



RESIDENTIAL CONSTRUCTION ROOF ASSEMBLIES

QUICK-CARDS® A UNIQUE QUICK-REFERENCE GUIDE

Based on the
2018 International
Residential Code
(IRC)

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WEATHER PROTECTION

TERM ALERT!

- ★ **Pan Flashing.** Corrosion-resistant flashing at the base of an opening that is integrated into the building exterior wall to direct water to the exterior and is pre-manufactured, fabricated, formed or applied at the job site.
- ★ **Roof Assembly.** A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, underlayment and roof covering and can also include a thermal barrier, ignition barrier, insulation or a vapor retarder.
- ★ **Roof Deck.** The flat or sloped surface not including its supporting members or vertical supports.
- ★ **Roof Recover.** The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.
- ★ **Scupper.** An opening in a wall or parapet that allows water to drain from a roof.

WEATHER PROTECTION (Based on IRC R903.1)

- Roof decks must be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter.
- Roof assemblies must be designed and installed in accordance with this code and the approved manufacturer's instructions such that the roof assembly must serve to protect the building or structure.

FLASHING (Based on IRC R903.2)

Flashings must be installed in a manner that prevents moisture from entering the wall and roof through joints in copings, through moisture permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

Locations

- Flashings must be installed at wall and roof intersections, wherever there is a change in roof slope or direction and around roof openings.
- A flashing must be installed to divert the water away from where the eave of a sloped roof intersects a vertical sidewall.
- Where flashing is of metal, the metal must be corrosion resistant with a thickness of not less than 0.019" (No. 26 galvanized sheet).

Crickets & Saddles

- A cricket or saddle must be installed on the ridge side of any chimney or penetration more than 30" wide as measured perpendicular to the slope.
- Cricket or saddle coverings must be sheet metal or of the same material as the roof covering.

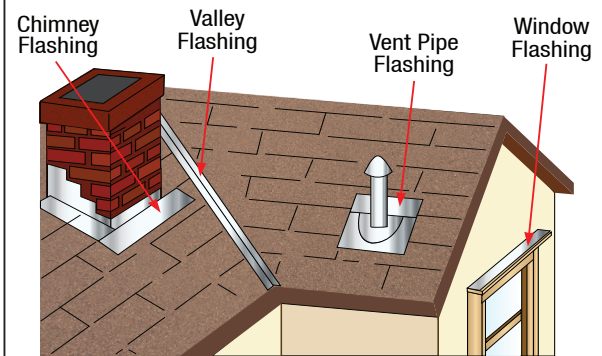
COPING (Based on IRC R903.3)

Parapet walls must be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

ROOF DRAINAGE (Based on IRC R903.4)

Unless roofs are sloped to drain over roof edges, roof drains must be installed at each low point of the roof.

ROOFING – FLASHING

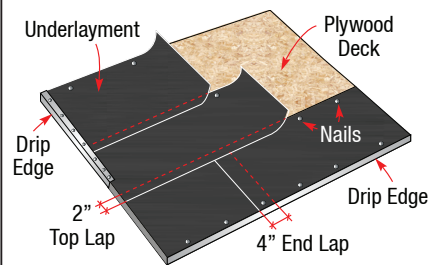


SECONDARY (EMERGENCY OVERFLOW) DRAINS OR SCUPPERS (Based on IRC R903.4.1)

- Where roof drains are required, secondary emergency overflow roof drains or scuppers must be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason.
- Overflow drains having the same size as the roof drains must be installed with the inlet flow line located 2" above the low point of the roof, or overflow scuppers having 3 times the size of the roof drains and having a min. opening height of 4" must be installed in the adjacent parapet walls with the inlet flow located 2" above the low point of the roof served.
- The installation and sizing of overflow drains, leaders and conductors must comply with Sections 1106 and 1108 of the International Plumbing Code, as applicable.
- Overflow drains must discharge to an approved location and must not be connected to roof drain lines.

ROOF COVERING – UNDERLAYMENT

UNDERLAYMENT



ROOF COVERING APPLICATION (Based on IRC R905.1)

- Roof coverings must comply with requirements of Section R905 and manufacturer's install. instructions.
- Unless otherwise specified, roof coverings must be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

ICE BARRIERS (Based on IRC R905.1.2)

- Areas with a history of ice forming along eaves (Table R301.2(1)), must have an ice barrier installed for asphalt shingles, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles and wood shakes.
- The ice barrier must consist of 2 layers min. of underlayment cemented together, or a self-adhering polymer-modified bitumen sheet must be used in place of normal underlayment and extend from the lowest edges of all roof surfaces to a point not less than 24" inside the exterior wall line of the building.
- On roofs with slope equal to or greater than 8:12, the ice barrier must also be applied not less than 36" measured along the roof slope from the eave edge of the building.

UNDERLAYMENT (Based on IRC R905.11)

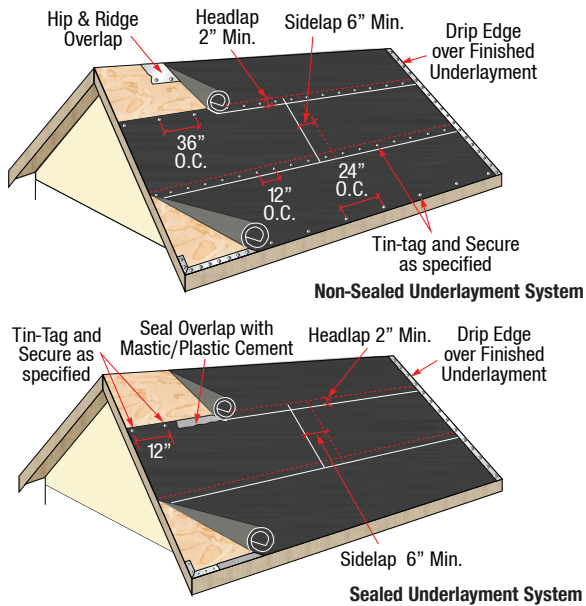
- Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and photovoltaic shingles must conform R905.
- Underlayment materials required to comply with ASTM D226, D1970, D4869 and D6757 must bear a label indicating compliance to the standard designation and, if applicable, type classification, see Table R905.1(1).
- Underlayment must be applied and attached according to Tables R905.1.1(2) and R905.1.1(3).

UNDERLAYMENT TYPES (Based on IRC Table R905.1(1))

Roof Covering	Section	Maximum Ultimate Design Wind Speed, $V_{ult} < 140$ mph	Maximum Ultimate Design Wind Speed, $V_{ult} \geq 140$ mph
Asphalt shingles	R905.2	ASTM D 226 Type I ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type III or IV ASTM D6757
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral-surfaced roll roofing	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M - mineral-surfaced roll roofing
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or IV
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or IV
Wood Shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood Shakes	R905.8	ASTM D 226 Type I or II ASTM D 4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or IV
Metal Panels	R905.10	Manufacturer's Instructions	ASTM D226 Type II ASTM D4869 Type III or IV
Photovoltaic Shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D4869 Type III or IV ASTM D6757

ROOF COVERING – UNDERLAYMENT (CONTINUED)

UNDERLAYMENT SYSTEMS



UNDERLAYMENT APPLICATION – CLAY & CONCRETE TILE

(Based on IRC Table R905.1.1(2))

Max. Ultimate Design Wind Speed, $V_{ult} < 140$ mph

- For roof slopes from 2½ units vertical in 12 units horizontal (2½:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment must be a min. of 2 layers applied as follows: starting at the eave, apply a 19-inch strip of underlayment parallel with the eave.
- Starting at the eave, apply 36-inch-wide strips of underlayment felt, overlapping successive sheets 19".

- For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment must be a min. of 1 layer of underlayment felt applied shingle fashion, parallel to and starting from the eaves and lapped 2".
- End laps must be 4" and must be offset by 6 ft.

Max. Ultimate Design Wind Speed, $V_{ult} \geq 140$ mph

- Same as Maximum Ultimate Design Wind Speed, $V_{ult} < 140$ mph except all laps must be not less than 4".

UNDERLAYMENT ATTACHMENT

(Based on IRC Table R905.1.1(3))

Max. Ultimate Design Wind Speed, $V_{ult} < 140$ mph

- Asphalt Shingles, Clay and Concrete Tile, Photovoltaic: Fastened sufficiently to hold in place
- Metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes and metal panels: Manufacturer's install. instructions.

Max. Ultimate Design Wind Speed, $V_{ult} \geq 140$ mph

The following reqs. are for asphalt shingles, clay and concrete tile, photovoltaic shingles, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and metal panels.

- The underlayment must be attached with corrosion-resistant fasteners in a grid pattern of 12" between side laps with a 6" spacing at side and end laps.
- Underlayment must be attached using metal or plastic cap nails or cap staples with a nominal cap diameter of not less than 1".
- Metal caps must have a thickness of not less than 32-gage sheet metal.
- Power-driven metal caps must have a min. thickness of 0.010".
- Min. thickness of the outside edge of plastic caps must be 0.035".
- The cap nail shank must be not less than 0.083" for ring shank cap nails and 0.091" for smooth shank cap nails.
- Staples must be not less than 21 gage.
- Cap nail shank and cap staple legs must have a length sufficient to penetrate through the roof sheathing or not less than 3/4" into the roof sheathing.

UNDERLAYMENT APPLICATION – ASPHALT SHINGLES & PHOTOVOLTAIC SHINGLES

(Based on IRC Table R905.1.1(2))

Max. Ultimate Design Wind Speed, $V_{ult} < 140$ mph

- For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment must be 2 layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves.
- Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19".
- Distortions in the underlayment must not interfere with the ability of the shingles to seal.
- End laps must be 4" and must be offset by 6 ft.
- For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment must be 1 layer applied in the following manner: underlayment must be applied shingle fashion, parallel to and starting from the eave and lapped 2".
- Distortions in the underlayment must not interfere with the ability of the shingles to seal.
- End laps must be 4" and must be offset by 6 ft.

Max. Ultimate Design Wind Speed, $V_{ult} \geq 140$ mph

- Same as Maximum Ultimate Design Wind Speed, $V_{ult} < 140$ mph except all laps must be not less than 4".

UNDERLAYMENT APPLICATION – METAL ROOF SHINGLES, MINERAL-SURFACED ROLL ROOFING, SLATE AND SLATE-TYPE SHINGLES, WOOD SHINGLES, WOOD SHAKES & METAL PANELS

(Based on IRC Table R905.1.1(2))

Max. Ultimate Design Wind Speed, $V_{ult} < 140$ mph

- Apply in according to manufacturer's instructions.

Max. Ultimate Design Wind Speed, $V_{ult} \geq 140$ mph

- For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment must be 2 layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves.
- Starting at the eave, apply 36" wide sheets of underlayment, overlapping successive sheets 19".
- For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment must be 1 layer applied in the following manner: underlayment must be applied shingle fashion, parallel to and starting from the eave and lapped 4".
- End laps must be 4" and must be offset by 6 ft.

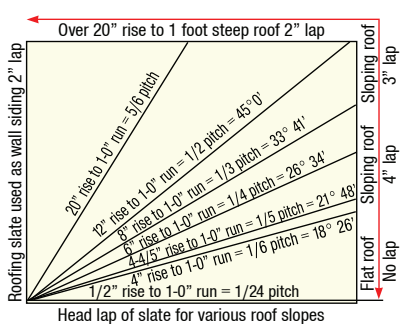
INFO YOU MUST KNOW!

(Based on IRC R904.2)

Roof assemblies must be of materials that are compatible with each other and with the building or structure to which the materials are applied.

SLATE SHINGLES

HEADLAP OF SLATE



SLATE SHINGLES

(Based on IRC R905.6.1 - R905.6.4)

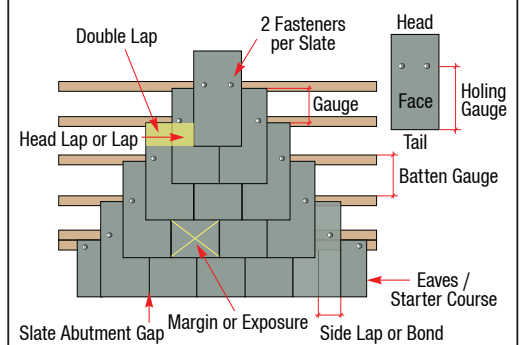
- Slate shingles must be fastened to solidly sheathed roofs.
- Slate shingles must be used only on slopes of 4 units vertical in 12 units horizontal (33% slope) or greater.
- Underlayment must comply with Section R905.1.1.
- Ice barriers must comply with Section R905.1.2.
- Slate shingles must comply with ASTM C406.

FLASHING

(Based on IRC R905.6.6)

- Flashing and counterflashing must be made with sheet metal.
- Valley flashing width: 15" Min.
- Valley and flashing metal must be a min. uncoated thickness of 0.0179-inch zinc coated G90.
- Chimneys, stucco or brick walls must have a min. of 2 plies of felt for a cap flashing consisting of a 4-inch-wide strip of felt set in plastic cement and extending 1" above the first felt and a top coating of plastic cement.
- The felt must extend 2" over the base flashing.

SLATE SHINGLES ROOFING



APPLICATION

(Based on IRC R905.6.5)

- For min. headlap for slate shingles, see Table R905.6.5.
- Slate shingles must be secured to the roof with 2 fasteners per slate.
- Installation: follow IRC and manufacturer's instructions.

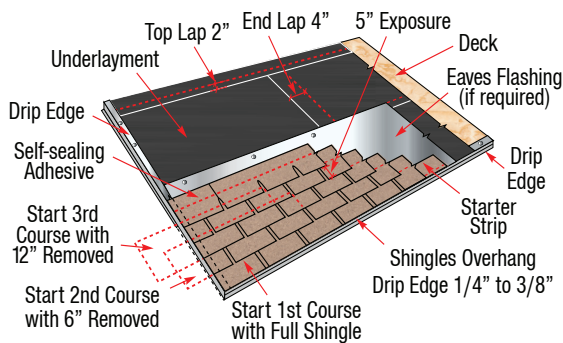
SLATE SHINGLE HEADLAP

(Table R905.6.5)

Slope	Headlap (inches)
4:12 ≤ slope < 8:12	4
8:12 ≤ slope < 20:12	3
Slope ≥ 20:12	2

ASPHALT SHINGLES

ASPHALT SHINGLES – FLASHING



ASPHALT SHINGLES (Based on IRC R905.2.1 - R905.2.4.1)

- Asphalt shingles must be fastened to solidly sheathed decks.
- Asphalt shingles must comply with ASTM D3462.
- Asphalt shingle packaging must bear a label to indicate compliance with ASTM D7158 and Table R905.2.4.1.

CLASSIFICATION OF ASPHALT ROOF SHINGLES

(Based on IRC Table R905.2.4.1)

Max. Ultimate Design Wind Speed, V_{ult} from Fig. R301.2(5)A (mph)	Max. Basic Wind Speed, V_{ASD} from Table R301.2.1.3 (mph)	ASTM D7158 Shingle Classification	ASTM D3161 Shingle Classification
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

VALLEY LINING MATERIAL (Based on IRC Table R905.2.8.2)

Material	Min. Thickness (inches)	Gage	Weight (pounds)
Cold-rolled copper	0.0216 nominal	—	ASTM B370, 16 oz. per sq. ft.
Lead-coated copper	0.0216 nominal	—	ASTM B101, 16 oz. per sq. ft.
High-yield copper	0.0162 nominal	—	ASTM B370, 12 oz. per sq. ft.
Lead-coated high-yield copper	0.0162 nominal	—	ASTM B101, 12 oz. per sq. ft.
Aluminum	0.024	—	—
Stainless steel	—	28	—
Galvanized steel	0.0179	26 (zinc coated G90)	—
Zinc alloy	0.027	1.62	—
Lead	—	—	2½
Painted terne	—	—	20

MINERAL-SURFACED ROLL ROOFING

DECK REQUIREMENTS (Based on IRC R905.5.1 - R905.5.2)

- Mineral-surfaced roll roofing must be fastened to solidly sheathed roofs.
- Mineral-surfaced roll roofing must not be applied on roof slopes below 1 unit vertical in 12 units horizontal (8% slope).

UNDERLAYMENT & ICE BARRIER (Based on IRC R905.5.3)

- Underlayment must comply with Section R905.1.1.
- Ice barriers must comply with Section R905.1.2.

MATERIAL STANDARDS (Based on IRC R905.5.4)

Mineral-surfaced roll roofing must conform to ASTM D3909 or ASTM D6380, lass M.

APPLICATION (Based on IRC R905.5.5)

Mineral-surfaced roll roofing must be installed in accordance with this chapter and the manufacturer's instructions.

FLASHING (Based on IRC R905.2.8 - R905.2.8.3)

Flashing for asphalt shingles must comply with this section and the asphalt shingle manufacturer's approved installation instructions.

Base and Cap

- Base and cap flashing must be installed according to manufacturer's instructions.
- Base flashing must be of either corrosion-resistant metal of min. nominal 0.019" thick or mineral-surfaced roll roofing weighing a min. of 77 pounds per 100 sq. ft.
- Cap flashing must be corrosion-resistant metal of min. nominal 0.019" thickness.

Valleys

- Valley linings must be installed per manufacturer's instructions before applying shingles.
- The following valley linings are permitted:
 - For open valleys (valley lining exposed) lined with metal, the valley lining must be a min. of 24" wide and of any of the corrosion-resistant metals in Table R905.2.8.2.
 - For open valleys, valley lining of 2 plies of mineral-surfaced roll roofing, complying with ASTM D3909 or ASTM D6380 Class M, must be permitted.
 - Bottom layer must be 18" wide.
 - Top layer must be a min. of 36" wide.
 - For closed valleys (valley covered with shingles), valley lining of 1 ply of smooth roll roofing complying with ASTM D6380 and a min. of 36" wide or valley lining as described in Item 1 or 2 is permitted.
- Self-adhering polymer-modified bitumen underlayment complying with ASTM D1970 must be permitted in lieu of the lining material.

Sidewall

- Base flashing against a vertical sidewall:
 - must be continuous or step flashing
 - must be a min. of 4" high and 4" wide
 - must direct water away from the vertical sidewall onto the roof or into the gutter
- Where siding is provided on the vertical sidewall, the vertical leg of the flashing must be continuous under the siding.
- Where anchored masonry veneer is provided on the vertical sidewall, the base flashing must comply with this section and counterflashing must comply with Section R703.8.2.2.
- Where exterior plaster or adhered masonry veneer is provided on the vertical sidewall, the base flashing must comply with this section and Section R703.6.3.

DRIP EDGE (Based on IRC R905.2.8.5)

- A drip edge must be provided at eaves and rake edges of shingle roofs.
- Adjacent segments of drip edge: overlapped 2" min.
- Drip edges must extend not less than 1/4" below the roof sheathing and extend up back onto the roof deck not less than 2".
- Drip edges must be mechanically fastened to the roof deck at not more than 12" o.c. with fasteners.
- Underlayment must be installed over the drip edge along eaves and under the underlayment along rake edges.

FASTENERS (Based on IRC R905.2.5)

- Fasteners for asphalt shingles must be galvanized steel, stainless steel, aluminum or copper roofing nails, min. 12-gage [0.105"] shank with a min. 3/8" dia. head, complying with ASTM F1667, of a length to penetrate through the roofing materials and not less than 3/4" into the roof sheathing.
- Where the roof sheathing is less than 3/4" thick, the fasteners must penetrate through the sheathing.

ATTACHMENT (Based on IRC R905.2.6)

- Asphalt shingles must have the min. number of fasteners required by the manufacturer's approved installation instructions, but not less than 4 fasteners per strip shingle or 2 fasteners per individual shingle.
- Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12, 175% slope), shingles must be installed as required by the manufacturer.

SLOPE (Based on IRC R905.2.2)

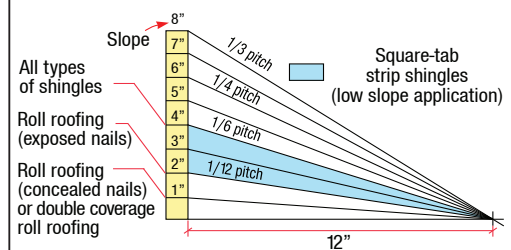
- Asphalt shingles must be used only on roof slopes of 2 units vertical in 12 units horizontal (2:12) or greater.
- For roof slopes from 2 units vertical in 12 units horizontal (2:12)(17%) up to 4 units vertical in 12 units horizontal (4:12)(33%), double underlayment application is required, see section R905.1.1.

UNDERLAYMENT & ICE BARRIERS

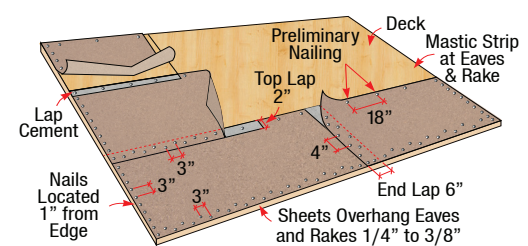
(Based on IRC R905.2.3 & R905.2.7)

- Underlayment must comply with Section R905.1.1.
- Ice barriers must comply with Section R905.1.2.

PITCH & SLOPE



MINERAL-SURFACED ROLL ROOFING



CLAY & CONCRETE TILE

DECK REQUIREMENTS (Based on IRC R905.3)

- The installation of clay and concrete tile must comply with the provisions of this section.
- Concrete and clay tile must be installed only over solid sheathing or spaced structural sheathing boards.
- Clay and concrete roof tile must be installed on roof slopes of 2½ units vertical in 12 units horizontal (2½:12)(25%) or greater.
- For roof slopes from 2½ units vertical in 12 units horizontal (2½:12) (25%) to 4 units vertical in 12 units horizontal (4:12)(33%), double underlayment application is required in accordance with Section R905.3.3.

CLAY & CONCRETE TILE (Based on IRC R905.3.4 & 905.3.5)

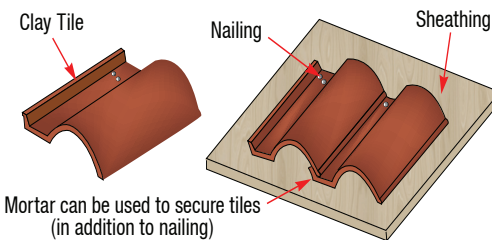
- Clay roof tile must comply with ASTM C1167.
- Concrete roof tile must comply with ASTM C1492.

CLAY & CONCRETE TILE ATTACHMENT

(Based on IRC Table R905.3.7)

Sheathing	Roof Slope	Number of Fasteners
Solid without battens	All	One per tile
Spaced or solid with battens and slope < 5:12	Fasteners not required	—
Spaced sheathing without battens	5:12 ≤ slope < 12:12	One per tile/ every other row
	12:12 ≤ slope < 24:12	One per tile

CLAY & CONCRETE TILE DETAILS



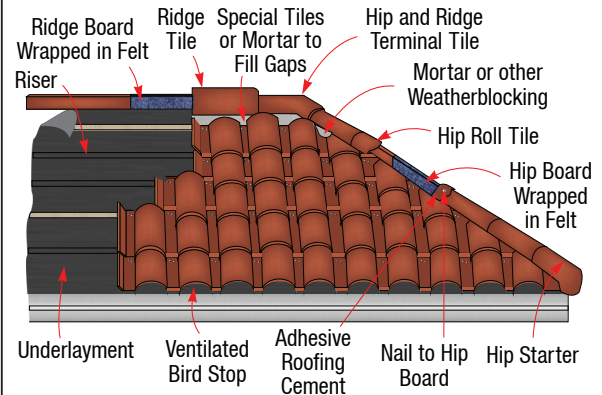
FASTENERS (Based on IRC R905.3.6)

- Nails must be corrosion resistant and not less than 11-gage, 5/16" head.
- Nails must be of sufficient length to penetrate the deck not less than ¾" or through the thickness of the deck, whichever is less.
- Attaching wire for clay or concrete tile must not be smaller than 0.083".
- Perimeter fastening areas include 3 tile courses but not less than 36" from either side of hips or ridges and edges of eaves and gable rakes.

APPLICATION (Based on IRC R905.3.7)

- Clay and concrete tile must be applied according to IRC and manufacturer's installation instructions, based on:
 1. Climatic conditions
 2. Roof slope
 3. Underlayment system
 4. Type of tile being installed
- Perimeter tiles must be fastened with at least 1 fastener per tile.
- Tiles with installed weight less than 9 lbs. per sq. ft. require a min. of 1 fastener per tile regardless of roof slope.
- Clay and concrete roof tile attachment must comply with manufacturer's installation instructions where applied in areas where the ultimate design wind speed exceeds 130 miles per hour and on buildings where the roof is located more than 40 ft. above grade.
- In areas subject to snow, at least 2 fasteners per tile are required.
- In other areas, clay and concrete roof tiles must be attached according to Table R905.3.7.

CLAY & CONCRETE TILE ROOFING



FLASHING (Based on IRC R905.3.8)

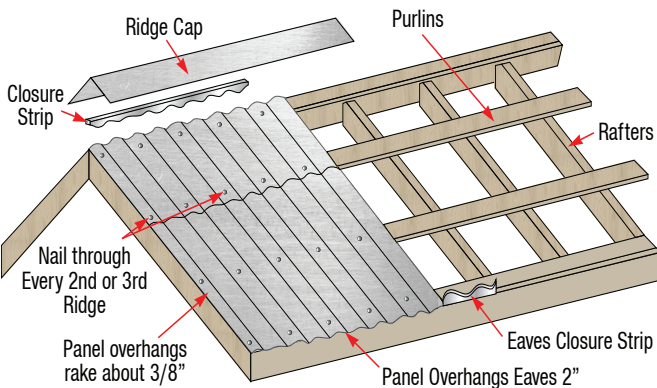
- At the juncture of roof vertical surfaces, flashing and counter-flashing must be provided in accordance the IRC and the manufacturer's installation instructions.
- At the juncture of roof vertical surfaces, flashing and counter-flashing of metal, it must be a min. of 0.019" (No. 26 galvanized sheet gage) corrosion-resistant metal.
- The valley flashing must extend a min. of 11" from the centerline each way and have a splash diverter rib not less than 1" in height at the flow line formed as part of the flashing.
- Sections of flashing must have an end lap of 4" Min.
- For roof slopes of 3 units vertical in 12 units horizontal (25% slope) and greater, valley flashing must have a 36" wide underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment.
- In areas where the average daily temperature in January is 25°F (-4°C) or less, metal valley flashing underlayment must be solid-cemented to the roofing underlayment for slopes less than 7 units vertical in 12 units horizontal (58% slope) or be of self-adhering polymer modified bitumen sheet.

UNDERLAYMENT (Based on IRC R905.3.3)

Underlayment must comply with Section R905.1.1.

METAL ROOF SHINGLES

METAL ROOF SHINGLES ROOFING



APPLICATION (Based on IRC R905.4.5)

Metal roof shingles must be secured to the roof as stated in the IRC and approved manufacturer's installation instructions.

UNDERLAYMENT & ICE BARRIER (Based on IRC R905.4.3)

- Underlayment must comply with Section R905.1.1.
- Where required, ice barriers must comply with Section R905.1.2.

DECK REQUIREMENTS

(Based on IRC R905.4.1 and R405.4.2)

- The installation of metal roof shingles must comply with this section.
- Metal roof shingles must be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.
- Metal roof shingles must not be installed on roof slopes below 3 units vertical in 12 units horizontal (25% slope).

METAL STANDARDS

(Based on IRC R905.4.4)

- Metal roof shingle roof coverings must comply with Table R905.10.3(1).
- Materials used for metal roof shingle roof coverings must be naturally corrosion resistant or be made corrosion resistant according to the standards and min. thicknesses listed in Table R905.10.3(2).

FLASHING (Based on IRC R905.4.6)

- Roof valley flashing must be of corrosion-resistant metal of the same material as the roof covering or must comply with the standards in Table R905.10.3(1).
- The valley flashing must extend a min. of 8" from the centerline each way and must have a splash diverter rib not less than ¾" in height at the flow line formed as part of the flashing.
- Sections of flashing must have an end lap 4" Min.
- The metal valley flashing must have a 36" wide underlayment directly under it consisting of 1 layer of underlayment running the full length of the valley, in addition to underlayment required for metal roof shingles.
- In areas where the average daily temperature in January is 25°F (-4°C) or less, the metal valley flashing underlayment must be solid cemented to the roofing underlayment for roof slopes under 7 units vertical in 12 units horizontal (58% slope) or self-adhering polymer modified bitumen sheet.

WOOD SHINGLES & WOOD SHAKES

MATERIALS (Based on IRC R905.7.4 & R905.8.9)

- Wood shingles must be of naturally durable wood, have minimum grades must be 1, 2 or 3 with CSSB as applicable grading rules.
- Wood shakes materials, see Table R905.8.5
- Each bundle of shingles/shakes must be identified by a label of an approved bureau or agency.

APPLICATION (Based on IRC R905.7.5 & R905.8.6)

Wood Shingles

- Wood shingles must be laid with a side lap a min. of 1 1/2" between joints in courses and 2 joints must not be in direct alignment in any 3 adjacent courses.
- Spacing between shingles: 1/4" to 3/8".
- Weather exposure for wood shingles must not exceed those set in Table R905.7.5(1).
- Fasteners for untreated (naturally durable) wood shingles must be box nails, see Table R905.7.5(2).
- Nails must be stainless steel Type 304 or 316 or hot-dipped galvanized with a coating weight of ASTM A153 Class D (1.0 oz/ft²).
- Alternatively, two 16-gage stainless steel Type 304 or 316 staples with crown widths 7/16" Min., 3/4" Max. must be used.
- Fasteners installed within 15 miles of saltwater coastal areas must be stainless steel Type 316.
- Fasteners for fire-retardant-treated shingles or pressure-impregnated-preservative-treated shingles of naturally durable wood (AWPA U1 must be stainless steel Type 316).
- All fasteners must have a min. penetration into the sheathing of 3/4".
- For sheathing less than 3/4" thickness, each fastener must penetrate through the sheathing.
- Wood shingles must be attached to the roof with 2 fasteners per shingle, positioned per manufacturer's installation instructions.
- Fastener packaging must bear a label indicating grade material or coating weight.

Wood Shakes

- Wood shakes must be laid with a side lap a min. of 1 1/2" between joints in adjacent courses.
- Spacing between shakes in the same course must be 3/8" to 5/8" including tapersawn shakes.
- Weather exposures for wood shakes must not exceed those set in Table R905.8.6.
- Fasteners for untreated (naturally durable) wood shakes must be box nails, see Table R905.7.5(2).
- Nails must be stainless steel Type 304 or Type 316 or hot-dipped with a coating weight of ASTM A 153 Class D (1.0 oz/ft²).
- Alternatively, two 16-gage Type 304 or Type 316 stainless steel staples, with crown widths 7/16" min., 3/4" max., must be used.
- Fasteners installed within 15 miles of salt water coastal areas must be stainless steel Type 316.
- Wood shakes must be attached to the roof with 2 fasteners per shake positioned according to manufacturer's installation instructions.
- Fasteners for fire-retardant-treated shakes or pressure-impregnated-preservative-treated shakes of naturally durable wood in accordance with AWPA U1 must be stainless steel Type 316.
- Fasteners must have a min. penetration into the sheathing of 3/4".
- Where the sheathing is less than 3/4" thick, each fastener must penetrate through the sheathing.
- Fastener packaging must bear a label indicating the appropriate grade material or coating weight.

DECK REQUIREMENTS

(Based on IRC R905.7.1 - R905.7.2 & R905.8.1-R905.8.2)

- Wood shingles and shakes must be installed on solid or spaced sheathing.
- Where spaced sheathing is used, sheathing boards must be a min. of 1" x 4" nominal dimensions and must be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.
 - Additionally, for wood shakes, where 1" x 4" spaced sheathing is installed at 10" on center, additional 1" x 4" boards must be installed between the sheathing boards.
- In areas where the average daily temperature in January is 25°F (-4°C) or less, solid sheathing is required on that portion of the roof requiring the application of an ice barrier.
- Wood shingles and shakes must only be installed on slopes of 3 units vertical in 12 units horizontal (25% slope) or greater.

VALLEY FLASHING (Based on IRC R905.7.6 & R905.8.8)

- Roof flashing must not be less than No. 26 gage [0.019"] corrosion-resistant sheet metal.
 - For shingles: must extend 10" from the centerline each way for roofs having slopes less than 12 units vertical in 12 units horizontal (100% slope) and 7" from the centerline each way for slopes of 12 units vertical in 12 units horizontal and greater.
 - For shakes: must extend not less than 11" from the centerline each way.
- Sections of flashing must have an end lap of not less than 4".

UNDERLAYMENT (Based on IRC R905.7.3 & R905.8.3)

- Underlayment for wood shingles and wood shakes must comply with R905.1.1.
- Ice barriers for wood shingles and wood shakes must comply with 905.1.2.
- For wood shakes: interlayment must comply with ASTM D226, Type I.

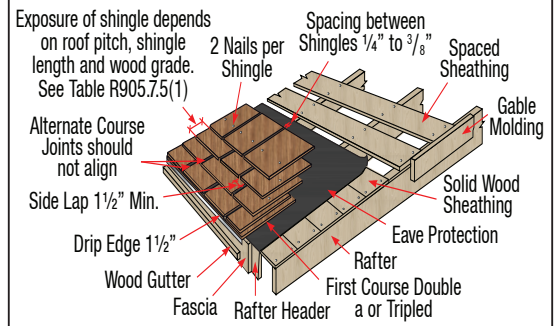
SHAKE PLACEMENT (Based on IRC R905.8.7)

- The starter course at the eaves must be doubled and the bottom layer must be either 15-inch, 18-inch or 24-inch wood shakes or wood shingles.
- 15-inch or 18-inch wood shakes must be permitted to be used for the final course at the ridge.
- Shakes must be interlaid with 18-inch wide strips of not less than No. 30 felt shingled between each course in such a manner that no felt is exposed to the weather by positioning the lower edge of each felt strip above the butt end of the shake it covers a distance equal to twice the weather exposure.

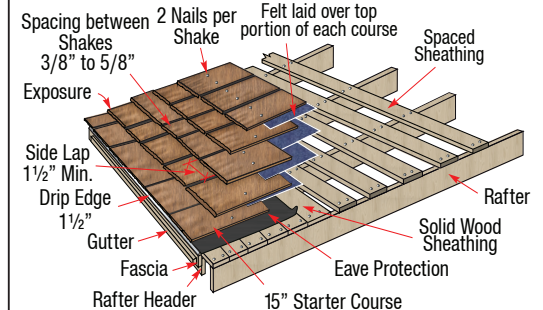
WOOD SHINGLE WEATHER EXPOSURE & ROOF SLOPE (Based on IRC Table R905.7.5(1))

Roofing Material	Length (inches)	Grade	Exposure (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3 3/4	5
		No. 2	3 1/2	4
		No. 3	3	3 1/2
	18	No. 1	4 1/4	5 1/2
		No. 2	4	4 1/2
		No. 3	3 1/2	4
	24	No. 1	5 3/4	7 1/2
		No. 2	5 1/2	6 1/2
		No. 3	5	5 1/2

WOOD SHINGLES ROOFING



WOOD SHAKES ROOFING



NAIL REQUIREMENTS (Based on IRC Table R905.7.5(2))

Shingle	Nail Type & Min. Length	Min. Head Size	Min. Shank Diameter
16" and 18"	3d box 1 1/4"	0.19"	.080"
24"	4d box 1 1/2"	0.19"	.080"
Shakes	Nail Type & Min. Length	Min. Head Size	Min. Shank Diameter
18" straight-split	5d box 1 3/4"	0.19"	.080"
18" and 24" handsplit and resawn	6d box 2"	0.19"	.0915"
24" taper-split	5d box 1 3/4"	0.19"	.080"
18" and 24" tapersawn	6d box 2"	0.19"	.0915"

WOOD SHAKE MATERIAL REQS. (Based on IRC Table R905.8.5)

Material	Min. Grades	Grading Rules
Wood shakes of naturally durable wood	1	Cedar Shake & Shingle Bureau
Tapersawn shakes of naturally durable wood	1 or 2	Cedar Shake & Shingle Bureau
Preservative-treated shakes and shingles of naturally durable wood	1	Cedar Shake & Shingle Bureau
Fire-retardant-treated shakes and shingles of naturally durable wood	1	Cedar Shake & Shingle Bureau

Note: This is an abridged table. For complete table see 2018 IRC.

WOOD SHAKE WEATHER EXPOSURE & ROOF SLOPE (Based on IRC Table R905.8.6)

Roofing Material	Length (inches)	Grade	Exposure (inches)
			4:12 pitch or steeper
Shakes of naturally durable wood	18	No. 1	7 1/2
	24	No. 1	10
Preservative-treated tapersawn shakes of Southern Yellow Pine	18	No. 1	7 1/2
	24	No. 1	10
	18	No. 2	5 1/2
Taper-sawn shakes of naturally durable wood	24	No. 2	7 1/2
	18	No. 1	7 1/2
	24	No. 2	10
	18	No. 2	5 1/2
	24	No. 2	7 1/2

PHOTOVOLTAIC SHINGLES & BIPV ROOF PANELS

PHOTOVOLTAIC SHINGLES (Based on IRC R905.16)

The installation of photovoltaic shingles must comply with this section, Sec. R324 and NFPA 70.

Deck Requirements

- PV shingles must be applied to a solid or closely-fitted deck, except where roof covering is specifically designed to be applied over spaced sheathing.
- PV shingles must be used only on roof slopes of 2 units vertical in 12 units horizontal (2:12) or greater.

Material Standards

- PV shingles must be listed and labeled according with UL 1703.

Attachment

- PV shingles must be attached in accordance with the manufacturer's installation instructions.

Wind Resistance

Photovoltaic shingles:

- must be tested according to ASTM D3161.
- must comply with Table R905.2.4.1 for the appropriate maximum basic wind speed.
- packaging must bear a label indicating compliance with ASTM D3161 and IRC Table R905.2.4.1.

BIPV ROOF PANELS (Based on IRC R905.17)

The installation of Building-integrated Photovoltaic (BIPV) roof panels applied directly to the roof deck must comply with the provisions of this section, Sec. R324 and NFPA 70.

Deck Requirements

- BIPV roof panels must be applied to a solid or closely-fitted deck, except where the roof covering is specifically designed to be applied over spaced sheathing.
- BIPV roof panels must be used only on roof slopes of two units vertical in 12 units horizontal (17% slope) or greater.

Material Standards

- BIPV roof panels must be listed and labeled according with UL 1703.

Attachment

- BIPV roof panels must be attached in accordance with the manufacturer's installation instructions.

Wind Resistance

- BIPV roof panels must be tested according to UL 1897.
- BIPV roof panel packaging must bear a label to indicate compliance with UL 1897.

TERM ALERT!

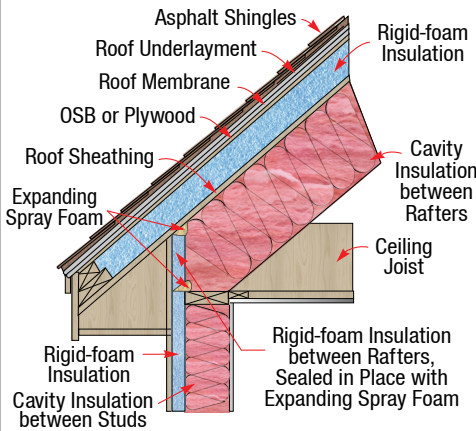
- ✦ **Building-Integrated Photovoltaic Roof Panel (BIPV Roof Panel).** A photovoltaic panel that functions as a component of the building envelope.
- ✦ **Photovoltaic Shingles.** A roof covering that resembles shingles and that incorporates photovoltaic modules.
- ✦ **Photovoltaic Panel System.** A system that incorporates discrete photovoltaic panels that convert solar radiation into electricity, including rack support systems.

UNDERLAYMENT (Based on IRC R905.16.3 & R905.17.3)

- Underlayment must comply with Section R905.1.1.
- Ice barriers must comply with Section R905.1.2.
- Additionally for BIPV: Where there's a history of ice forming along the eaves causing a backup of water (Table R301.2(1)), an ice barrier consisting of a min. of 2 layers of underlayment cemented together or a self-adhering polymer-modified bitumen sheet must be used and must extend from the lowest edges of all roof surfaces to a point not less than 24" inside the exterior wall line of the building.

ROOF INSULATION

ROOFING INSULATION



ROOF INSULATION (Based on IRC R906.1)

The use of above-deck thermal insulation must be permitted provided the following is met:

- insulation is covered with an approved roof covering
- insulation complies with FM 4450 or UL 1256.

MATERIAL STANDARDS FOR ROOF INSULATION (Based on IRC Table R906.2)

Cellular glass board	ASTM C552
Composite boards	ASTM C1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C578
Extruded polystyrene board	ASTM C578
Fiber-reinforced gypsum board	ASTM C1278
Glass-faced gypsum board	ASTM C1177
Mineral wool board	ASTM C726
Perlite board	ASTM C728
Polyisocyanurate board	ASTM C1289, Type I or II
Wood fiberboard	ASTM C208

REROOFING

STRUCTURAL & CONSTRUCTION LOADS (Based on IRC R908.2)

Structural roof components must be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the roof covering system.

ROOF REPLACEMENT (Based on IRC R908.3)

Roof replacement must include the removal of existing layers of roof coverings down to the roof deck.

ROOF RECOVERING (Based on IRC R908.4)

Where application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface must be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

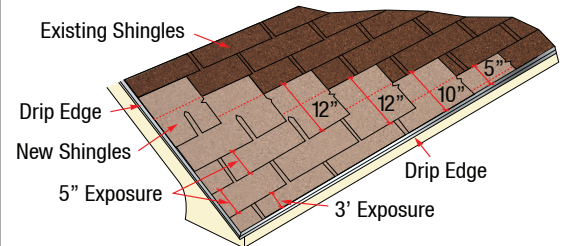
REINSTALLATION OF MATERIALS (Based on IRC R908.5)

- Existing slate, clay or cement tile is permitted for reinstallation, except that damaged, cracked or broken slate or tile must not be reinstalled.
- Any existing flashings, edgings, outlets, vents or similar devices that are part of the assembly must be replaced where rusted, damaged or deteriorated.
- Do not reinstall aggregate surfacing materials.

FLASHINGS (Based on IRC R908.6)

- Flashings must be reconstructed according to approved manufacturer's install. instructions.
- Metal flashing to which bituminous materials are to be adhered must be primed prior to installation.

REROOFING



ROOF RECOVER (Based on IRC R908.3.1)

- Installation of a new roof covering over an existing roof covering is permitted where any of the following occur:
 - Where the new roof covering is installed according with the roof covering manufacturer's instructions
 - Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and do not rely on existing roofs and roof coverings for support, must not require the removal of existing roof coverings.
 - Metal panel, metal shingle and concrete and clay tile roof coverings are permitted to be installed over existing wood shake roofs where applied according to Sec. R908.4.
 - The application of a new protective roof coating over an existing protective roof coating, metal roof panel, metal roof shingle, mineral surfaced roll roofing, built-up roof, modified bitumen roofing, thermoset and thermoplastic single-ply roofing and spray polyurethane foam roofing system is permitted without tear-off of existing roof coverings.
- A roof recover is not permitted:
 - Where existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof covering is not adequate as a base for additional roofing.
 - Where existing roof covering is slate, clay, cement or asbestos-cement tile.
 - Where existing roof has 2 or more roof covering applications.



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