

1503.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall.

[P] 1503.4 Roof drainage. Design and installation of roof drainage systems shall comply with the *International Plumbing Code*.

1503.4.1 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3 as applicable in Section 101.2, private garages and buildings of Type V construction, shall be of noncombustible material or a minimum of Schedule 40 plastic pipe.

1503.5 Roof ventilation. Intake and exhaust vents shall be provided in accordance with Section 1203.2 and the manufacturer's installation instructions.

SECTION 1504 PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

1504.1.1 Wind resistance of asphalt shingles. Asphalt shingles shall be designed for wind speeds in accordance with Section 1507.2.7.

1504.2 Wind resistance of clay and concrete tile. Clay and concrete tile roof coverings shall be connected to the roof deck in accordance with Chapter 16.

1504.3 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for cladding in Chapter 16.

1504.3.1 Other roof systems. Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4450, FM 4470, UL 580 or UL 1897.

1504.3.2 Metal panel roof systems. Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592.

1504.4 Ballasted low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Section 1507 shall be designed in accordance with ANSI/SPRI RP-4.

1504.5 Edge securement for low-slope roofs. Low-slope membrane roof systems metal edge securement, except gutters, installed in accordance with Section 1507, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609.

1504.6 Physical properties. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G 152, ASTM G 155 or ASTM G 154. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not

demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37-G-52M or FM 4470.

SECTION 1505 FIRE CLASSIFICATION

1505.1 General. Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

TABLE 1505.1^{a,b}
MINIMUM ROOF COVERING CLASSIFICATION
FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C ^c	B	C ^c	B	B	C ^c

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

- Unless otherwise required in accordance with the *International Urban Wildland Interface Code* or due to the location of the building within a fire district in accordance with Appendix D.
- Nonclassified roof coverings shall be permitted on buildings of Group R-3, as applicable in Section 101.2, and Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.
- Buildings that are not more than two stories in height and having not more than 6,000 square feet of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles.

1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exception: Class A roof assemblies include those with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or sheets.

1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

Exception: Class B roof assemblies include those with coverings of metal sheets and shingles.

1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

TABLE 1507.2
ASPHALT SHINGLE APPLICATION

COMPONENT	INSTALLATION REQUIREMENT
1. Roof slope	Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (2:12) or greater. For roof slopes from two units vertical in 12 units horizontal (2:12) up to four units vertical in 12 units horizontal (4:12), double underlayment application is required in accordance with Section 1507.2.8.
2. Deck requirement	Asphalt shingles shall be fastened to solidly sheathed roofs.
3. Underlayment	Underlayment shall conform with ASTM D 226, Type 1, or ASTM D 4869, Type 1.
For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12)	Underlayment shall be two layers applied in the following manner: Apply a minimum 19-inch strip or underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 35-inch-wide sheets of underlayment overlapping successive sheets 19 inches and fastened sufficiently to hold in place.
For roof slopes from four units vertical in 12 units horizontal (4:12) or greater	Underlayment shall be one layer applied in the following manner: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches, fastened only as necessary to hold in place.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water	A membrane that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.
4. Application	
Attachment	Asphalt shingles shall have the minimum number of fasteners required by the manufacturer and Section 1504.1. Asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 20 units vertical in 12 units horizontal (20:12), special methods of fastening are required.
Fasteners	Galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gauge (0.105 inch) shank with a minimum 3/8-inch diameter head. Fasteners shall be long enough to penetrate into the sheathing 3/4 inch or through the thickness of the sheathing.
Flashings	In accordance with Section 1507.2.9.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F) - 32]/1.8, 1 mile per hour = 1.609 km/h.

with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap at a maximum spacing of 36 inches (914 mm) on center.

1507.2.8.2 Ice dam membrane. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, a membrane that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.2.9 Flashings. Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer's printed instructions.

1507.2.9.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with the manufacturer's instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness or mineral-surfaced roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m²). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness.

1507.2.9.2 Valleys. Valley linings shall be installed in accordance with the manufacturer's instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys (valley lining exposed/lined with metal, the valley lining shall be at least 16 inches (406 mm) wide and of any of the corrosion-resistant metals in Table 1507.2.9.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing shall be permitted. The

bottom layer shall be 18 inches (457 mm) and the top layer a minimum of 36 inches (914 mm) wide.

3. For closed valleys (valleys covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 224 and at least 36 inches (914 mm) wide or types as described in Items 1 and 2 above shall be permitted. Specialty underlayment shall comply with ASTM D 1970.

TABLE 1507.2.9.2
VALLEY LINING MATERIAL

MATERIAL	MINIMUM THICKNESS	GAGE	WEIGHT
Copper	—	—	16 oz
Aluminum	0.024 in.	—	—
Stainless steel	—	28	—
Galvanized steel	0.0179 in.	26 (zinc-coated G90)	—
Zinc alloy	0.027 in.	—	—
Lead	—	—	2.5 pounds
Painted terne	—	—	20 pounds

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg, 1 ounce = 28.35 g.

1507.2.9.3 Drip edge. Provide drip edge at eaves and gables of shingle roofs. Overlay to be a minimum of 2 inches (51 mm). Eave drip edges shall extend 0.25 inch (6.4 mm) below sheathing and extend back on the roof a minimum of 2 inches (51 mm). Drip edges shall be mechanically fastened a maximum of 12 inches (305 mm) o.c. A cricket or saddle shall be installed on the ridge side of any chimney greater than 30 inches (762 mm) wide. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

1507.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

1507.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing or spaced structural sheathing boards.

1507.3.2 Deck slope. Clay and concrete roof tile shall be installed on roof slopes of $2\frac{1}{2}$ units vertical in 12 units horizontal (21-percent slope) or greater. For roof slopes from $2\frac{1}{2}$ units vertical in 12 units horizontal (21-percent slope) to four units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.3.3.

1507.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to: ASTM D 226, Type II; ASTM D 2626 or ASTM D 249 Type I mineral-surfaced roll roofing.

1507.3.3.1 Low-slope roofs. For roof slopes from $2\frac{1}{2}$ units vertical in 12 units horizontal (21-percent slope), up to four units vertical in 12 units horizontal (33-percent

slope), underlayment shall be a minimum of two layers applied as follows:

1. Starting at the eave, a 19-inch (483 mm) strip of underlayment shall be applied parallel with the eave and fastened sufficiently in place.
2. Starting at the eave, 36-inch-wide (914 mm) strips of underlayment felt shall be applied overlapping successive sheets 19 inches (483 mm) and fastened sufficiently in place.

1507.3.3.2 High-slope roofs. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to, and starting from the eaves and lapped 2 inches (51 mm), fastened only as necessary to hold in place.

1507.3.4 Clay tile. Clay roof tile shall comply with ASTM C 1167.

1507.3.5 Concrete tile. Concrete roof tiles shall be in accordance with the physical test requirements as follows:

1. The transverse strength of tiles shall be determined according to Section 6.3 of ASTM C 1167 and in accordance with Table 1507.3.5.
2. The absorption of concrete roof tiles shall be according to Section 7 of ASTM C 140. Roof tiles shall absorb not more than 15 percent of the dry weight of the tile during a 24-hour immersion test.
3. Roof tiles shall be tested for freeze-thaw resistance according to Section 8 of ASTM C 67. Roof tiles shall show no breakage and not have more than 1 percent loss in dry weight of any individual concrete roof tile.

TABLE 1507.3.5
TRANSVERSE BREAKING STRENGTH
OF CONCRETE ROOF TILE (lbs.)

TILE PROFILE	DRY	
	Average of five tiles	Individual tile
High profile	400	350
Medium profile	300	250
Flat profile	300	250

For SI: 1 pound = 4.45 N.

1507.3.6 Fasteners. Tile fasteners shall be corrosion resistant and not less than 1/16-inch (8.0 mm) head, and of sufficient length to penetrate the deck a minimum of 0.75 inch (19.1 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914 mm) from either side of hips or ridges and edges of eaves and gable rakes.

1507.3.7 Attachment. Clay and concrete roof tiles shall be fastened in accordance with Table 1507.3.7.

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

TABLE 1507.3.7
CLAY AND CONCRETE TILE ATTACHMENT^{a, b, c}

GENERAL — CLAY OR CONCRETE ROOF TILE				
Maximum basic wind speed (mph)	Mean roof height (feet)	Roof slope up to < 3:12	Roof slope 3:12 and over	
85	0-60	One fastener per tile. Flat tile without vertical laps, two fasteners per tile.	Two fasteners per tile. Only one fastener on slopes of 7:12 and less for tiles with installed weight exceeding 7.5 lbs./sq. ft. having a width no greater than 16 inches.	
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.7.2.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS ^{d, e} (Installations on spaced/solid sheathing with battens or spaced sheathing)				
Maximum basic wind speed (mph)	Mean roof height (feet)	Roof slope up to < 5:12	Roof slope 5:12 < 12:12	Roof slope 12:12 and over
85	0-60	Fasteners are not required. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener per tile every other row. All perimeter tiles require one fastener. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener required for every tile. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.7.2.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS (Installations on solid sheathing without battens)				
Maximum basic wind speed (mph)	Mean roof height (feet)	All roof slopes		
85	0-60	One fastener per tile.		
100	0-40	One fastener per tile.		
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.7.2.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.7.2.		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0478 kN/m².

- Minimum fastener size. Corrosion-resistant nails not less than No. 11 gage with $\frac{3}{16}$ -inch head. Fasteners shall be long enough to penetrate into the sheathing 0.75 inch or through the thickness of the sheathing, whichever is less. Attaching wire for clay and concrete tile shall not be smaller than 0.083 inch.
- Snow areas. A minimum of two fasteners per tile are required or battens and one fastener.
- Roof slopes greater than 24:12. The nose of all tiles shall be securely fastened.
- Horizontal battens. Battens shall be not less than 1 inch by 2 inch nominal. Provisions shall be made for drainage by a minimum of $\frac{1}{8}$ -inch riser at each nail or by 4-foot-long battens with at least a 0.5-inch separation between battens. Horizontal battens are required for slopes over 7:12.
- Perimeter fastening areas include three tile courses but not less than 36 inches from either side of hips or ridges and edges of eaves and gable rakes.

1507.3.8 Application. Tile shall be applied according to the manufacturer's installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

1507.3.9 Flashing. At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 36 galvanized sheet gage) corrosion-resistant. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) 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 or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or of self-adhering polymer modified bitumen sheet.

1507.4 Metal roof panels. The installation of metal roof panels shall comply with the provisions of this section.

1507.4.1 Deck requirements. Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

1507.4.2 Deck slope. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25-percent slope). The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be one-half vertical unit in 12 units horizontal (4-percent slope). The minimum slope for standing seam roof systems shall be one-quarter unit vertical in 12 units horizontal (2-percent slope).

1507.4.3 Material standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3.

1507.4.4 Attachment. Metal roofing fastened directly to steel framing shall be attached by approved manufacturers' fasteners. In the absence of manufacturer recommendations, any of the following fasteners shall be used:

1. Galvanized fasteners shall be used for galvanized roofs.
2. 300 series stainless-steel fasteners shall be used for copper roofs.

3. Stainless steel fasteners are acceptable for all types of metal roofs.

**TABLE 1507.4.3
METAL ROOF COVERINGS**

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A 653 G-90 zinc-coated, 0.013-inch-thick minimum
Lead-coated copper	ASTM B 101
Hard lead	2 lbs./sq. ft.
Soft lead	3 lbs./sq. ft.
Prepainted steel	ASTM A 755
Terne (tin) and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.

For SI: 1 ounce per square foot = 0.0026 kg/m²,
1 pound per square foot = 4.882 kg/m²,
1 inch = 25.4 mm, 1 pound = 0.454 kg.

1507.5 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

1507.5.1 Deck requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

1507.5.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

1507.5.3 Underlayment. Underlayment shall conform to ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.5.4 Material standards. Metal roof shingle roof covering shall comply with Table 1507.4.3.

1507.5.5 Attachment. Metal roof shingles shall be secured to the roof in accordance with the approved manufacturer's installation instructions.

1507.5.6 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3. The valley flashing shall extend at least 8 inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than 0.75 inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it consisting of one layer of underlayment running the full length of the valley, in addition to underlayment required for metal roof shingles. The metal valley flashing underlayment shall be solid cemented to the roofing underlayment for roof slopes under seven units vertical in 12 units horizontal (58-percent slope) or of self-adhering polymer-modified bitumen sheet.

1507.6 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

1507.6.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

1507.6.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

1507.6.3 Underlayment. Underlayment shall conform to ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.6.4 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D 226, ASTM D 229, ASTM D 371 or ASTM D 3909.

1507.7 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

1507.7.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type II. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.7.4 Material standards. Slate shingles shall comply with ASTM C 406.

1507.7.5 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.5. Slate shingles shall be secured to the roof with two fasteners per slate.

**TABLE 1507.7.5
SLATE SHINGLE HEADLAP**

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope ≥ 20:12	2

For SI: 1 inch = 25.4 mm

1507.7.6 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be a minimum of 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc-coated G90. Chimneys, stacks or brick walls shall have a minimum of two plies of felt for a cap flashing consisting of a 4-inch-wide (102 mm) strip of felt set in plastic cement and extending 1 inch (25 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing 2 inches (51 mm).

1507.8 Wood shingles. The installation of wood shingles shall comply with the provisions of this section and Table 1507.8.

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1 inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

1507.8.1.1 Solid sheathing required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.8.2 Deck slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25-percent slope) or greater.

1507.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

TABLE 1507.8
WOOD SHINGLE AND SHAKE INSTALLATION

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (3:12) or greater.	Wood shakes shall be installed on slopes of four units vertical in 12 units horizontal (4:12) or greater.
2. Deck requirement	—	—
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1" x 4" nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1" x 4" nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners. When 1" x 4" spaced sheathing is installed at 10 inches, boards must be installed between the sheathing boards.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water.	Solid sheathing required.	Solid sheathing is required.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D 226, Type 1.
4. Underlayment	—	—
Temperate climate	Underlayment shall comply with ASTM D 226, Type 1.	Underlayment shall comply with ASTM D 226, Type 1.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water.	An ice shield that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.	An ice shield that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.
5. Application	—	—
Attachment	Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.6	Weather exposures shall not exceed those set forth in Table 1507.9.7
Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses; and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and tapered shakes of naturally durable wood and shall be 0.25 to 0.375 inch for preservative-treated shakes.
Flashing	In accordance with Section 1507.8.7.	In accordance with Section 1507.9.8.

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

1507.8.4 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.4.

**TABLE 1507.8.4
WOOD SHINGLE MATERIAL REQUIREMENTS**

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB = Cedar Shake and Shingle Bureau

1507.8.5 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with a minimum of two fasteners.

1507.8.6 Application. Wood shingles shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be 0.25 to 0.375 inches (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.6.

**TABLE 1507.8.6
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE**

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	3.75	5
		No. 2	3.5	4
		No. 3	3	3.5
	18	No. 1	4.25	5.5
		No. 2	4	4.5
		No. 3	3.5	4
	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

For SI: 1 inch = 25.4 mm.

1507.8.7 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) 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 or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope).

1507.9 Wood shakes. The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed a 10 inches (254 mm) o.c., additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

1507.9.1.1 Solid sheathing required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.9.2 Deck slope. Wood shakes shall only be used on slopes of four units vertical in 12 units horizontal (33-percent slope) or greater.

1507.9.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer-modified bitumen sheet shall extend from the edge of the eave to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.9.4 Interlayment. Interlayment shall comply with ASTM D 226, Type I.

1507.9.5 Material standards. Wood shakes shall comply with the requirements of Table 1507.9.5.

**TABLE 1507.9.5
WOOD SHAKE MATERIAL REQUIREMENTS**

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern yellow pine treated in accordance with AWPA Standard C2	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.

TFS = Forest Products Laboratory of the Texas Forest Services.

1507.9.6 Attachment. Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend

through the sheathing. Each shake shall be attached with a minimum of two fasteners.

1507.9.7 Application. Wood shakes shall be laid with a side lap not less than 1 inch (25.4 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 0.375 to 0.625 inches (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.75 inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.7.

**TABLE 1507.9.7
WOOD SHAKE WEATHER EXPOSURE
AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10a
Preservative-treated taper sawn shakes of Southern yellow pine	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5

For SI: 1 inch = 25.4 mm.

a. For 24-inch by 0.375-inch handsplit shakes, the maximum exposure is 7.5 inches.

1507.9.8 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of 3 units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) 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 or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope).

1507.10 Built-up roofs. The installation of built-up roofs shall comply with the provisions of this section.

1507.10.1 Slope. Built-up roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage, except for coal-tar built-up roofs that shall have a design slope of a minimum one-eighth unit vertical in 12 units horizontal (1-percent slope).

1507.10.2 Material standards. Built-up roof covering materials shall comply with the standards in Table 1507.10.2.

1507.11 Modified bitumen roofing. The installation of modified bitumen roofing shall comply with the provisions of this section.

**TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS**

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D 1227; D 2823; D 4479
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal-tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar pitch used in roofing	ASTM D 450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D 43
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665, D 5726

1507.11.1 Slope. Modified bitumen membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.11.2 Material standards. Modified bitumen roof covering shall comply with CGSB 37-GP-56M, ASTM D 6162, ASTM D 6163, ASTM D 6164, ASTM D 6222, ASTM D 6223 and ASTM D 6298.

1507.12 Thermoset single-ply roofing. The installation of thermoset single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope. Thermoset single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.12.2 Material standards. Thermoset single-ply roof coverings shall comply with RMA RP-1, RP-2 or RP-3, or ASTM D 4637, ASTM D 5019 or CGSB 37-GP-62M.