General Installation Guidelines for Natural Quarried Roofing Slate

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Slate Roofing Contractors Association of North America, Inc.

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INTRODUCTION

These Installation Guidelines have been developed and produced for the general public by professional slate roofing contractor members of the Slate Roofing Contractors Association of North America, Inc., a 501c6 non-profit international trade association, via a peer-reviewed, consensus-based committee process taking place over an extended period of time. These Installation Guidelines, if followed, are designed to produce a long-lasting, weathertight slate roof for most basic applications. Refer to the SRCA Section 07310 “Slate Shingles” for architectural specifications.

PART 1 — GENERAL PROJECT PREPARATION AND EXECUTION

1.1. CONTRACTORS

A. It is recommended that prospective contractors have foremen or supervisors who have a minimum of five years of professional experience in installing natural quarried slate roofing and who can provide a resume listing successful completion of slate roof installations of similar size and scope.

B. Contractors shall furnish all insurance, permits, labor, materials, equipment, apparatus, tools, transportation and services necessary for, and incidental to, the proper installation and completion of the slate roof. This work may include removing and properly disposing off-site of existing slate roofing or other shingles, if any; installing underlayment; installing new sheet metal flashings and installing new or salvaged roofing slate to cover the entire existing slate roof area, leaving a very long term, damage resistant, weatherproof roof.

C. Contractors shall use workmen who are trained and experienced in laying slate, installing metal flashing, and all other skills needed to satisfactorily complete the project as specified, or use workmen who are under the full-time supervision of a foreman or supervisor with such training and experience.

D. Contractors shall use workmen familiar with the use of slate hammers for punching and nailing slate shingles, slate rippers for removing slates already installed, slate cutters for trimming and cutting slate shingles, slater’s stakes used with slate hammers that have a cutting shank, roof brackets and scaffolding for staging the roof, and hook ladders for accessing areas of the roof not staged.

1.2. CONTRACT DOCUMENTS

A. Contractors will provide contract documents that include detailed specifications for all materials and installation styles, including, but not limited to slate types, thicknesses, colors, and origins; nail types and lengths; underlayment types and weights; headlaps; ridge style; valley style; flashing materials, including weights, types and sizes of metals.

B. Contract documents shall also include a detailed warranty (see Section 1.8). It is recommended that this SRCA General Roofing Installation Guidelines for Natural Quarried Slate document be attached to the contract as an addendum.

1.3. MATERIALS DELIVERY AND STORAGE

A. Slate roofing shingles shall be delivered on manufacturers' skids with intact labels indicating source whenever possible.

B. Rolled underlayment shall be stored on end and manufacturers' recommendations for job-site storage and protection shall be followed.

C. Materials shall not be stored on existing fire escapes, in areas that may obstruct the ingress or egress of essential doorways or walkways, or on low-slope roofs or other roof slopes where the weight of the materials may damage the roof structure.

1.4 CODES AND REGULATIONS

A. Contractor shall comply with all federal, state, local and contractual regulations regarding specific installations, and abide by applicable building, safety and health codes related to construction practices or use of equipment.

B. Contractor shall comply with the regulations of local governing Historical Societies and the National Registry of Historic Properties, when applicable.

1.5 PROTECTION OF ROOF SURFACES

A. Workers shall not damage slates by walking on them.

B. The roof shall be properly staged to allow safe work surfaces, such as with roof brackets and scaffold-grade planks, that prevent unnecessary foot traffic on the slates.

C. Where foot traffic is unavoidable, roof ladders, hook ladders, chicken ladders, foam pads or other such devices should be used to protect the slates.

1.6 INSURANCE

A. Contractor shall carry Liability Insurance and Workers Compensation Insurance according to state requirements.

B. Contractor will provide, upon request, Certificates of Insurance to Owner prior to the execution of any work.

1.7 CLEAN UP

A. Tools, equipment, surplus materials, slate scraps, and debris resulting from the slate roof installation shall be organized and cleaned up, or removed and properly disposed of, on a daily basis.

B. Gutters and roof areas will be cleaned of debris at the end of each workday and upon completion of the work.

C. Dust and dirt may infiltrate into the attic space during installation or removal of roofing slate. Owner shall be advised to remove any valuable items from the attic space and/or to cover such items with plastic, tarps, or other suitable covering prior to the commencement of any work.

1.8 WARRANTY

A. Contractor shall warrant a new slate roof installation, covering both material and labor for defects that may occur, for a minimum period of five years.

B. Owner shall visually inspect the Work on an annual basis and report to the contractor any observed defects that are covered by the warranty.

C. The contractor cannot be held responsible for damage caused by other persons or by unusual and damaging weather events such as large hail, strong winds, lightning, flooding, earthquakes, excessive snow and ice buildup, or other “acts of God.”

D. Contractor's warranty terms shall be clearly detailed in the contract documents.

E. An extended service maintenance agreement is recommended beyond the warranty period.

1.9 EXTRA MATERIAL

A. Contractor shall provide for the Owner two percent of field slates used in the Work as maintenance stock for future repairs.

B. The maintenance stock is to be placed in storage in a location at the work site to be determined by the Owner.

PART 2 — ROOFING SLATE

2.1 PROCUREMENT

A. Procure new roofing slates from known sources so that additional matching supplies can be obtained if needed. A single quarry source is recommended.

B. Slates shall be supplied by manufacturers that are experienced in the production of roofing slates and that quarry or mine high-quality rock specifically selected for roofing grade applications. Provide manufacturer's warranty in writing. Substitution of slates with slates from other sources shall not be permitted without written approval from the Owner or architect.

C. Slates shall be identified and labeled according to the quarry source and location. For example, foreign slates shall not be misrepresented as domestic slates.

D. When ordering field slates, whenever possible, also procure the starter slates from the same manufacturer, punched for nail holes to allow the starter slates to be laid back side out. The starter slates should be the same width as the field slates (when uniform width slates are used), and long enough to allow for a minimum headlap of three inches on the starter course.

E. Refer to http://slateroofers.org/sources_new_slate.html for sources of new roofing slate.

2.2 QUALITY CONTROL

A. Slates shall conform to ASTM C 406 and shall be Grade S1 (minimum 575 lbf breaking load[1], maximum 0.25% absorption[2], and maximum 0.002 inches depth of softening[3]).

[[1]ASTM C120, Test Methods of Flexure Testing of Slate (Breaking Load, Modulus of Rupture, Modulus of Elasticity); [2]ASTM C 121, Test Method for Water Absorption of Slate; [3]ASTM C 217, Test Method for Weather Resistance of Slate]

B. All slates shall be hard, dense, sound rock of natural cleft with chamfered (beveled) edges. No broken or cracked slate shall be used, although broken slates may be cut into smaller, unbroken pieces.

C. Slates up to 3/8" in thickness shall be punched for nail holes; slates over 3/8" in thickness may be drilled and countersunk, for a minimum of two nail holes each. The holes punched in the slates shall be the correct diameter to provide a snug fit for the shank of the roofing nails. Slates shall be punched back to front (except starter slates, which are punched front to back). Slates shall be punched on the thinner end if there is a variation in the thickness along the length of the slate.

D. Rectangular slates with broken corners on the exposed end shall be rejected if a corner is broken off greater than 1.5 inches in either direction, although such slates may be used for cutting into smaller pieces.

E. Curvature of slates shall not exceed 1/8 inch over a distance of 12 inches. Curved slates shall be trimmed and punched to permit them to be laid with the convex side facing up.

F. Defects in slates such as "knuckles," "knots," "knurls" and "cramps" which protrude above the surface of the slates shall be positioned such that they remain on the exposed top surface of the slate after installation. Knots, knurls and cramps shall not be permitted on the back or covered

portions of the slates unless removed by grinding beforehand. A slate shall be rejected if a surface defect adversely affects the proper laying of the slate.

G. Slates shall be free of pyrite inclusions that can visibly leach rust stains onto the roof.

H. Slates shall not have carbon-bearing bands known as “ribbons” as these are considered defects that undermine the longevity of the slate.

I. Nail holes are to be positioned no more than 1.5” in from the side edges of the slate. Nail holes must be positioned approximately 2/3 the distance from the bottom of the slate when using standard 3” headlap. The top of the underlying slate shall not be penetrated by the slating nails.

2.3 INSTALLATION STYLES

A. Slate installation styles may include, but are not limited to:

1. A “standard” pattern where all the slates are the same length and width, although these can include slates of differing colors and shapes;

2. A “random width” style where the slates are the same length, but differing widths;

3. A “textural” style where thicknesses, textures, colors, lengths, widths and types of slate may be blended for architectural effect;

4. A “graduated” style where thicker or longer slates are installed near the eaves and the slates gradually decrease in size as they near the top of the roof;

5. A “staggered butt” style where slates of varying lengths are installed in such a manner that the exposed butts are staggered.

B. When mixed, graduated, or textural slate styles are to be installed, or slates with mixed colors, sizes, types and/or thicknesses, the quantities of the various sizes and types of slates and the layout patterns of the slates are to be clearly specified in the contract documents.

C. If necessary, build mockups to demonstrate aesthetic effects and to set quality standards.

1. Use materials specified for the project in the mockup.

2. Retain mockup for duration of the project.

3. Approved mockups may become part of the completed work.

PART 3 — GENERAL MATERIALS

3.1 ROOFING UNDERLAYMENT

A. Cover surfaces to be slated with roofing underlayment to weather in the building, when needed.

B. Roofing underlayment shall, at a minimum, comply with ASTM D 226 asphalt-saturated organic felt, Type II, No. 30, unperforated.

C. Felt shall be installed horizontally with sections overlapped toward eaves or drains by a minimum of two inches and at ends by a minimum of six inches. The felt shall overlap hips and ridges by approximately 12 inches. All felt shall be preserved unbroken, tight, and whole.

D. Felt shall be secured with minimum 1” electro-galvanized roofing nails along laps, ends, and in the field as necessary to properly hold the felt in place and to protect the building from water infiltration until covered with slate.

E. The maximum length of exposure for felts prior to slating shall be one month. When the felt must be left for long periods before the slates can be installed, the exposed nail heads are to be skimmed over with a thin layer of trowel grade roof mastic to prevent leakage around the nail heads.

F. When self-adhesive underlayment is used along eaves or elsewhere, it shall be covered with felt.

G. On slopes from 4:12 to 12:12, a half-lapped double layer of No. 30 felt is recommended when the felt is not going to be slated over immediately. Slopes over 12:12 may use a single layer of felt as may any slope that is to be slated within a few days.

H. Additional underlayment may also be used in ice-dam prone areas, such as Type II felt installed on top of the existing felt, with a layer of trowel-grade roof mastic spread evenly underneath the additional felt layer.

3.2 NAILS

A. Nails shall be solid copper, smooth-shank roofing nails, minimum 11 gauge, minimum 1.25” length. Copper nails 2.5” or longer shall be minimum 10 gauge. Alternatively, Type 304 smooth-shank stainless steel roofing nails can be used, not less than 1.25” long.

B. Hot-dipped galvanized smooth-shank roofing nails may be utilized when specified.

C. Nail length is to be approximately twice the thickness of the slates plus one inch. Nails are to fully embed into the roof decking material without more than 1/4” nail length being exposed on the underside of the roof decking. When the underside of the roof decking is exposed, such as at

overhanging eaves, the nails shall be long enough to penetrate the roof decking, but not so long that they may be visibly driven through.

D. Recommended nail lengths are as follows when 1” or thicker roof deck is utilized:

1. 3/16"-1/4" thick slates are to be fastened with 1.5" nails.

2. 3/8” thick slates are to be fastened with 1.75" nails.

3. 1/2" thick slates are to be fastened with 2" nails.

4. 3/4" thick slates are to be fastened with 2.5" nails.

5. 1" thick slates are to be fastened with 3" nails.

3.3 FLASHING

A. Flashing shall be minimum 16-ounce copper conforming to ASTM B 370, minimum 28-gauge stainless steel, or minimum 4 lb. sheet lead. Twenty-ounce copper flashing is recommended.

B. Flashing shall be installed where there are roof plane intersections, where the roof abuts walls, parapets, dormers and chimneys, or where there are roof penetrations.

C. All flashings and fasteners are to be galvanically compatible metals.

D. Additional flashing guidelines are available from SMACNA’s “Architectural Sheet Metal Manual” and the publication “Copper and Common Sense” by Revere Copper Products.

3.4 MASTIC

A. Roof mastic shall be non-asbestos fibered asphalt cement complying with ASTM D 4586.

B. Roof mastic shall be designed for trowel application.

3.5 SLATE HOOKS

A. Slate hooks shall be a minimum three inches long, solid copper or stainless steel.

B. Standard slate hooks are for use with slates of commercial standard thickness only. Custom slate hooks may be fabricated for use with thicker slates.

3.6 CANTS

A. Wood cants for installing underneath the starter course of slate shingles shall be minimum 1/4 inch by 1-inch lath or other solid, glue-free wood. Alternatively, minimum 16-ounce copper or 28-gauge stainless steel edging with a built-in cant may be used.

B. When installing standard thickness slates (3/16” to 1/4” thick) the cant should be approximately 1/4” to 3/8”. Thicker slates will require a thicker cant.

3.7 ROOF DECKING

A. The roof deck shall be a minimum of 3/4” thick wood. Solid, glue-free wood is recommended.

B. Nailable concrete and gypsum concrete may also be suitable roof decking materials.

C. Minimum 3/4” glue-free slating lath or skip sheathing can be spaced on rafters as a nailing substrate.

D. Minimum 3/4” glue-free boards, slating lath or skip sheathing can be installed over glued or laminated roof decks to provide a suitable nailing substrate.

E. Surfaces to which the roof slates are to be applied shall be in a suitable condition or shall be repaired to a condition satisfactory for slating. All surfaces to be slated shall be swept clean of any debris.

PART 4 — SLATE EXECUTION

4.1 FASTENERS

A. All standard slates shall be fastened with minimum two roofing nails fastened above the head of the underlying slate and as far from the center of the slate as is practical.

B. Larger, heavier slates may need four nails per slate.

C. Screws shall not be used when fastening slates.

D. Slates overlapping sheet metal shall have the nails placed so as to not puncture the metal.

E. Exposed nail heads are not permissible except where unavoidable. Any exposed nail heads shall be sealed with gaskets or approved sealants. The application of slate dust to cover exposed sealants is recommended.

F. Nails shall not be driven in so far as to produce an excessive strain on the slates and shall instead be driven to a depth such that the nail heads lie within the counter-sunk nail hole and do not rub excessively against the overlying slates.

G. Use of pneumatic or electric nail guns to install slate shingles shall not be permitted.

H. Slates shall not be bedded in roof mastic or other adhesives except where absolutely necessary such as at exposed edges in high-wind areas.

I. Ridges and hips shall be installed without exposed fasteners.

J. If a slating nail is installed in a crack or hole in the sheathing, it shall be renailed properly.

4.2 HEADLAP

A. All standard field slates shall be installed with a minimum 3" head lap when the roof slope is 8:12 up to 20:12.

B. Less than an 8:12 slope down to 4:12, the slates shall be installed with a minimum 4” headlap.

C. Installing roofing slates on slopes less than 4:12 is not recommended.

D. On slopes 20:12 or greater, slates may be installed with a 2” headlap.

E. Headlaps may be increased at ice-dam prone or poor drainage areas.

4.3 EAVES SLATES, EDGE SLATES AND STARTER COURSES

A. Eave slates shall be laid to provide a minimum 1.5" projection beyond the furthest extent of the fascia, cornice, crown molding, metal drip edge, trim, or other construction material at the eaves.

B. Rake edge (gable end) slates shall extend 1” beyond the furthest extent of the gable trim, fascia or edge.

C. Slates at the eaves shall be doubled by first installing a slate starter or under-eave course installed back side up (chamfered side down). The first course of slate shall be laid over the starter course so that the drip edges of both courses align flush. The first course of slates shall break side-butt joints with the starter course side-butt joints by not less than 3”. The second course of slates must overlap the starter course by a minimum of 3” and not less than the general headlap of the field slates along the eaves [see Figure 1].

D. The starter course of slates is to be canted to allow the starter slates to be tilted to the same angle as the field slates.

4.4 SLATE INSTALLATION

A. Slate shall be installed starting at the bottom or eaves and proceeding toward the ridge or top.

B. All slates will be installed following chalk lines marking the top edge of each course of slates, whenever possible.

C. When supplied on pallets, slates are not to be used from one pallet at a time but are to be used from all pallets simultaneously in order to blend the various pallets uniformly on the roof.

D. Slate side-butt joints shall be positioned as near the mid-point of the underlying slates as possible, and not less than 3" from the underlying side-butts. Each slate course shall break butt-joints laterally by a minimum of 3”, if possible, with the underlying or overlying courses.

E. When installed, slates shall be laid side-to-side with a maximum 1/8” gap between slates, on average, unless otherwise specified.

F. Slate will be neatly fitted around any pipes, ventilators, and other roof penetrations.

G. Slates are to be cut from the back side in order to preserve the chamfered edge on the front exposed surface. Use of grinders, saws, or other mechanical means to cut and trim roofing slates shall not be permitted unless the slates maintain a chamfered appearance along the exposed sawn edges. At the apex of slated hips and ridges, and at the juncture of a closed valley, the chamfered edge may, as an option, be reversed to create a tighter fitting joint.

H. Slates along valleys shall be cut in neat and straight lines. Valley slates are to be cut on the back side of the slate to maintain a chamfered slate edge when along an open valley.

I. Contractor shall visually and manually inspect the slates when roof brackets are removed to make sure no slates were broken by the roof scaffolding. Upon completion, all slate shall be sound, unbroken, un-cracked, whole and clean, showing no exposed roof cement.

J. Individual slates that must be installed in the field of the roof after the installation is complete, such as where a roof bracket had been removed or where a repair has been made, shall be installed using stainless steel or copper slate hooks or the “nail and hidden bib” installation method where standard nailing is not possible. The top of bib flashings shall extend to the top of the head of the underlying slate.

K. Contractors shall keep the building weatherproof and make every reasonable attempt to complete the project on schedule. Work is to be scheduled when weather conditions allow the work to be performed according to manufacturer’s recommendations and in compliance with warranty requirements.

L. Temporary roof coverings, tarps, or other materials shall remain available onsite in the event that the work must be ceased suddenly due to weather conditions and the roof needs to be weathered in until such time as the work may be continued.

PART 6 — REFERENCE INFORMATION

6.1 ASTM REFERENCES

ASTM A167 — Type 304 Terne coated stainless steel, 0.015-inch (0.38 mm) thick stainless steel core material, coated with 0.092 lb./sq ft (450 g/sq m) Terne alloy on both sides

ASTM A666 — Type 304 stainless steel, soft annealed 2D finish (unless harder temper is required for forming or performance), 0.0156 inch (0.4 mm) thick

ASTM B101 — Specification for Lead-Coated Copper Sheet and Strip for Building Construction

ASTM B370 — Specification for Copper Sheet and Strip for Building Construction

ASTM B749 — Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products

ASTM C406 — Specification for Roofing Slate

ASTM C920 — Specification for Elastomeric Joint Sealants

ASTM C1311 — Specification for Solvent Release Sealants

ASTM D312 — Specification for Asphalt Used in Roofing

ASTM D1079 — Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials

ASTM D1970 — Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

ASTM D2626 — Specification for Asphalt-Saturated and Coated Organic Felt Base Roofing Sheet

ASTM D2822 Specification for Asphalt Roof Cement, Asbestos-Containing

ASTM D3019 — Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos, Fibered, and Non Asbestos Fibered

ASTM D4022 — Specification for Coal Tar Roof Cement, Asbestos Containing

ASTM D4586 — Specification for Asphalt Roof Cement, Asbestos-Free.

ASTM D4869 — Specification for Asphalt-Saturated Organic Felt Underlayment for Steep Slope Roofing.

ASTM F1667 — Specification Standard for Driven Fasteners

6.2 SLATE GRADES

A. ASTM C 406 Grade S1: Expected service life in excess of 75 years.

B. ASTM C 406 Grade S2: Expected service life 40-75 years.

C. ASTM C 406 Grade S3: Expected service life 20-40 years.

6.3 SLATE THICKNESSES, SIZES AND COLORS

A. Thicknesses

1. Standards; Nominal 3/16 inch (5 mm) to 1/4 inch (7 mm)

2. Quarters; Nominal 1/4 inch (7 mm) to 3/8 inch (10 mm)

3. Heavies; Nominal 3/8 inch (10 mm) to 1/2 inch (13 mm)

4. Extra Heavies; Nominal 1/2 inch (13 mm) to 3/4 inch (19 mm)

B. Standard Slate Sizes

1. 24”L X 14”W (610 mm X 356mm)

2. 24”L X 12”W (610 mm X 305 mm)

3. 22”L X 12”W (559 mm X 305 mm)

4. 22”L X 11”W (559 mm X 279 mm)

5. 20”L X 14”W (508 mm X 356 mm)

6. 20”L X 12”W (508 mm X 305 mm)

7. 20”L X 11”W (508 mm X 279 mm)

8. 20”L X 10”W (508 mm X 254 mm)

9. 18”L X 14”W (457 mm X 356 mm)

10. 18”L X 12”W (457 mm X 305 mm)

11. 18”L X 11”W (457 mm X 279 mm)

12. 18”L X 10”W (457 mm X 254 mm)

13. 18”L X 9”W (457 mm X 229 mm)

14. 16”L X 14”W (406 mm X 356 mm)

15. 16”L X 12”W (406 mm X 305 mm)

16. 16”L X 11”W (406 mm X 279 mm)

17. 16”L X 10”W (406 mm X 254 mm)

18. 16”L X 9”W (406 mm X 229 mm)

19. 16”L X 8”W (406 mm X 203 mm)

20. 14”L X 10” W (356 mm X 254 mm)

21. 14”L X 9”W (356 mm X 229 mm)

22. 14”L X 8”W (356 mm X 203 mm)

23. 14”L X 7”W (356 mm X 178 mm)

24. 12”L X 10”W (305 mm X 254 mm)

25. 12”L X 9”W (305 mm X 229 mm)

26. 12”L X 8”W (305 mm X 203 mm)

27. 12”L X 7”W (305 mm X 178 mm)

28. 12”L X 6”W (305 mm X 152 mm)

C. North American Roofing Slate Colors

1. Unfading Black

2. Semi-Weathering Gray/Black

3. Unfading Gray

4. Semi-Weathering Gray

5. Unfading Purple

6. Semi-Weathering Purple

7. Unfading Mottled Green and Purple

8. Unfading Green

9. Semi-Weathering Green (Sea Green, Gray/Green)

10. Unfading Red

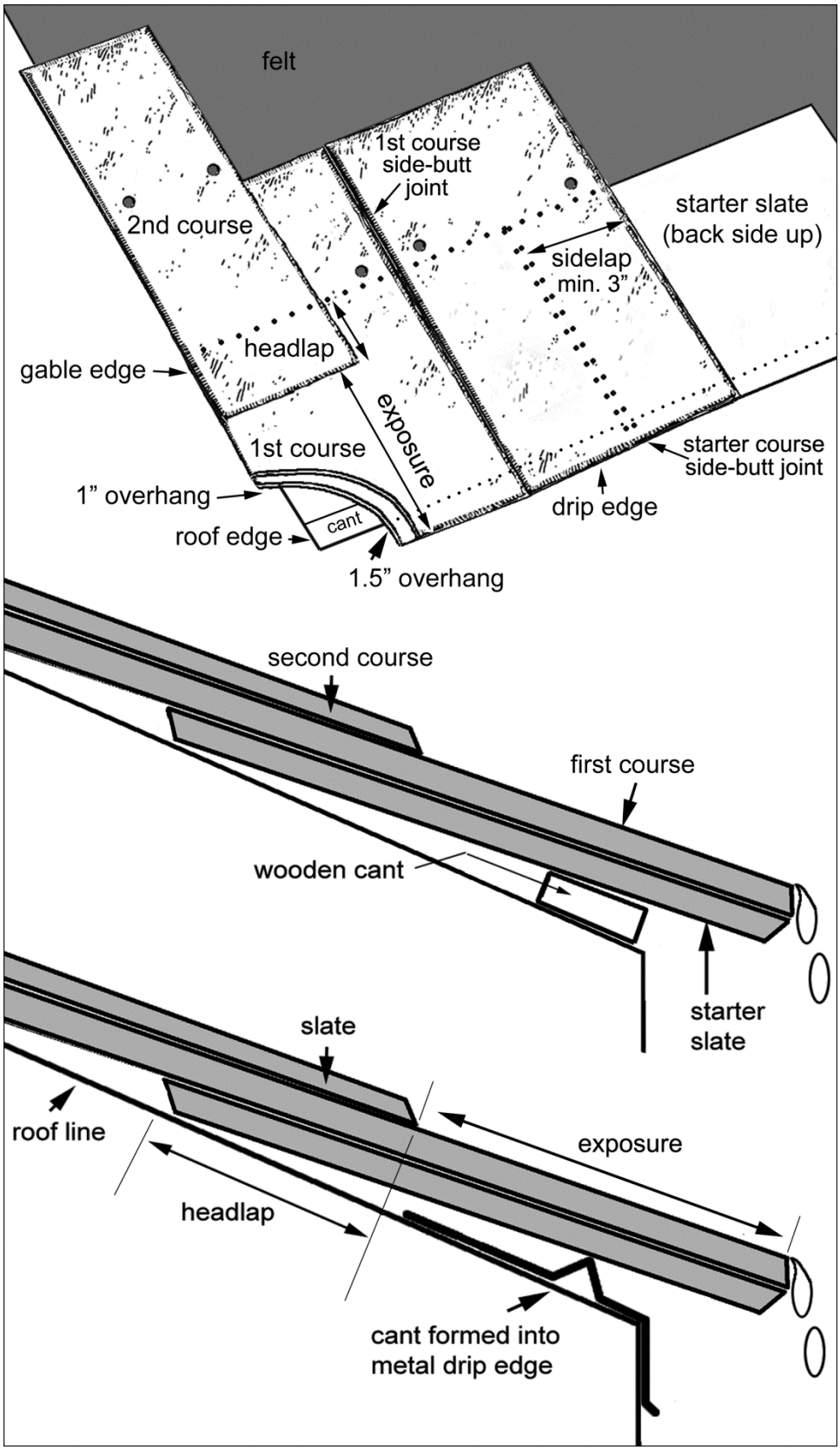
6.4. SLATE EXPOSURES AND HEADLAPS

When Using 3” and 4” Headlaps (showing number of slates per square)

Slate Size (in.)	Exposure (3” H.L.)	Slates/Square	Exp. (4” Headlap)	Slates/Square
6x10	3 1/2”	686	3”	800
7x10	3 1/2”	588	3”	686
8x10	3 1/2”	514	3”	600
6x12	4 1/2”	533	4”	600
7x12	4 1/2”	457	4”	515

8x12	4 1/2”	400	4”	450
9x12	4 1/2”	355	4”	400
10x12	4 1/2”	320	4”	360
7x14	5 1/2”	374	5”	412
8x14	5 1/2”	327	5”	360
9x14	5 1/2”	290	5”	320
10x14	5 1/2”	261	5”	288
12x14	5 1/2”	218	5”	240
8x16	6 1/2”	277	6”	300
9x16	6 1/2”	246	6”	256
10x16	6 1/2”	222	6”	230
12x16	6 1/2”	185	6”	192
9x18	7 1/2”	213	7”	221
10x18	7 1/2”	192	7”	199
11x18	7 1/2”	175	7”	187
12x18	7 1/2”	160	7”	171
10x20	8 1/2”	170	8”	180
11x20	8 1/2”	154	8”	164
12x20	8 1/2”	141	8”	150
14x20	8 1/2”	121	8”	129
11x22	9 1/2”	138	9”	146
12x22	9 1/2”	126	9”	134
14x22	9 1/2”	109	9”	115
12x24	10 1/2”	114	10”	120
14x24	10 1/2”	98	10”	103

Fig. 1


felt
1st course
side-butt
joint
starter slate
(back side up)
2nd course
sidelap
min. 3"
headlap
gable edge
exposure
1st course
starter course
side-butt joint
1" overhang
drip edge
cant
roof edge
1.5" overhang
second course
first course
wooden cant
starter
slate
slate
roof line
exposure
headlap
cant formed into
metal drip edge