1 Vented Circular Cover Section

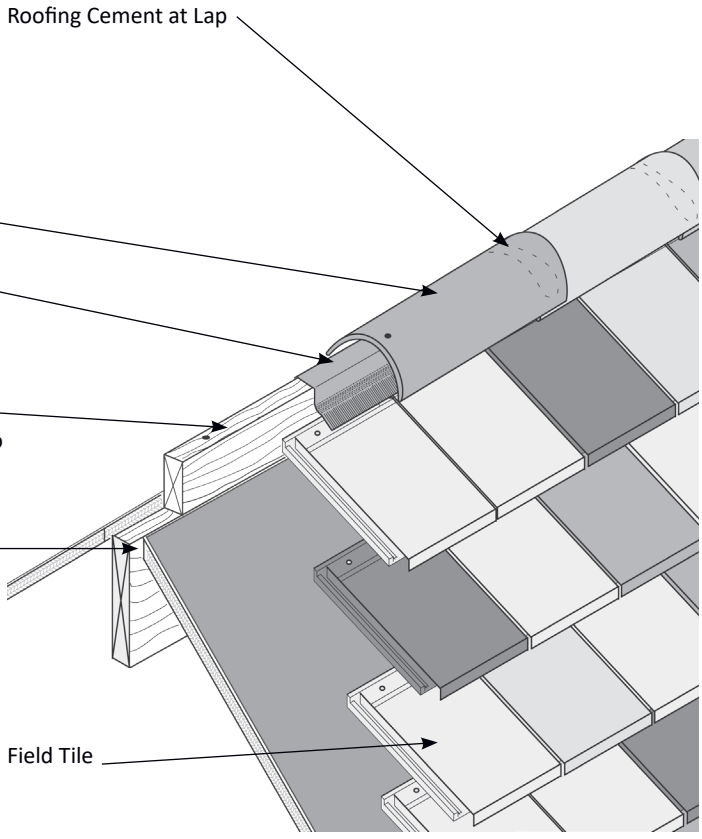


Figure 53.3 Vented Circular Cover Ridge Detail

211 Ridge Vented

This ridge vent allows 6.27 square inches of ventilation per foot of ridge.

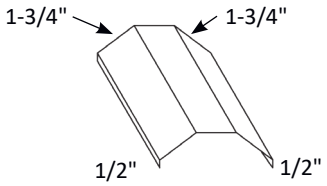


Figure 54.1 #211 Vented Ridge Cap Flashing

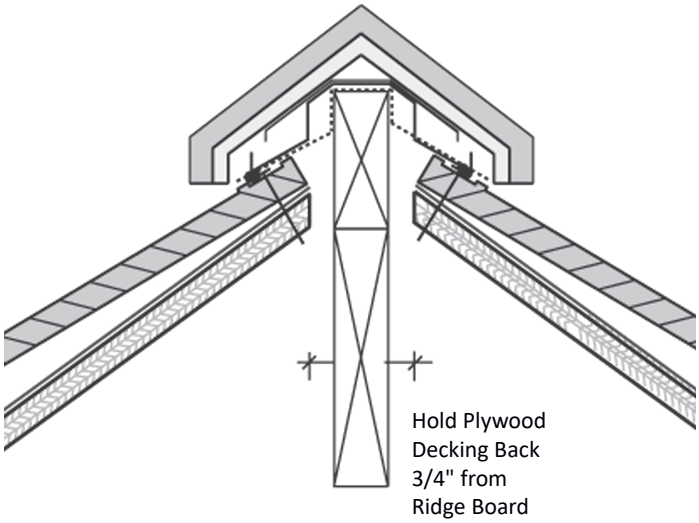


Figure 54.3 #211 Vented Ridge Section

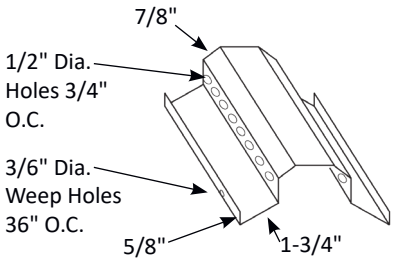


Figure 54.2 #211 Vented Ridge Vent Flashing

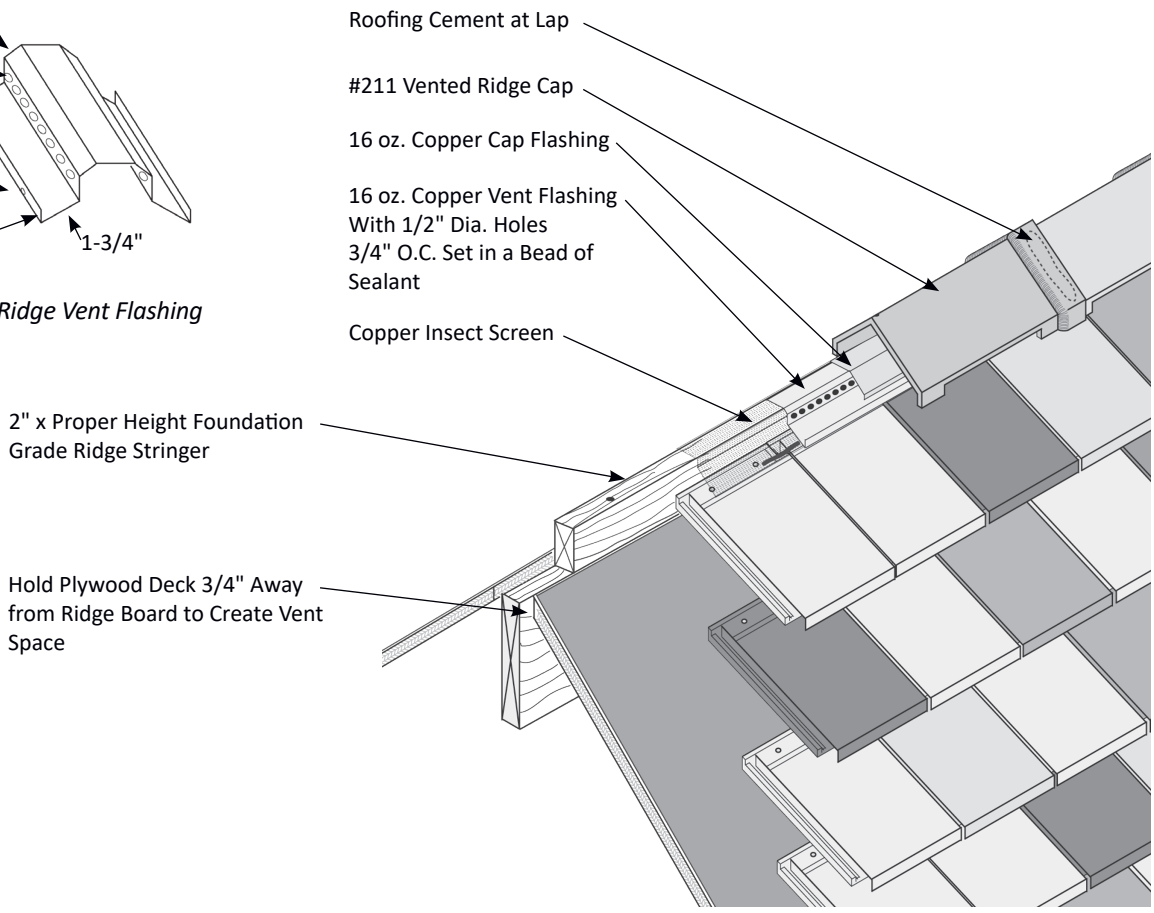


Figure 54.4 #211 Vented Ridge Detail

206 Ridge Vented

This ridge vent allows 6.27 square inches of ventilation per foot of ridge.

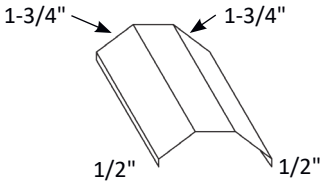


Figure 55.1 #211 Vented Ridge Cap Flashing

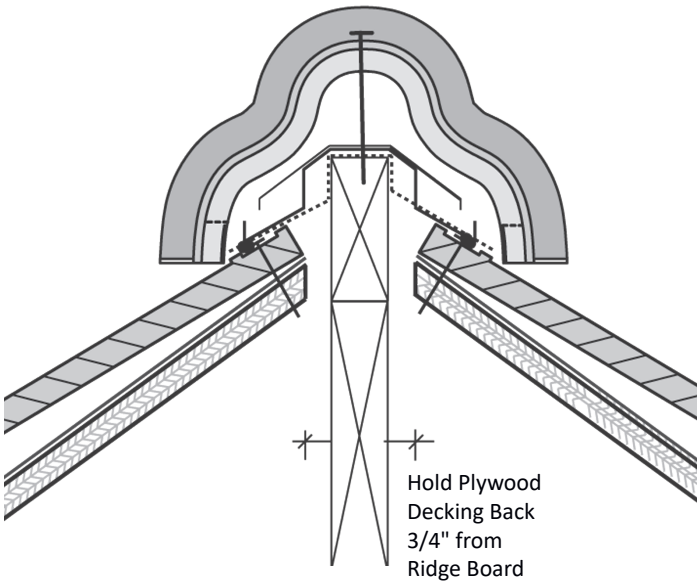


Figure 55.3 #211 Vented Ridge Section

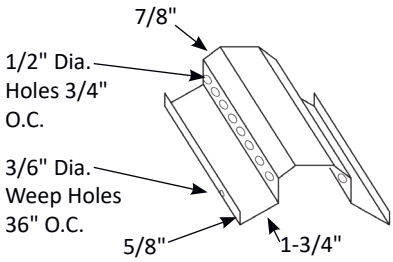


Figure 55.2 #211 Vented Ridge Vent Flashing

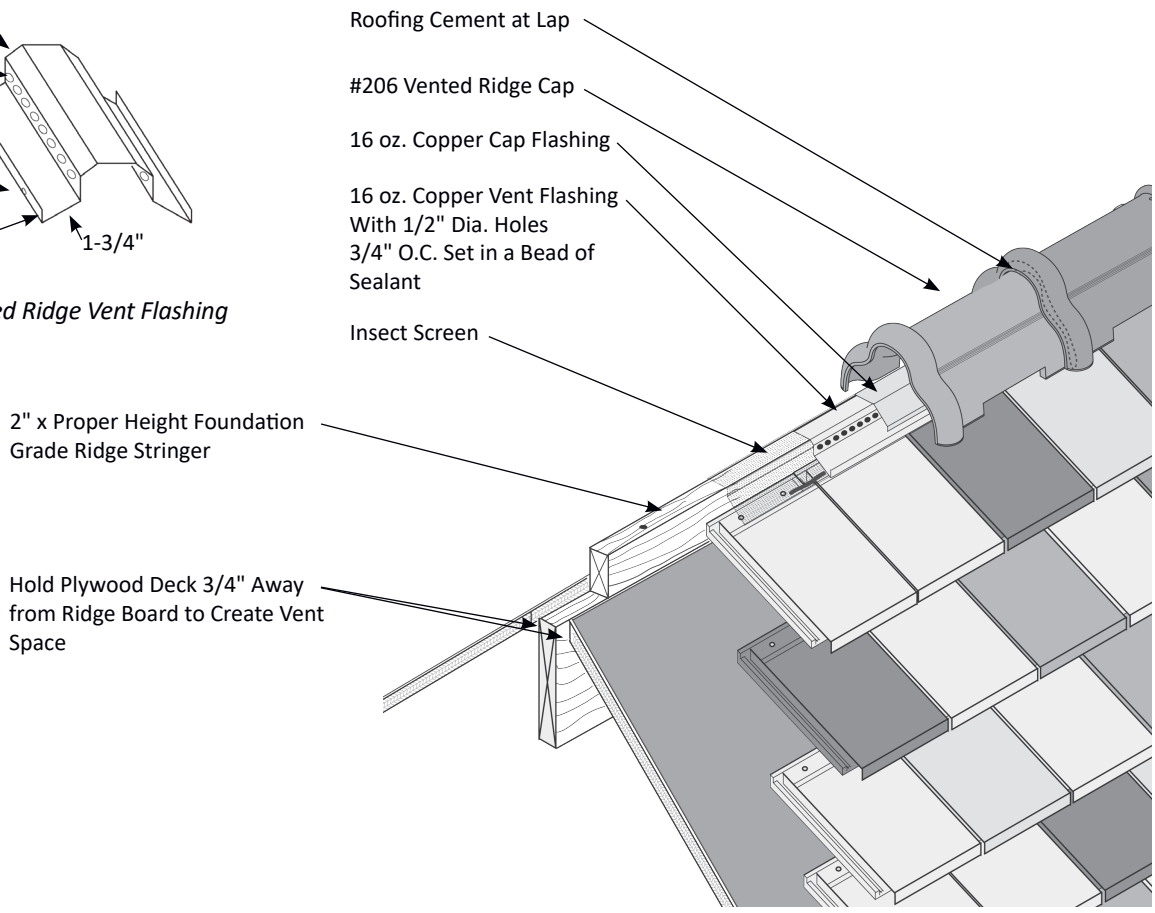


Figure 55.4 #206 Vented Ridge Detail

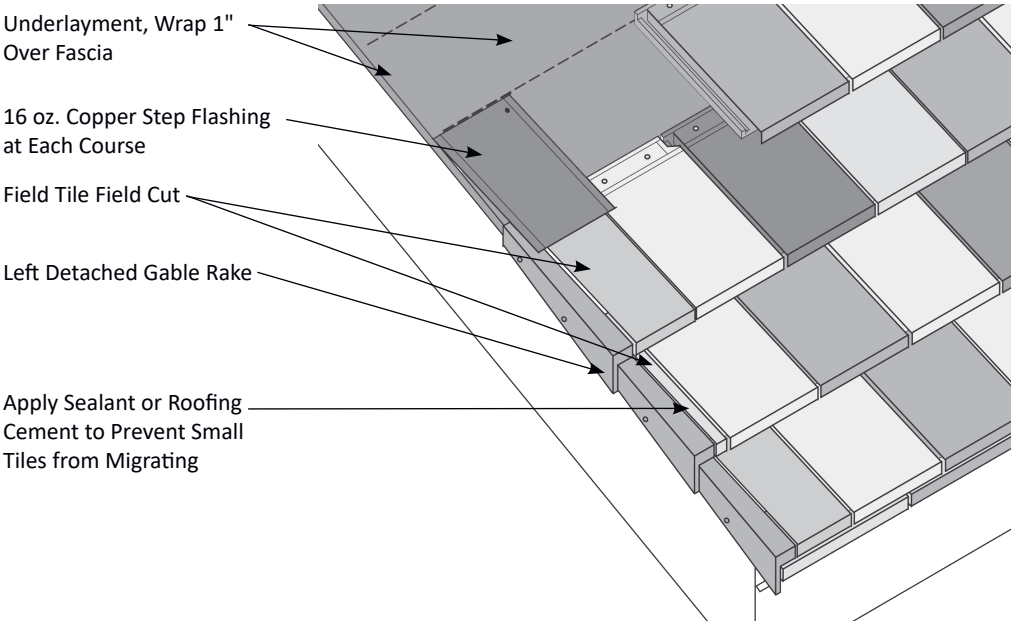


Figure 56.1 Left Rake Step Flashing for Field Cut Field Tiles

Figure 58.1 For conditions where inadequate spacing doesn't allow for the use of full field tiles and end bands.

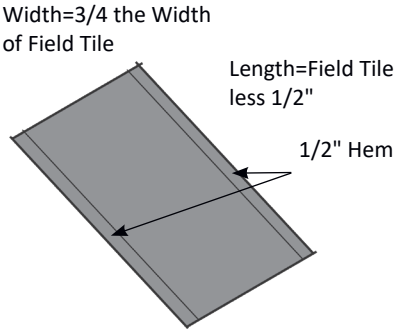


Figure 41.2 Left Rake Step Flashing

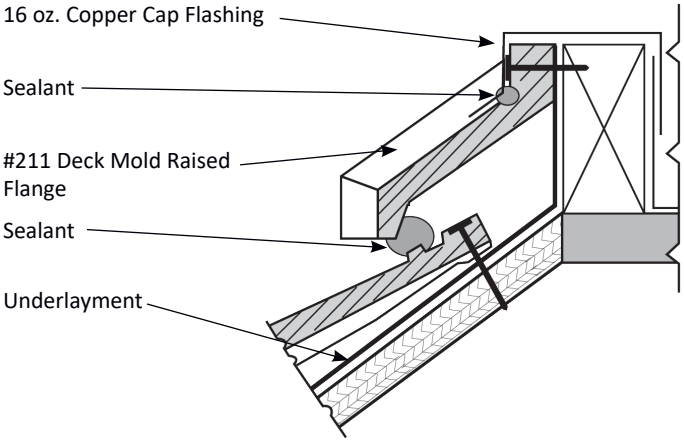


Figure 56.3 Deck Section with #211 Deck Mold Raised Flange

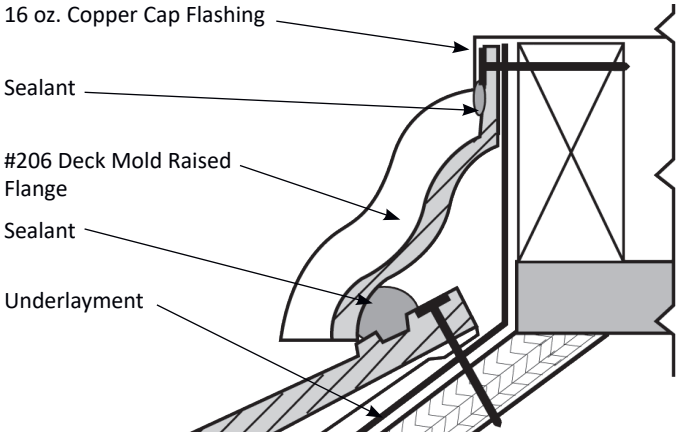


Figure 56.4 Deck Section with #206 Deck Mold Raised Flange

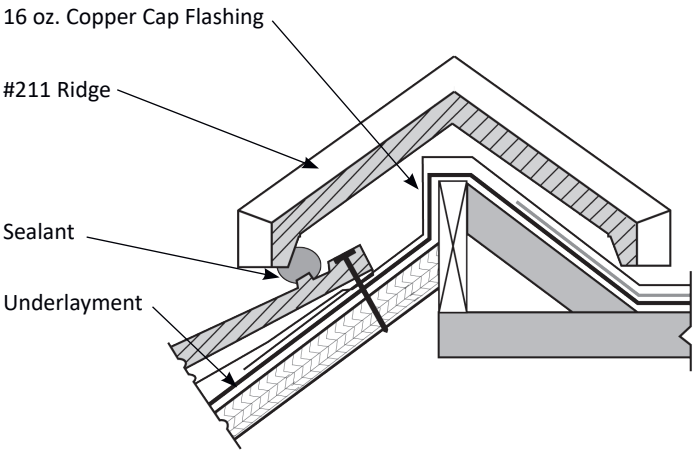


Figure 56.5 Deck Section with #211 Ridge

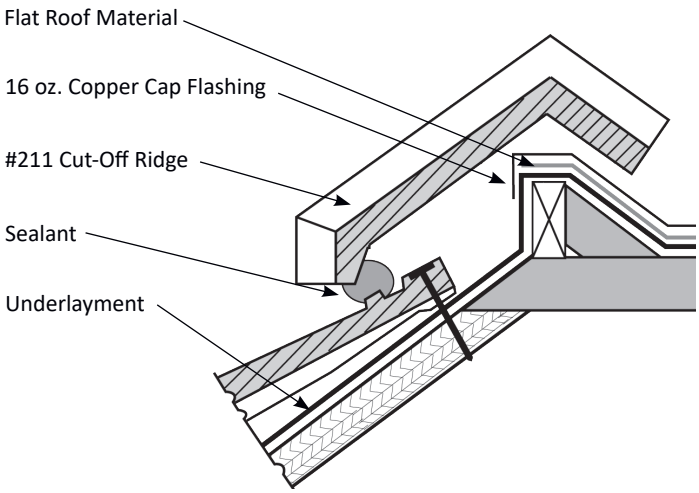


Figure 56.6 Deck Section with #211 Cut-Off Ridge

Terminals

Ludowici makes ridge end caps for all trim groups. Ridge end caps come as a starter or finisher, (a male/female lap). Care should be taken to determine correct orientation of the parts ordered and the proper installation sequence to accommodate the installation with minimal cutting.

Ludowici manufactures Terminals to accommodate Ridge and Hip transitions. These are the most effective way to waterproof the transition and finish it in an aesthetically pleasing manor. Terminals are also made with a starter and finisher.

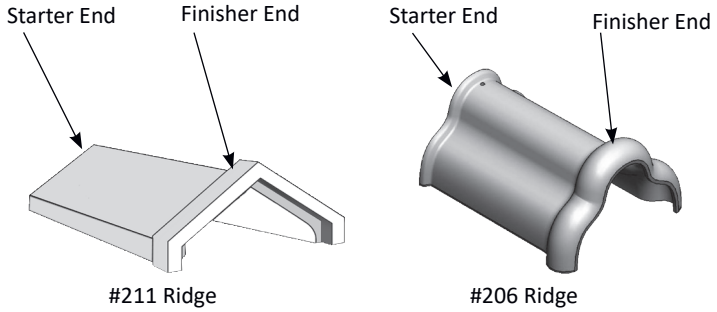


Figure 57.2 Ridge Starter Finisher Diagram

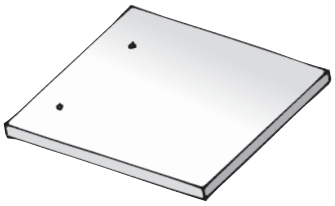


Figure 57.3 Typical 2 Hip/1 Ridge V-Terminal

Vertical Wall Application

Flat Shingle or Interlocking tile can be used on a vertical surface. For Shingle tile, short tops and long tops and under eave cant strips are used. For Interlocking tile, use cant strips where needed.

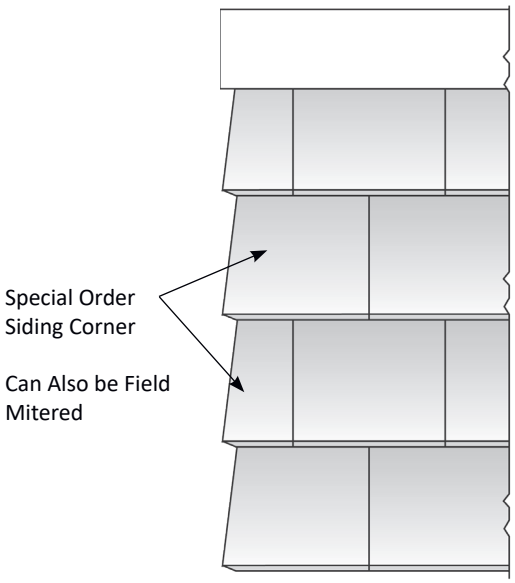


Figure 57.1 Vertical Wall Corner

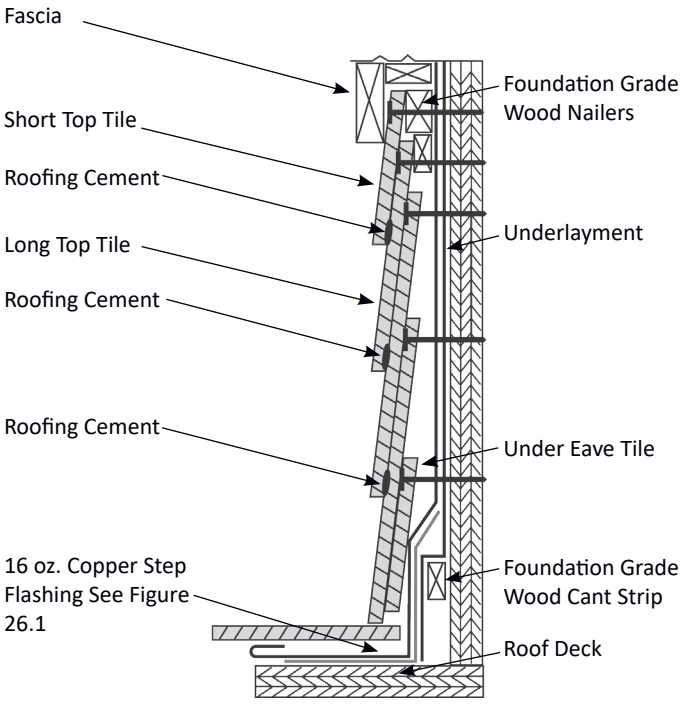


Figure 57.4 Vertical Wall Section

Snow Guards

Snow guards are generally required in areas where snow and ice may accumulate on the roof. Snow guards are sometimes used on sloped roofs to prevent a mass of snow or ice from sliding off the roofs and injuring persons, damaging gutters or plants and blocking walks and driveways. Snow guards hold the snow in place above the eaves until it can melt and the water runs off.

It is recommended that snow guards should be installed on at least 3 or 4 courses, offset from course to course, spaced in staggered interval rows. Begin with the third or fourth row. However, spacing and quantity of snow guards is a matter of judgement based on local weather conditions (see Figure 60.1).

Alpine conditions will require a professional engineer to design the required snow retainage system. Tile should not be exposed to ice and snow loads exceeding 100 pounds per square foot.

A snow guard must be made of nonferrous material to prevent possible rust stains.

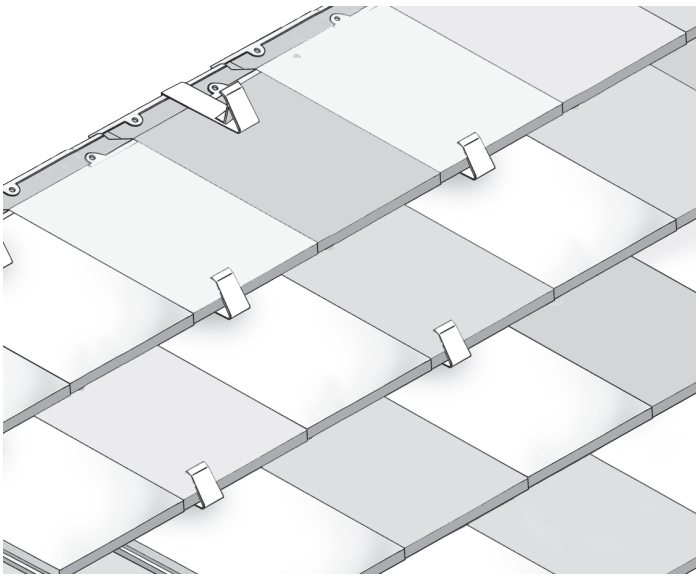


Figure 58.1 Snow Guard Spacing

Staggered Application

LudoSlate™ and LudoShake™ can be laid with staggered butts to achieve a more rustic appearance.

The roofer will need to snap off the waterlock knockouts on both the lower left corner and the upper right corner to allow the tiles to be laid staggered.

Strike the chalk lines in the same method as a standard installation. Lay the first course in a straight line. On the second and above courses lay the tiles on the chalk line and randomly drop some up to 3/4" below the chalk line to achieve the random staggered look.

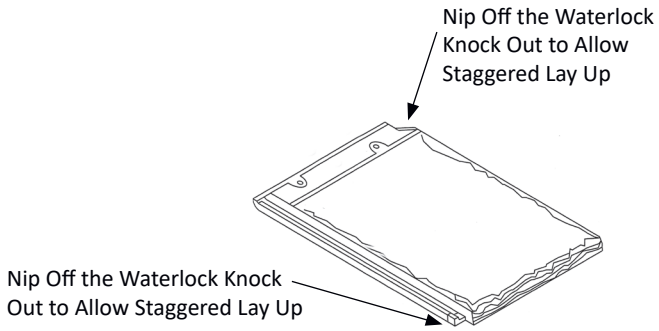


Figure 58.2 Staggered Tile Prep

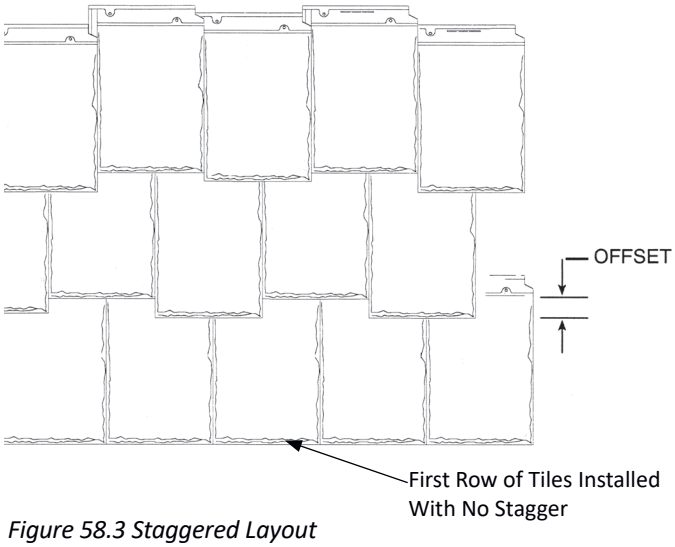


Figure 58.3 Staggered Layout

Repair

To replace a broken or damaged tile do not use an exposed Copper strap. These are unsightly and can work loose allowing the replacement tile to slide out.

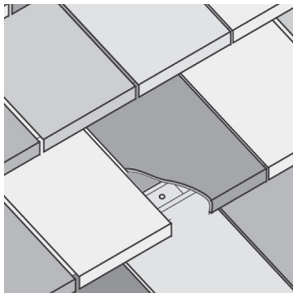


Figure 59.1 Damaged Tile

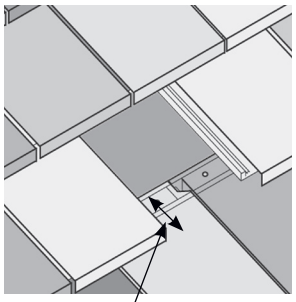


Figure 59.2 Remove Damaged Tile

Completely remove damaged tile and fasteners. A slate ripper will facilitate removal of fasteners. Measure the distance from the top of the course below to the bottom of the adjacent tile to the replacement.

Ludowici's Quik-Tach™ Brackets are a quick, efficient and concealed method for tile replacement. Follow these steps:

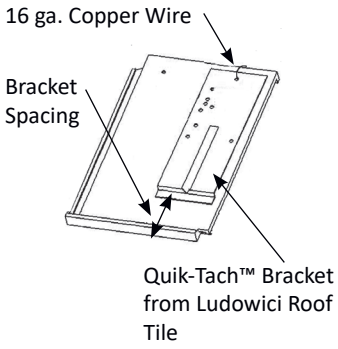


Figure 59.3 Replacement Tile with Quik-Tach™ Bracket

Align a Quik-Tach™ Bracket on the back of the replacement tile to the correct bracket spacing. Wire bracket to the replacement tile with 16 ga. Copper Wire.

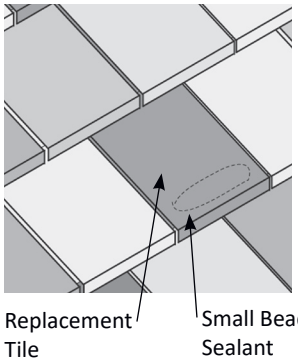


Figure 59.4 Finished Tile Replacement

Lift the tile in the course above and slide the replacement tile into place so the bracket engages the top of the tile below the replacement. Apply a small bead of Sealant or roofing Cement under replacement tile.

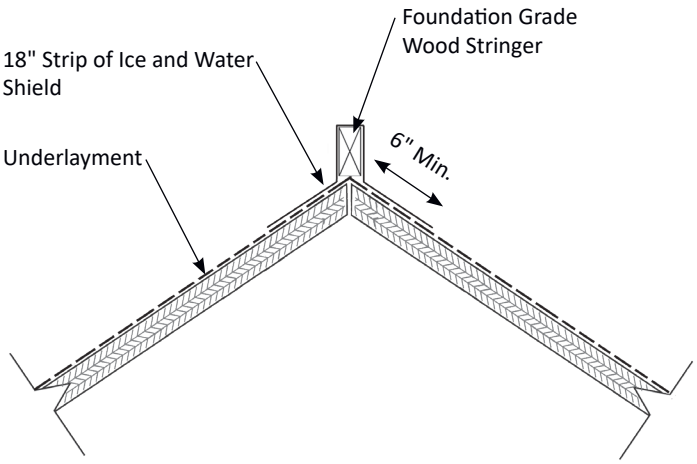


Figure 60.1 Ridge and Hip Stringer Detail

Measuring and Chalking the Roof

Layout and chalking the roof accurately are critical to the roof's performance and appearance. If the eaves are straight and level, all horizontal lines must be parallel to the eaves and all vertical lines must be perpendicular to the eaves. Check the roof deck to determine if the deck is square prior to layout.

Step 1: *Determine Width and Length Exposure*
Clay tiles, depending on the style and profile, vary in exposure and recommended head lap. Ludowici Interlocking tiles are laid with a minimum headlap of 3". Before chalking the roof the installer should verify the tile pattern being installed, and measure, noting average length and width exposures of the tile shipped.

The width exposure should also include the spacing gap between tiles. Interlocking tiles are typically laid with a gap of 1/8"; however, this can be compressed or expanded slightly. The usual overhang at the eave is 2"; however, this can be compressed slightly to accommodate full courses.

Step 2: *Chalking Vertical Lines*
Vertical lines are chalked first. In the case of a hip roof, the first line is struck in the center of the roof equidistant from each hip. The remaining vertical lines are then struck to the right and left at intervals equal to your average width exposure x 5. Care must be taken to ensure that all vertical lines are parallel to the water flow. For roofs with gables at both ends the horizontal exposure should be adjusted to work out to full tile or half tile to reduce cutting.

NOTE: Vertical lines are not needed with random width LudoSlate™ Premier or LudoShake™ Premier.

Step 3: *Chalking Horizontal Lines*
Horizontal lines are struck after the vertical lines are struck.

Strike a line for the under eave tile. Subtract 2" (for overhang) from the under eave to determine distance.

For Interlocking tile the first field tile line will equal the average length of the tile minus the overhang (typically 2").

Successive lines are then struck at intervals equal to your average length of exposure. Length exposure of Interlocking tile is determined by subtracting 3" (for headlap) from the tile length.

Your eave to ridge measurement may determine the average length exposure rather than the size of the tile itself.

NOTE: Do not adjust exposure to a headlap less than 3".

Care must be taken to ensure that all horizontal lines are perpendicular to the water flow.

IMPORTANT:
The tile dimensions can vary because of clay firing temperatures. Be sure to measure tiles in your shipment to determine their average width and length dimensions, so you can chalk your roof properly.

Figure 61.2 Finished Tile Replacement

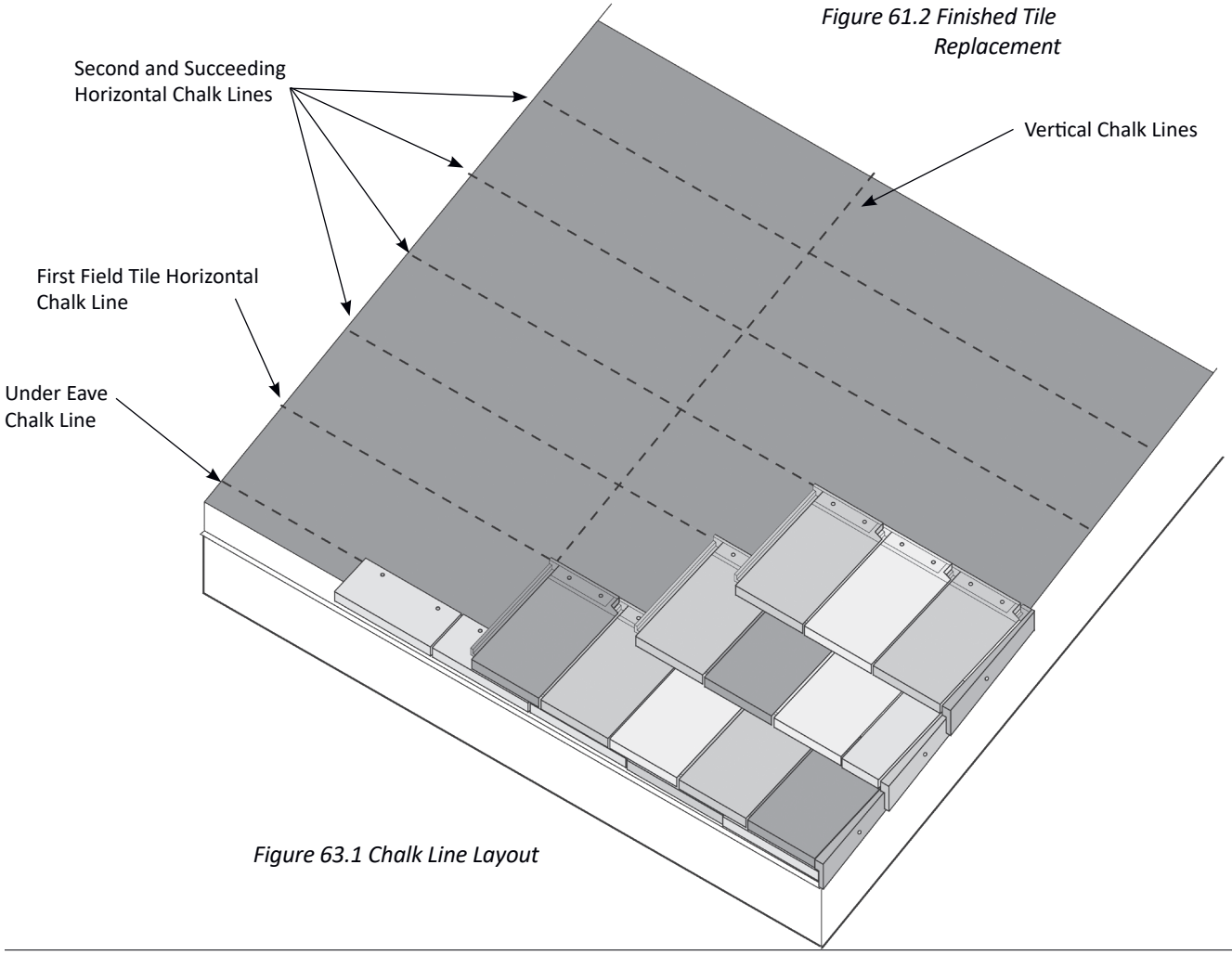
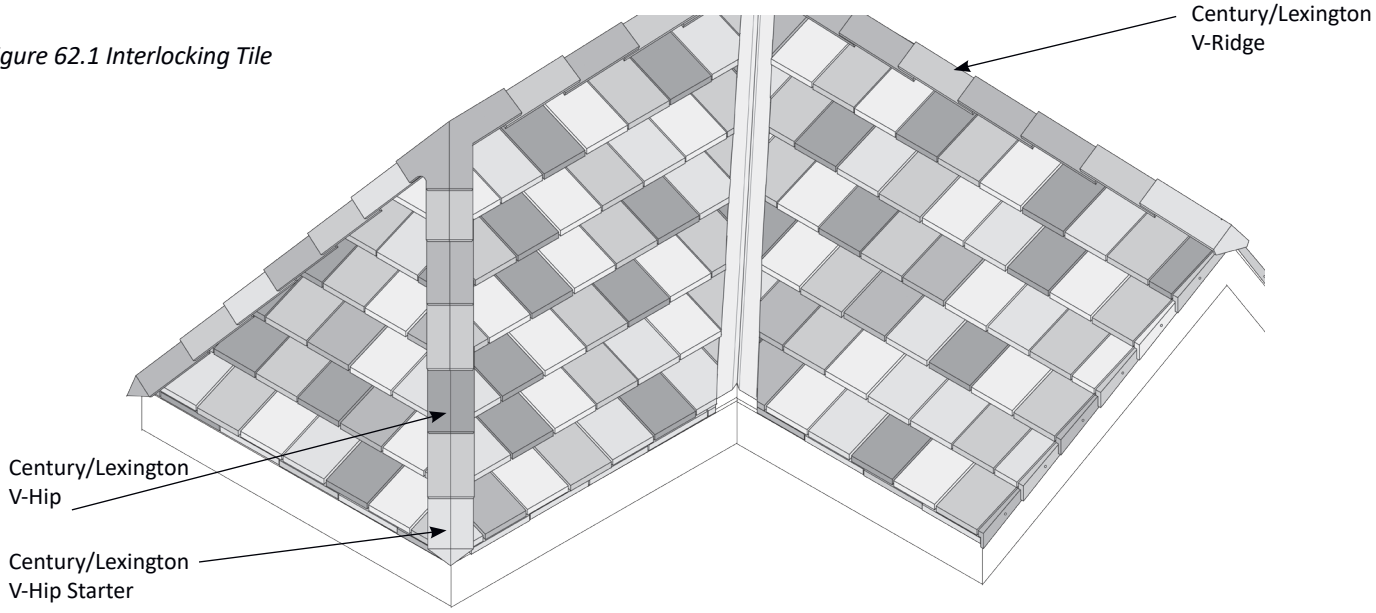


Figure 63.1 Chalk Line Layout

Lexington Slate® & Century Shake® Tile Installation

Figure 62.1 Interlocking Tile



The following roof preparations must be completed before installing any roof tile.

For detailed information on these items refer to the previous sections in this manual or the NRCA Manual on Steep Roofing.

- Install the flashings required for ensuring watertightness:
  - Eave Flashing
  - Rake Edge Flashing (if required)
  - Valley Flashing
  - Dormer and Sidewall Flashing, Skylight Flashing, Chimney and Cricket Flashing
  - Vent Flashing
- Underlayment for the entire roof deck, including the appropriate waterproof underlayments required for all flashing and, where required, the ice dam membrane
- All cant strips and Hip and Ridge stringers should be installed and covered in underlayment.
- Roof surface chalked with vertical and horizontal lines
- ***To avoid damaging the new roof adjoining walls, chimneys and other above the roof line components of the structure should be complete prior to installing the tile to minimize other trades traversing the completed roof.***

Points to Remember During Field Tile Installation

Tile installation will generally progress in a diagonal fashion, moving from the starting point of the under eave tile.

- Use the chalk lines as a guide.
- Watch for any irregularities in the roof deck construction.
- After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.
- When each course is 10 to 12 tiles from the terminating end, compare the remaining distance to the width of the tiles to determine if a slight crowding or stretching of the tile may be required to ensure the last piece in the course is an end band (1/2 tile) or a full tile. DO NOT crowd or pull to the extreme any more than 5 or 6 pieces positioned side by side.

NOTE: Each flat Interlocking field tile is provided with two fastening nail holes and French field tile with one. When installing field tiles or accessories care should be taken to fasten each tile with nails or screws in every provided fastening hole.

Eave

Installation of most Ludowici Interlocking tile patterns require the use of an Under Eave Tile. This under eave tile provides the proper cant angle for the starter course. The under eave tiles are normally laid right to left, or laid from the gable end to a valley. Normal practice requires the under eave tile to be laid with a 2" overhang at the eave and flush at the rake. Lay the under eave course loose across the slope to determine what adjustments, if any, are needed in the course before nails or screws are installed. Once layout is established, install these under eave tile in the normal right to left fashion. Century Shake® and Lexington Slate® can be installed with under eave tiles or a cant strip.

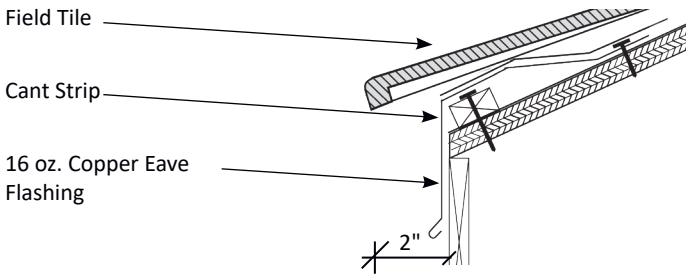


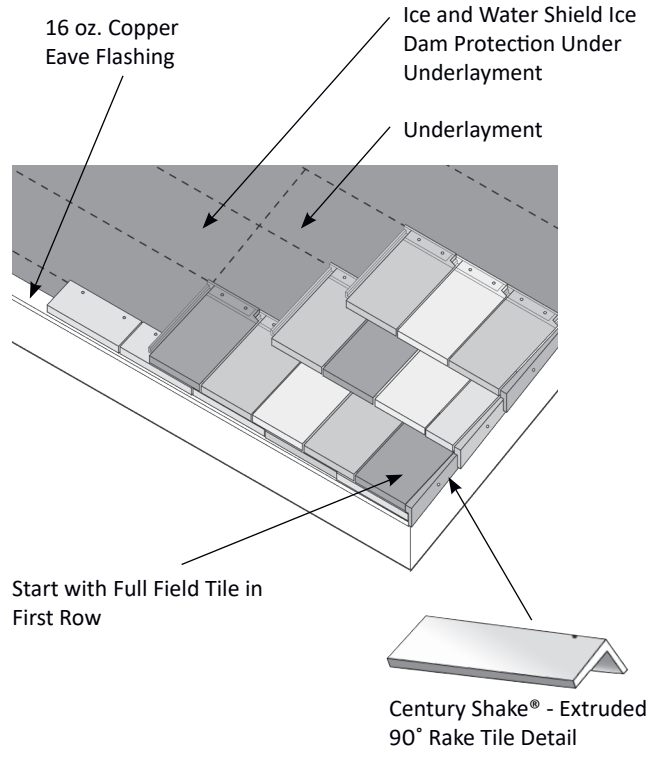
Figure 63.1 Lexington Slate® and Century Shake® Eave Detail with Cant Strip

First and Succeeding Courses of Tile

Interlocking clay tile are normally laid from right to left starting with the right detached gable rake. The detached gable rake serves as a flashing detail for the rake edge and is available in left and right hand versions. These tile shall be installed with the fasteners typical to the field tile installation, but they will also require flashing cement (meeting requirements of ASTM D-4586) to be applied between the contact areas of the field tile and the gable rake. When looking at the eave courses of the field tiles, the gable rakes to the right are called the rights and vise-versa.

After installing the right detached gable rake, the starter course will begin with a full tile placed directly over the first under eave tile. The second course will be started with an end band tile and will be laid to provide the proper vertical exposure with the normal head lap of 3". This exposure is continued through each successive course. All joints of the second course and succeeding courses should be at the center line of the previous course. If the Interlocking tile are to start at a valley it is suggested to lay the tile loose across the slope to determine what adjustments, if any, are needed.

Figure 63.2 Eave Detail



Valley Tiles

Tile to be installed in valleys can be mitered in the field or by ordering and using special factory tile. Whether field miter cut or factory tile are used, the tile fasteners should never penetrate the valley flashings. Tile to be installed over the copper valley flashing should be drilled or notched and wired with solid 16 gauge wire to fasteners driven into the deck beyond the flashing.

To encourage leaves and snow to slide down the valley, the gap between the Valley Tiles and the center line of the valley should be tapered from 3" at the top to 4" at the bottom. This can be increased for long valleys or heavy snow locations.

NOTE: Notching and drilling was addressed previously on Page 21. In situations where valley tile pieces are so small that it is not practical to notch or drill, use the adhesive RT600 (an OSI product) or its equivalent.

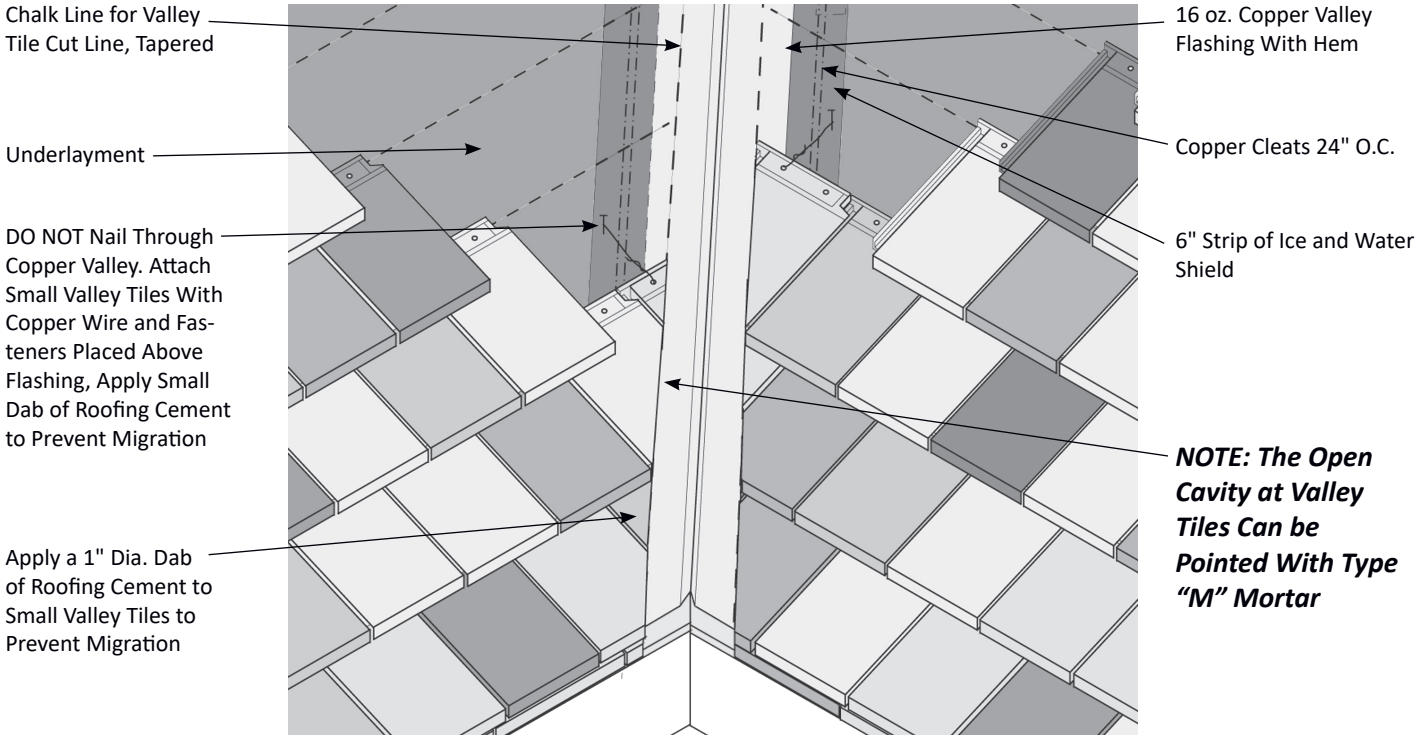


Figure 64.1 Valley Detail

Hip Tiles

There are a number of methods to finish the hips of Interlocking tile roof depending on the design aesthetics desired. These methods are flushed mitered, V-Hip tile or one of Ludowici's other trim groups.

Tiles to be installed at hips are field mitered.

V-Hip and Other Cap Type Hip Rolls

Hips are started with a special V-Hip Starter tile which should cover the field tile approximately 3" on both sides. The regular V-Hip tile is then installed by creating an approximate 2" head lap on the V-Hip starter tile. This 2" head lap is continued up the hip and roofing cement is applied at each hip tile's overlap. The last fastener on the upslope end of the hip is typically covered with a V-Hip and Ridge Terminal. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative for the project's special roof requirements.

Chart 67.1

Roof Pitch Rise:Run	V-Hip
4:12	2 1/4"
5:12	2 1/4"
6:12	2"
7:12	2"
8:12	1 3/4"
9:12	1 3/4"
10:12	1 1/2"
11:12	1 1/2"
12:12	1 1/4"
13:12	1 1/4"
14:12	1 1/4"

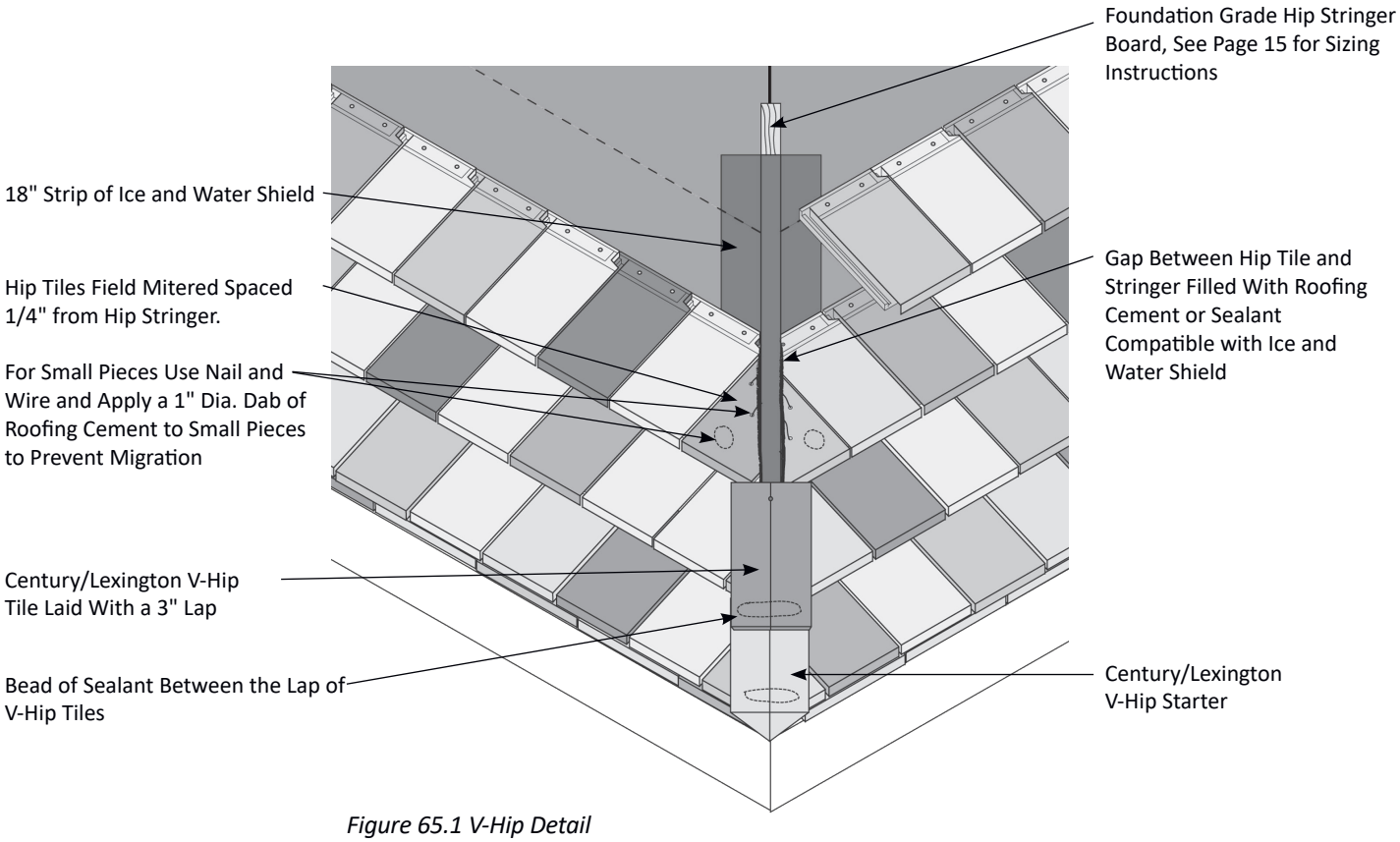
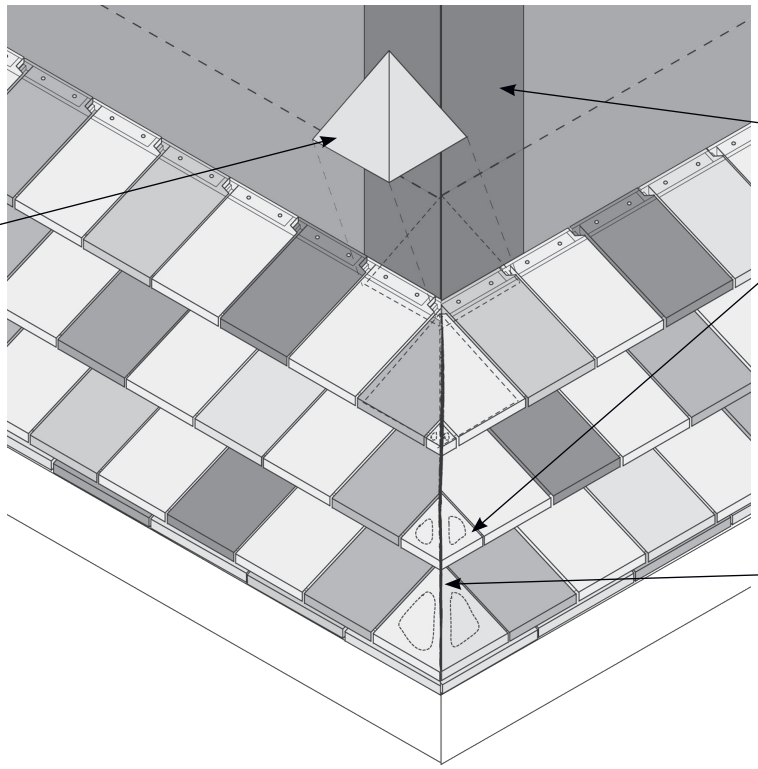


Figure 65.1 V-Hip Detail

Mitered Hip

A flush mitered hip can be done by accurately miter-cutting the field tile and sealing the finished joint with an approved sealant, meeting the requirements of ASTM D-4586. Mitred hips require the use of copper step flashing on every course.

Figure 66.1 Mitred Hip Detail



Roof Pitch Rise:Run	Century/Lexington V-Ridge
4:12	1 1/4"
5:12	1"
6:12	13/16"
7:12	9/16"
8:12	3/8"
9:12	1/4"
10:12	3/16"
11:12	9/16"
12:12	7/16"
13:12	1/4"
14:12	1/8"

Chart 66.1

Ridge

Century/Lexington V-Ridge

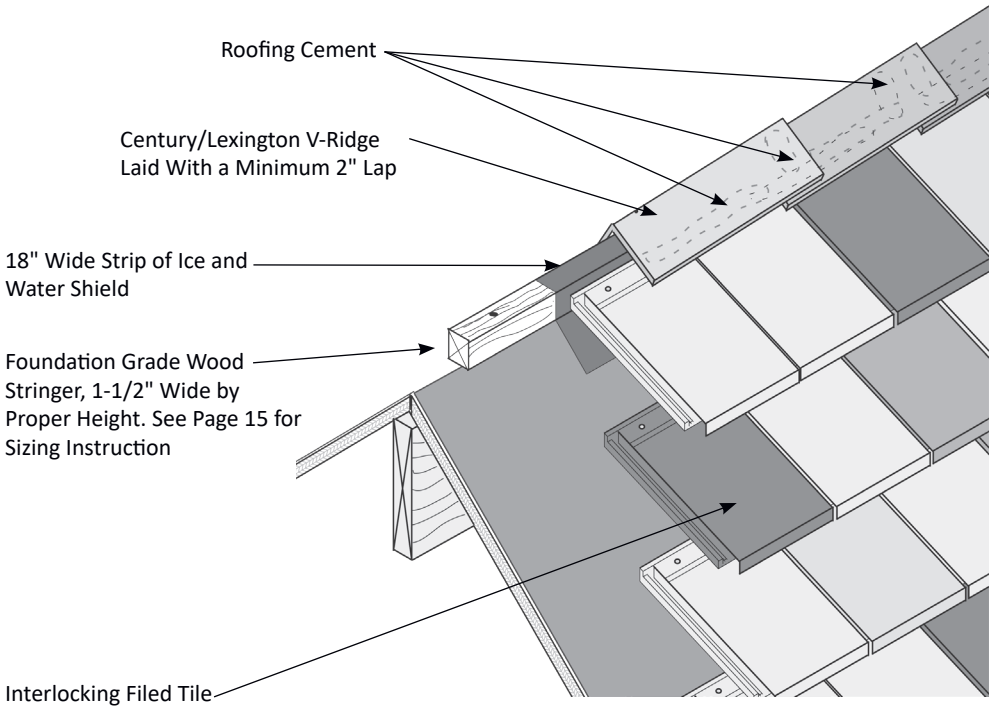


Figure 67.1 V-Ridge Detail

Mitered Ridge

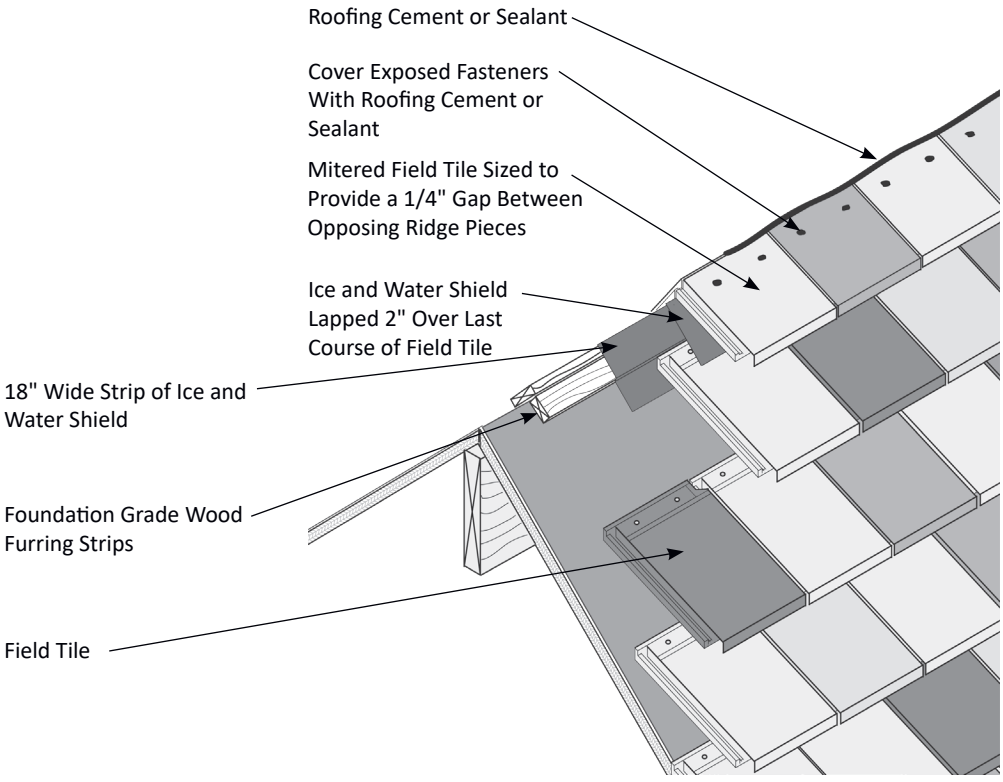


Figure 67.2 Mitered Ridge Detail

211 Ridge Vented

This ridge vent allows 6.27 square inches of ventilation per foot of ridge.

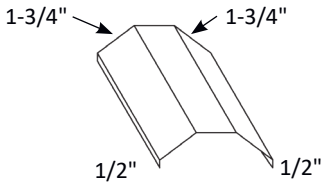


Figure 68.1 #211 Vented Ridge Cap Flashing

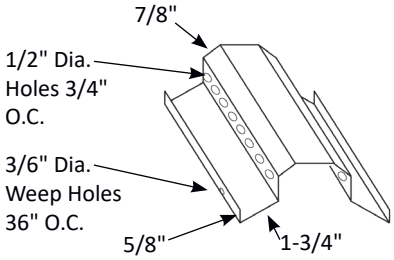


Figure 68.2 #211 Vented Ridge Vent Flashing

206 Ridge Vented

This ridge vent allows 6.27 square inches of ventilation per foot of ridge.

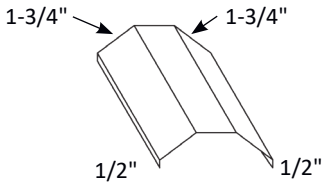


Figure 68.3 #211 Vented Ridge Cap Flashing

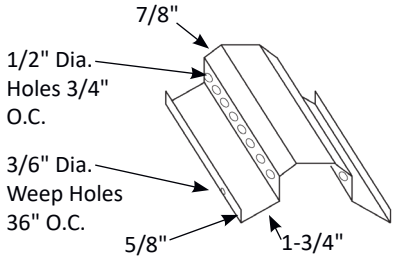


Figure 68.4 #211 Vented Ridge Vent Flashing

Terminals

Ludowici makes ridge end caps for all trim groups. Ridge end caps come as a starter or finisher, (a male/female lap). Care should be taken to determine correct orientation of the parts ordered and the proper installation sequence to accommodate the installation with minimal cutting.

Ludowici manufactures Terminals to accommodate Ridge and Hip transitions. These are the most effective way to waterproof the transition and finish it in an aesthetically pleasing manor. Terminals are also made with a starter and finisher.

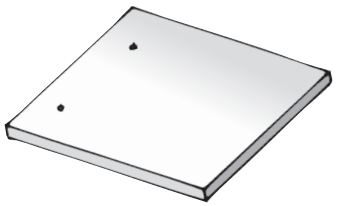


Figure 69.2 Typical 2 Hip/1 Ridge Century/Lexington V-Terminal

Vertical Wall Application

Flat Shingle or Interlocking tile can be used on a vertical surface. For Shingle tile, short tops and long tops and under eave cant strips are used. For Interlocking tile, use cant strips where needed.

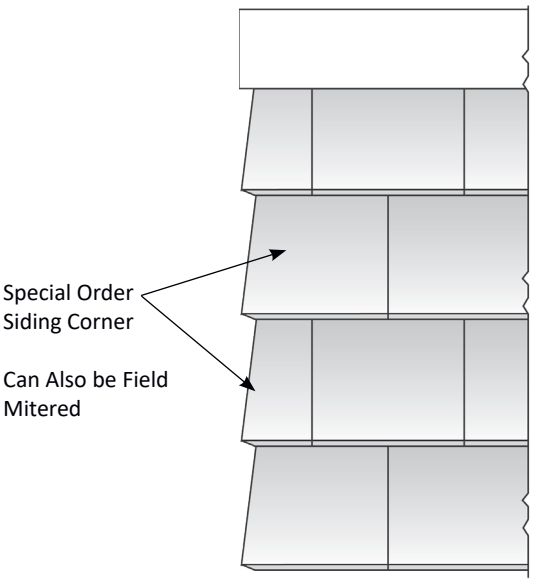


Figure 69.1 Vertical Wall Corner

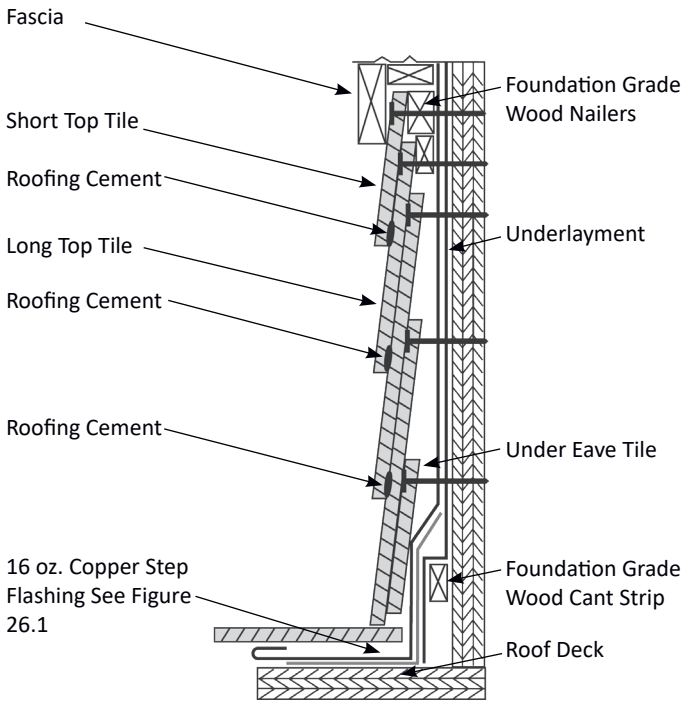


Figure 69.3 Vertical Wall Section

Snow Guards

Snow guards are generally required in areas where snow and ice may accumulate on the roof. Snow guards are sometimes used on sloped roofs to prevent a mass of snow or ice from sliding off the roofs and injuring persons, damaging gutters or plants and blocking walks and driveways. Snow guards hold the snow in place above the eaves until it can melt and the water runs off.

It is recommended that snow guards should be installed on at least 3 or 4 courses, offset from course to course, spaced in staggered interval rows. Begin with the third or fourth row. However, spacing and quantity of snow guards is a matter of judgement based on local weather conditions (see Figure 75.1).

Alpine conditions will require a professional engineer to design the required snow retainage system. Tile should not be exposed to ice and snow loads exceeding 100 pounds per square foot.

A snow guard must be made of nonferrous material to prevent possible rust stains.

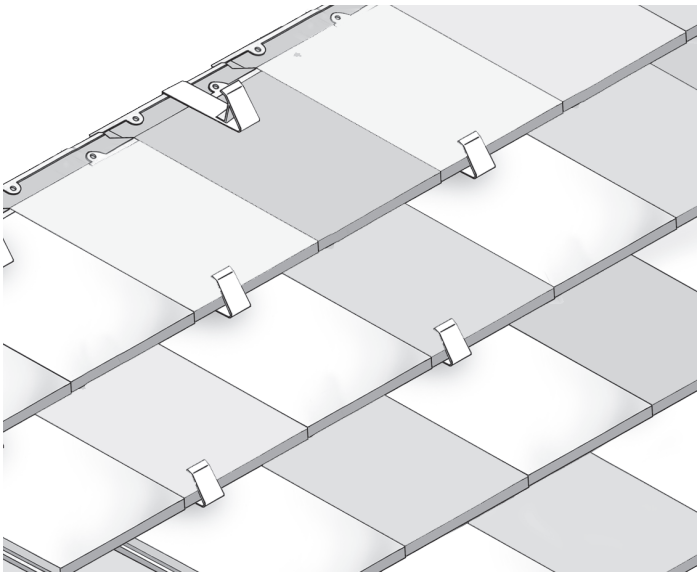


Figure 70.1 Snow Guard Spacing

Repair

To replace a broken or damaged tile do not use an exposed Copper strap. These are unsightly and can work loose allowing the replacement tile to slide out.

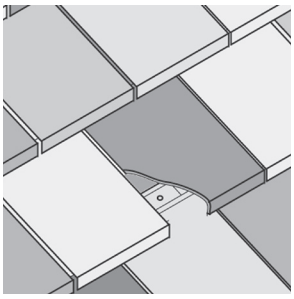


Figure 71.1
Damaged Tile

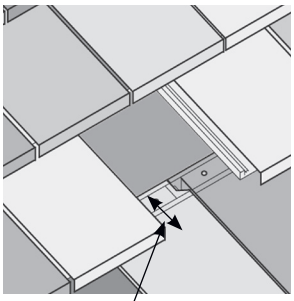


Figure 71.2
Remove Damaged Tile

Completely remove damaged tile and fasteners. A slate ripper will facilitate removal of fasteners. Measure the distance from the top of the course below to the bottom of the adjacent tile to the replacement.

Ludowici's Quik-Tach™ Brackets are a quick, efficient and concealed method for tile replacement. Follow these steps:

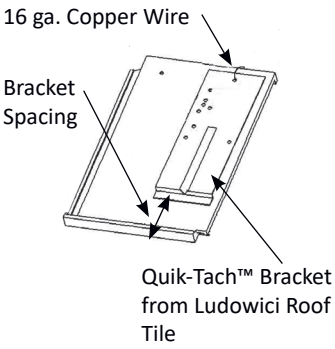


Figure 71.3
Replacement Tile with Quik-Tach™ Bracket

Align a Quik-Tach™ Bracket on the back of the replacement tile to the correct bracket spacing. Wire bracket to the replacement tile with 16 ga. Copper Wire.

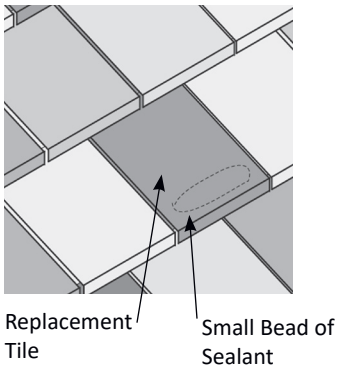


Figure 71.4
Finished Tile Replacement

Lift the tile in the course above and slide the replacement tile into place so the bracket engages the top of the tile below the replacement. Apply a small bead of Sealant or roofing Cement under replacement tile.

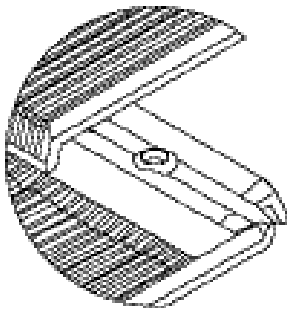
Measuring and Chalking the Roof

Layout and chalking the roof accurately are critical to the roof's performance and appearance. If the eaves are straight and level, all horizontal lines must be parallel to the eaves and all vertical lines must be perpendicular to the eaves. Check the roof deck to determine if the deck is square prior to layout.

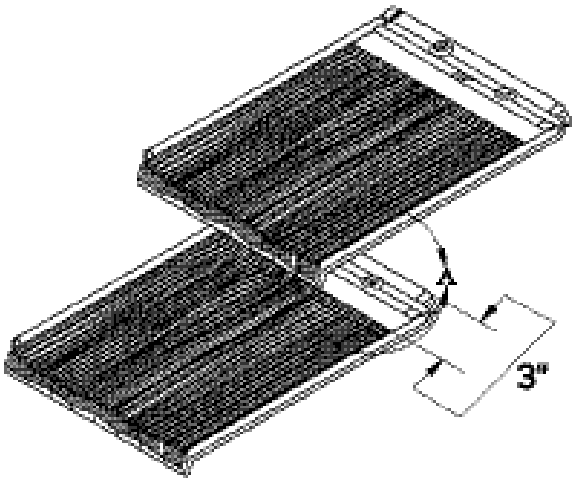
IMPORTANT:
The tile dimensions can vary because of clay firing temperatures. Be sure to measure tiles in your shipment to determine their average width and length dimensions, so you can chalk your roof properly.

Step 1: *Determine Width and Length Exposure*
Clay tiles, depending on the style and profile, vary in exposure and recommended head lap. Ludowici Interlocking tiles are laid with a minimum headlap of 3". Before chalking the roof the installer should verify the tile pattern being installed, and measure, noting average length and width exposures of the tile shipped.

The width exposure should also include the spacing gap between tiles. Interlocking tiles are typically laid with a gap of 1/8"; however, this can be compressed or expanded slightly. The usual overhang at the eave is 2"; however, this can be compressed slightly to accommodate full courses.



DETAIL A
Course above on support shelf



Step 2: *Chalking Horizontal Lines*
Horizontal lines are struck after the vertical lines are struck.

Strike a line for the under eave tile. Subtract 2" (for overhang) from the under eave to determine distance.

For Interlocking tile the first field tile line will equal the average length of the tile minus the overhang (typically 2").

Successive lines are then struck at intervals equal to your average length of exposure. Length exposure of Interlocking tile is determined by subtracting 3" (for headlap) from the tile length.

Your eave to ridge measurement may determine the average length exposure rather than the size of the tile itself.

NOTE: Do not adjust exposure to a headlap less than 3".

Care must be taken to ensure that all horizontal lines are perpendicular to the water flow.

This manual includes the basic installation instructions from start to finish in an easy-to-read format. However, the applicator must always give consideration to regional climactic conditions and code requirements.

For alpine or tropical installations contact the Ludowici Technical Service Department for assistance.

Have a question about how to install Ludowici tile?

Contact your local Ludowici Sales Representative or the Ludowici Technical Service Department at

1-800-945-8453

LUDOWICI®

4757 Tile Plant Rd.
P.O. Box 69
New Lexington, OH 43764
1-800-945-8453
www.ludowici.com