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S.C. SUPREME COURT

THE STATE OF SOUTH CAROLINA
In the Supreme Court

APPEAL FROM OCONEE COUNTY
Court of Common Pleas
Alexander S. Macaulay, Presiding Judge Seventh Judicial Circuit

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Appellate Case No. 2015-000392
Opinion Filed December 13, 2018

Stoneledge at Lake Keowee Owners' Association, Inc.; C. Dan Carson; Jeffrey J. Dauler; Joan W. Davenport; Michael Furnari; Donna Furnari; Jessy B. Grasso; Nancy E. Grasso; Robert P. Hayes; Lucy H. Hayes; Ty Hix; Jennifer D. Hix; Paul W. Hund, III; Ruth E. Isaac; Michael D. Plourde; Mary Lou Plourde; Carol C. Pope; Steven B. Taylor; Bette J. Taylor; and Robert White, Individually and on Behalf of all others similarly situated, Respondents,

v.

IMK Development Co., LLC; Keowee Townhouses, LLC; Ludwig Corporation, LLC; SDI Funding, LLC; Medallion at Keowee, LLC; Integrys Keowee Development, LLC; Marick Home Builders, LLC; Bostic Brothers Construction, Inc.; Miller/Player & Associates; Bradford D. Seckinger; John Ludwig; William Cox; Larry D. Lollis; Rick Thoennes; M Group Construction and Development; LLC; Mel Morris; Joe Bostic; Jeff Bostic; Clear View Construction, LLC; Michael Franz; MHC Contractors; Miguel Porras Choncoas; Builders First Source-Southeast Group; Mike Green; Southern Concrete Specialties; Carl Compton d/b/a Compton Enterprize a/k/a Compton Enterprises; Gunter Heating & Air; All Pro Heating; A/C & Refrigeration, LLC; Coleman Waterproofing; Heyward Electrical Services, Inc.; Tinsley Electrical, LLC; Hutch N Son Construction, Inc.; Upstate Utilities, Inc.; Southern Basements; Carl Catoe Construction, Inc.; T.G. Construction, LLC; Delfino Construction; Francisco Javier Zarate d/b/a Zarate Construction; Alejandro Avalos Cruz; Herberto Acros Hernandez; Martin Hernandez-Aviles; Francisco Villalobos Lopez; Ambrosio Martinez-Ramirez; Ester Moran Mentado; Socorro Castillo Montel; MJG Construction and Homebuilders, Inc. d/b/a MJG Construction; KMAC of the Carolinas, Inc.; Eufacio Garcia; Everado Jarmamillio; Garcia Parra Insulation, Inc.; J&J Construction; Jose Nino; Jose Manuel Garcia; Eason Construction, Inc.; Vincent Morales d/b/a Morales Masonry and Miller/Player & Associates, Defendants,

Of Which Marick Home Builders, LLC and Rick Thoennes are the Petitioners,

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APPENDIX
VOLUME VIII OF VIII

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Of Defendants, Marick Home Builders, LLC and Rick Thoennes .....Appellants,

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RECORD ON APPEAL
Volume VII of VII

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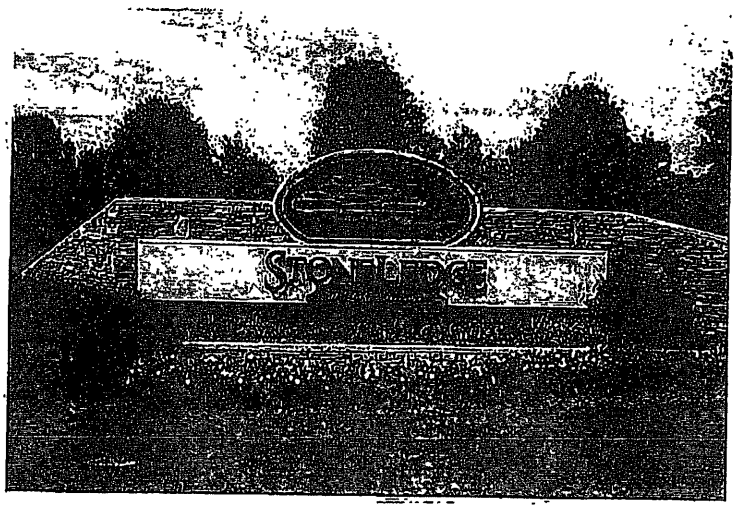
Stoneledge at Lake Kewoee

West Union, South Carolina

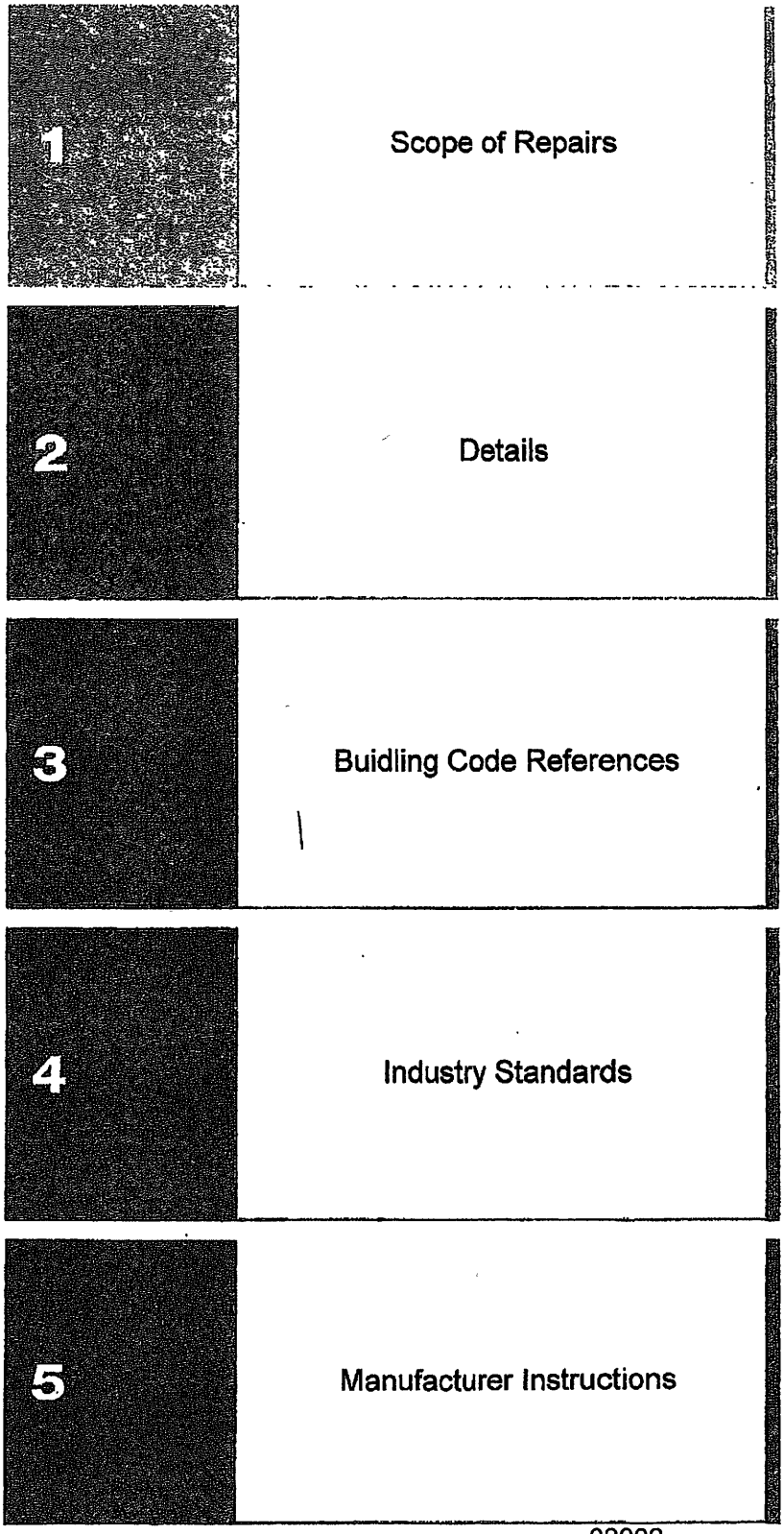
January 24, 2011

Repair Documents



Construction Science and Engineering, Inc.
218 East Main Street
Westminster, SC 29693
Phone: (864) 647-1065

PLAINTIFF'S EXHIBIT 287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CSE File No. 237.01
January 24, 2011

Stoneledge at Lake Keowee HOA
c/o Mr. Robert Lyles
Lyles and Lyles, Inc.
P.O. Box 773
(342 East Bay Street)
Charleston, SC 29402 (29401)

Re: Scope of Repairs (Excluding Below Grade Waterproofing and Associated Repairs)
Stoneledge at Lake Keowee
West Union, SC

Dear Mr. Lyles:

Pursuant to the request of The Stoneledge at Lake Keowee Homeowners Association (HOA), Construction Science & Engineering, Inc. (CSE) has performed visual surveys of the subject property. The purpose of our surveys were to determine the extent of construction deficiencies and provide repair recommendations, as necessary. This letter provides an outline scope of repairs based on visual surveys and destructive testing performed to date. In order for CSE to provide final opinions about the extent of construction defects at the subject property, additional destructive testing may be necessary to substantiate our initial findings at certain locations. The outline scope of repairs should be provided to a qualified general contractor for purposes of preparing a cost estimate for the repairs.

DESCRIPTION

General Project

The subject project is located in West Union, South Carolina on the shore of Lake Keowee. The subject project includes a total of nineteen (19) buildings, which include eighteen (18) residential townhouse structures and one (1) common use clubhouse structure. Each residential structure contains three (3) to seven (7) townhouse units. There are a total of ninety-one (91) townhouse units located at the subject project.

The subject project was developed in two (2) phases, Phase One and Phase Two, respectively. Phase One includes all structures located on the south and west sides of the lake. Phase Two includes all structures located north of the lake. The clubhouse building is adjacent to an exterior pool area and is located in Phase Two. For descriptive purposes,

the front of each unit will be considered the elevation facing the street and parking areas. Subsequently, all other elevations (i.e. left, right, and rear) will be referenced relative to the front elevation.

Townhouse Models

Three (3) different townhouse models were constructed, and are referred to as Parkside, Hampton, or Hickory in the original architectural drawings. The three (3) models vary from one another by exterior window locations and interior floor plans. All residential buildings are two (2) stories, with most units also having full walk-out basements with covered patio areas. However, a few units do not have basements. For units with basements, the finish level of the basement ranges from unfinished to fully finished. Units typically have elevated balconies. A portion of each balcony is uncovered, while the remaining portion is screen enclosed. A copy of the original construction permit drawings were provided by to CSE by the Oconee County (South Carolina) Building Department. Copies of the plans will be provided by CSE upon request.

Townhouse Construction

Typical construction for the residential townhouse units includes concrete slab-on-grade foundations for the basement floors. Concrete foundation walls enclose three (3) sides of the basement and support the conventional wood framing above. The roofs are constructed using prefabricated metal plate connected wood trusses. Architectural grade composition shingles cover all roof areas. The exterior wall cladding includes cultured stone veneer (CSV) at the lower area of first floor and basement, cedar lapped siding over the main body of exterior walls, and accent areas of cedar shake. Oriented Strand Board (OSB) wall sheathing and/or gypsum wall sheathing products were used for exterior wall substrates. Windows are typically aluminum clad wood casement windows with insulated glazing (IG). Patio doors are painted wood, full lite (IG), outswing doors with fixed full lite (IG) panel(s) separated by wood framing and trim. Entry doors are stained wood, partial lite (IG), inswing doors of a different style, compared to the patio doors.

Garages

Most townhouse units include a detached garage located in front of the unit. Units 328 Blue Water Way and 335 Blue Water Way do not have a detached garage. The detached garages accommodate a separate parking area for either one (1) or two (2) townhouse units. All detached garages are one (1) story structures. Garage roofs are constructed using either a gable or hip configuration covered with architectural grade composition shingles. The garages are wood frame construction supported by a concrete slab-on-grade foundation. The exterior walls have CSV along the base, with cedar lapped siding above.

02905

BACKGROUND

Phase One

Construction for Phase One structures was permitted from August 2002 to June 2005. The applicable building code for this time period was the 2000 International Residential Code for One and Two Family Dwellings (2000 IRC). All repairs included in this Scope of Repairs will be required to meet the current applicable building code, which is the 2006 IRC.

Phase Two

Phase Two construction was permitted in March 2006. The applicable building code for this time period was the 2003 International Residential Code for One and Two Family Dwellings (2003 IRC). All repairs included in this Scope of Repairs will be required to meet the current applicable building code, which is the 2006 IRC.

OUTLINE SCOPE OF REPAIRS

1. Roof – Low Slope (Slope less than 4:12)

   A. Remove and dispose of existing roof covering and underlayment.
   B. Inspect existing roof deck and replace damaged roof decking with whole sheets (4'-0" x 8'-0") of similar deck material as necessary.
   C. Inspect roof deck for excessive deflection indicative of damaged framing.
   D. Remove roof deck as required to repair framing, per registered engineer repair directive.
   E. Install new composition roof coverings of like kind and quality to existing with proper underlayment, new metal drip edge, and proper flashings.
   F. Properly integrate roof repairs with adjacent wall assembly(s). Install proper step flashing and metal kick-out flashing where applicable.

2. Roof – Steep Slope (Slope more than 4:12)

   A. Remove one (1) full shingle at two (2) separate locations per unit to check for proper roof underlayment. Test locations shall be taken randomly and not within the same roof plane area.
      I. If proper underlayment is observed, proceed to reinstall shingle in accordance with accepted industry standards.
      II. If no underlayment is observed, remove existing shingles and install one (1) layer #30 asphalt saturated felt underlayment and new composition roof covering to match existing. Repairs to be performed on a per roof plane basis.
      III. Inspect existing roof deck. Replace damaged roof decking with whole sheets (4'-0" x 8'-0") of similar deck material as necessary.
      IV. Repair framing, per registered engineer repair directive.

B. Inspect roof deck for excessive deflection indicative of damaged framing.
   I. Remove roof deck as required to repair framing, per registered engineer repair directive.
   II. Install new composition roof coverings of like kind and quality with proper underlayment, new metal drip edge and proper flashings.
C. Install metal drip edge at all rakes and eaves.
   I. Install 6" (minimum) self-adhered flashing over new metal drip edge. Properly integrate with roof underlayment.
   II. Install additional new composition roof coverings of like kind and quality with proper underlayment where the existing roof covering does not properly cover the roof area or adjacent trim. New roof coverings should be installed on a per roof plane basis.
   III. Remove and dispose of excessive roof covering(s) at edges that do not conform to the applicable building code.
D. Properly integrate roof repairs with adjacent wall assembly(s). Install proper step flashing and metal kick-out flashing where applicable.

3. Cladding – Cedar Lap Siding at Non-rated Wall Assemblies

A. Remove and dispose of existing horizontal lap cedar siding and wood trim.
B. Remove and dispose of any existing weather resistive barrier (WRB).
C. Inspect existing wall sheathing fastener locations and add fastener(s) per the applicable building code.
D. Inspect wall sheathing and replace damaged sheathing with whole (4'-0" x 8'-0") sheets of similar sheathing as necessary.
E. Inspect wood framing at locations where repairs to wall sheathing are performed and replace/repair damaged wood framing per a repair directive provided by a registered engineer.
F. Remove and re-install windows and doors with proper flashing.
G. Install one (1) layer of #30 asphalt saturated felt (WRB) over exterior wall sheathing.
H. Install flashing at appropriate locations (i.e. above protruding trim, floor lines, balcony/wall intersections, etc.)
I. Install new horizontal lap cedar siding.
J. Properly integrate cedar lap siding with adjacent cladding material(s).

4. Cladding – Cedar Shake Siding at Non-rated Wall Assemblies

A. Remove and dispose of existing cedar shake siding and wood trim.
B. Remove and dispose of any existing weather resistive barrier (WRB).
C. Inspect existing wall sheathing fastener locations and add fastener(s) as necessary.
D. Inspect wall sheathing and replace damaged sheathing with whole (4'-0" x 8'-0") sheets of similar sheathing as necessary.
E. Inspect wood framing at locations where repairs to wall sheathing are performed and replace/repair damaged wood framing per a repair directive provided by a registered engineer.

02907

F. Remove and re-install windows with proper flashing.
G. Install one (1) layer of #30 asphalt saturated felt (WRB) over exterior wall sheathing
H. Install flashing at appropriate locations (i.e. above protruding trim, floor lines, balcony/wall intersections, etc.)
I. Install new cedar shake siding to match existing style and color.
J. Properly integrate cedar lap siding with adjacent cladding material(s).

5. Cladding – Cultured Stone Veneer at Non-rated Wall Assemblies

A. Remove and dispose of existing cultured stone veneer cladding.
B. Remove and dispose of any existing WRB.
C. Inspect existing wall sheathing fastener locations and add fastener(s) as necessary.
D. Inspect wall sheathing and replace damaged sheathing with whole (4'-0" x 8'-0") sheets of similar sheathing as necessary.
E. Inspect wood framing at locations where repairs to wall sheathing are performed and replace/repair damaged wood framing per a repair directive provided by a registered engineer.
F. Remove and re-install windows and doors with proper flashing.
G. Install two (2) layers of #30 asphalt saturated felt (WRB) over exterior wall sheathing.
H. Install Polyguard® drainage mat at the top of the rear wall, below the outboard edge of the balcony floor.
I. Install flashing at appropriate locations (i.e. above protruding trim, floor lines, balcony/wall intersections, etc.) in accordance with manufacturers' installation instructions.
J. Install new Owens Corning® Cultured Stone® veneer cladding to match existing style and color(s).
K. Properly integrate cultured stone veneer cladding with adjacent cladding material(s).

6. Cladding – Cedar Lap Siding at Rated Wall Assemblies

A. Remove existing windows from rated wall assembly.
B. Remove and dispose of existing horizontal lap cedar siding and wood trim.
C. Remove and dispose of any existing weather resistive barrier (WRB).
D. Remove and dispose of existing interior grade gypsum wall board material and/or other damaged wall sheathing material.
E. Inspect wood framing for damage. Replace/repair damaged wood framing per a repair directive provided by a registered engineer.
F. Install new DensGlass® Fireguard® Sheathing to the exterior side of the stud framing in order to construct an exterior rated wall assembly as required to meet the applicable building code.
G. Remove and re-install windows and doors with proper flashing.

H. Install one (1) layer of #30 asphalt saturated felt (WRB) over exterior wall sheathing.
I. Install flashing at appropriate locations (i.e. above protruding trim, floor lines, balcony/wall intersections, etc.)
J. Install new horizontal lap cedar siding.
K. Properly integrate cedar lap siding with adjacent cladding material(s).

7. Cladding – Cultured Stone Veneer at Rated Wall Assemblies

A. Remove existing windows from rated wall assembly.
B. Remove and dispose of existing cultured stone veneer cladding.
C. Remove and dispose of any existing WRB.
D. Inspect wood framing for damage. Replace/repair damaged wood framing per a repair directive provided by a registered engineer.
E. Install new DensGlass® Fireguard® Sheathing to the exterior side of the stud framing in order to construct an exterior rated wall assembly as required to meet the applicable building code.
F. Install two (2) layers of #30 asphalt saturated felt (WRB) over exterior wall sheathing.
G. Install flashing at appropriate locations (i.e. above protruding trim, floor lines, balcony/wall intersections, etc.) in accordance with manufacturers' installation instructions.
H. Install new Owens Corning® Cultured Stone® veneer cladding to match existing style and color(s).
I. Properly integrate synthetic stone veneer cladding with adjacent cladding material(s).

8. Rear Balconies at Phase One

A. Remove concrete topping on elevated balconies.
B. Remove damaged oriented strand board (OSB) subfloor on elevated balconies.
C. Remove all balcony floor framing for exposed portion of floor (not covered by roof, i.e. screen porch area).
D. Inspect balcony floor framing for damage at covered portion of balcony (i.e. screen porch area).
E. Install new balcony floor framing in exposed balcony area. Repair floor framing in covered balcony area per a repair directive provided by a registered engineer.
F. All new balcony floor framing should slope away from the rear exterior wall at a minimum of 1/8 inch per foot. Adjust existing framing as required to provide a continuous floor plane for the entire balcony.
G. Install new preservative treated plywood subfloor over the floor framing.
H. Install new Polyguard® waterproofing and drainage mat over plywood subfloor as indicated on the attached Repair Drawings.
I. Install new concrete topping over the drainage mat on elevated balconies. Form edge of concrete to match attached Repair Drawings.

J. Install/integrate new flashing at wall intersections as indicated on the attached Repair Drawings.
K. Install/integrate new flashing at post(s)/railing intersections as indicated on the attached Repair Drawings.
L. Install/integrate new flashing at door intersections as indicated on the attached Repair Drawings.
M. Remove, discard, and replace tongue-and-groove cedar ceiling beneath balcony floor as required. Install new material to match existing style and color.
N. Properly integrate balcony waterproofing with adjacent wall(s), door(s), column(s), and post(s) as indicated on the attached Repair Drawings.

Note: Complete or partial removal of screen enclosure will be necessary to perform the balcony repairs described above.

9. Rear Balconies at Phase Two

A. Remove concrete topping on elevated balconies.
B. Remove damaged plywood subfloor on elevated balconies.
C. Inspect all balcony floor framing for damage.
D. Repair existing balcony floor framing as required. All framing repairs to be performed per a repair directive provided by a registered engineer.
E. All framing should slope away from the rear exterior wall at a minimum of 1/8 inch per foot. Adjust existing framing as required to provide a continuous floor plane for the entire balcony.
F. Install new preservative treated plywood over the floor framing.
G. Install new Polyguard® waterproofing and drainage mat over plywood as indicated on the attached Repair Drawings.
H. Install new concrete topping over the drainage mat on elevated balconies. Form edge of concrete to match attached Repair Drawings.
I. Install/integrate new flashing at wall intersections as indicated on the attached Repair Drawings.
J. Install/integrate new flashing at post(s)/railing intersections as indicated on the attached Repair Drawings.
K. Install/integrate new flashing at door intersections as indicated on the attached Repair Drawings.
L. Remove, discard and replace tongue-and-groove cedar ceiling beneath balcony floor as required. Install new material to match existing style and color.
M. Properly integrate balcony waterproofing with adjacent wall(s), door(s), column(s) and post(s) as indicated on the attached Repair Drawings.

Note: Complete or partial removal of screen enclosure will be necessary to perform the balcony repairs described above.

10. Below-Grade Waterproofing

A. All repairs associated with below-grade waterproofing are not included in this scope of repair, and will be determined at a later date.

11. Interior Finishes

A. Repair damaged gypsum wallboard as needed to match existing finish (i.e. consequential damages caused by window repairs, wall sheathing repairs, etc.). Repairs should include repair of incidental nail pops, spackling, prepping and painting exterior walls.
B. Repair or replace damaged flooring as needed to match existing finish (i.e. consequential damages caused by door repairs, etc.).

12. General Notes for All Repairs

A. All materials specified in this Scope of Repairs and associated Repair Drawings should be installed according to the respective manufacturers' installation instructions.
B. All work should be performed in accordance with applicable building codes and accepted industry standards.
C. Material substitutions may occur with prior acceptance by CSE.

This scope of repairs is based on a reasonable degree of engineering certainty regarding the extent of known defects at the subject property. In the event that additional relevant information becomes available, we respectively reserve the right to amend the repair recommendations provided herein.

Representative photographs of damages related to the construction defects at the subject property are available upon request. Please feel free to contact me if you have any questions or require additional assistance.

Sincerely,

CONSTRUCTION SCIENCE AND ENGINEERING, INC.

For Derek A. Hodgin, P.E. with permission

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Summary of Construction Defects

Stoneledge at Lake Keowee

West Union, South Carolina

CSE Job Number 237 01

Codes in Use: 2000 International Residential Code for One and Two Family Dwellings

2007 International Residential Code for One and Two Family Dwellings

A	Roofing					
1		No Ice and Water Shield installed	Damage observed to sheathing at base of roof-to-wall intersections at multiple locations. Damage is not considered to be isolated to the lack of Ice and Water Shield flashing. See also Missing / Inadequate underlayment at eave of Roofing; Incomplete / Inconsistent sidewall flashing of Roofing; and Missing/Incomplete WRB at exterior side of Exterior Walls.	Ice and Water Shield should be installed according to industry standard - National Roofing Contractors Association "The NRCA Roofing and Waterproofing Manual"	Ice and Water Shield should be installed according to industry standard - National Roofing Contractors Association "The NRCA Roofing and Waterproofing Manual"	Install Ice and Water Shield flashing as required in accordance with industry standard (NRCA)
2		Missing / Inadequate underlayment at eave	Inadequate protection of roof sheathing resulting in observed water damage to bottom edge of roof sheathing (at eave). Damage is not considered to be isolated to the missing / inadequate underlayment. See also No Ice and Water Shield installed at Roofing; Incomplete / Inconsistent sidewall flashing of Roofing; and Missing / Incomplete WRB at exterior side of Exterior Walls.	R905.2.7 "Roof slopes shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure." R905.2.7 For roof slopes from two units vertical in 12 units horizontal up to four units vertical in 12 units horizontal, underlayment shall be two layers.	R905.2.7 "Roof slopes shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure." R905.2.7 For roof slopes from two units vertical in 12 units horizontal up to four units vertical in 12 units horizontal, underlayment shall be two layers.	Install minimum drip edge at all rake and eave. Install 6" (minimum) ice and water flashing over new metal drip edge properly integrate with roof underlayment.
3a		Missing underlayment, (Low slope - 4:12 or less)	Not code compliant. Potential damage due to lack of required weather protection.	R905.2.7 For roof slopes from two units vertical in 12 units horizontal up to four units vertical in 12 units horizontal, underlayment shall be two layers.	R905.2.7 For roof slopes from two units vertical in 12 units horizontal up to four units vertical in 12 units horizontal, underlayment shall be two layers.	Remove shingles, felt and any underlayment on all low slope roofs (not over 4/12 units rise per twelve (12) units run), install 2 layers #30 ASTM saturated felt underlayment. Stagger and lap roof underlayment joints per applicable building code. Install new composition roof covering to match existing.
3b		Missing underlayment (Steep Slope - 4:12 or over)	Not code compliant, though not anticipated to be cause of damage, there was a failure to install required weather protection.	R905.2.7 For roof slopes from two units vertical in 12 units horizontal up to four units vertical in 12 units horizontal, underlayment shall be two layers.	R905.2.7 For roof slopes from two units vertical in 12 units horizontal up to four units vertical in 12 units horizontal, underlayment shall be two layers.	Remove one (1) full shingle course (minimum 12" separate locations per exterior elevation of each steep slope roof (three in all four (4) roof faces per home (12) each total) to check for proper roof underlayment. If no underlayment is observed, remove existing shingles and install one (1) layer #30 ASTM saturated felt underlayment and new composition roof covering to match existing. Repeat to be performed on all pre roof plane tests.

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4	Missing fasteners at shingles	Roof code compliant. Potential damage due to improper attachment	R905.2.5 Fasteners for asphalt shingles shall be of sufficient length to penetrate through the roofing into the roof sheathing a minimum of 3/4" into the roof sheathing R905.2.6 Asphalt shingles shall have the minimum number of fasteners required by the manufacturer	R905.2.5 Fasteners for asphalt shingles shall be of sufficient length to penetrate through the roofing into the roof sheathing a minimum of 3/4" into the roof sheathing R905.2.6 Asphalt shingles shall have the minimum number of fasteners required by the manufacturer	Inspect steep slope roof(s) for missing shingle fasteners. Repair shingles as required All low slope roofs to be repaired per Repair Area A4a.
5	Excessive edge distance between shingles, roof sheathing and/or trim	Shingles are vulnerable to blow off damage during a wind event	R903.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure."	R903.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure."	Install aluminum drip edge at eaves and rakes. Install 6" (minimum) self adhered flashing over new aluminum drip edge properly integrated with roof underlayment
6	Shingles do not overhang roof sheathing and/or trim	Roof assembly is vulnerable to water intrusion at unprotected areas	R903.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure."	R903.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure."	Install new drip edge at all eaves and rakes. Install 6" (minimum) self adhered flashing over new metal drip edge. Properly integrate with roof underlayment. Install new composition roof covering to match existing as required per applicable building code.
7	Improper shingle installation - spaced shingle in body of roof	Roof assembly is vulnerable to water intrusion at unprotected areas	R903.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure."	R903.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure."	Inspect steep slope roof(s) for improper shingle installation. Repair shingles as required All low slope roofs to be repaired per Repair Area A4a
8	Improper / deteriorated sidewall flashing	Roof code compliant. Potential damage due to lack of required weather protection	R905.2.8.4 Roof valleys. Valley flashing shall be of the material specified in Table R905.2.8.4. Valley flashing shall be installed in accordance with this section and the manufacturer's instructions. Open valleys (valleys with an intervening width of exposed roofing between adjacent roofing) shall be flashed with metal not less than 0.019 inch (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 8 inches (203 mm) from the centerline each way and shall be formed to provide a splash diverter at the flow line, not less than 1 inch (25 mm) high, to deflect water from the valley onto the roofing below. Valley flashing shall have an end dam turned up not less than 1 inch (25 mm) where valleys intersect eaves. Valley flashing shall be installed before any roofing is installed. Roofing not installed according to manufacturer's installation instructions and this code shall be subject to removal and reinstallation.	R905.2.8.4 Roof valleys. Valley flashing shall be of the material specified in Table R905.2.8.4. Valley flashing shall be installed in accordance with this section and the manufacturer's instructions. Open valleys (valleys with an intervening width of exposed roofing between adjacent roofing) shall be flashed with metal not less than 0.019 inch (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 8 inches (203 mm) from the centerline each way and shall be formed to provide a splash diverter at the flow line, not less than 1 inch (25 mm) high, to deflect water from the valley onto the roofing below. Valley flashing shall have an end dam turned up not less than 1 inch (25 mm) where valleys intersect eaves. Valley flashing shall be installed before any roofing is installed. Roofing not installed according to manufacturer's installation instructions and this code shall be subject to removal and reinstallation.	Remove all roof to sidewall flashing. Properly install new roof to wall flashing. Properly integrate with adjacent existing material to remain and new material required per any CSE Scope of Repair Documents
9	Improper roof to wall flashing	Roof code compliant. Potential damage due to lack of required weather protection	Roofing not installed according to manufacturer's installation instructions and this code shall be subject to removal and reinstallation. The Asphalt Roofing Manufacturer's Association "Residential Asphalt Roofing Manual"	Roofing not installed according to manufacturer's installation instructions and this code shall be subject to removal and reinstallation. The Asphalt Roofing Manufacturer's Association "Residential Asphalt Roofing Manual"	Remove all roof to sidewall flashing. Properly install new roof to wall flashing. Properly integrate with adjacent existing material to remain and new material required per the CSE Scope of Repair Documents
10	Inadequate roof sheathing attachment	Roof complies. Roof unlikely to blow off or damage during a wind event	Table R503.2.1 (1) Allowable spans and loads for wood structural panels for roof and subfloor sheathing and continuous subfloor underlayment	Table R503.2.1 (1) Allowable spans and loads for wood structural panels for roof and subfloor sheathing and continuous subfloor underlayment	Inspect all roof decks for deflection, evidence of damaged framing and/or sheathing attached. Repair as required by registered engineer.

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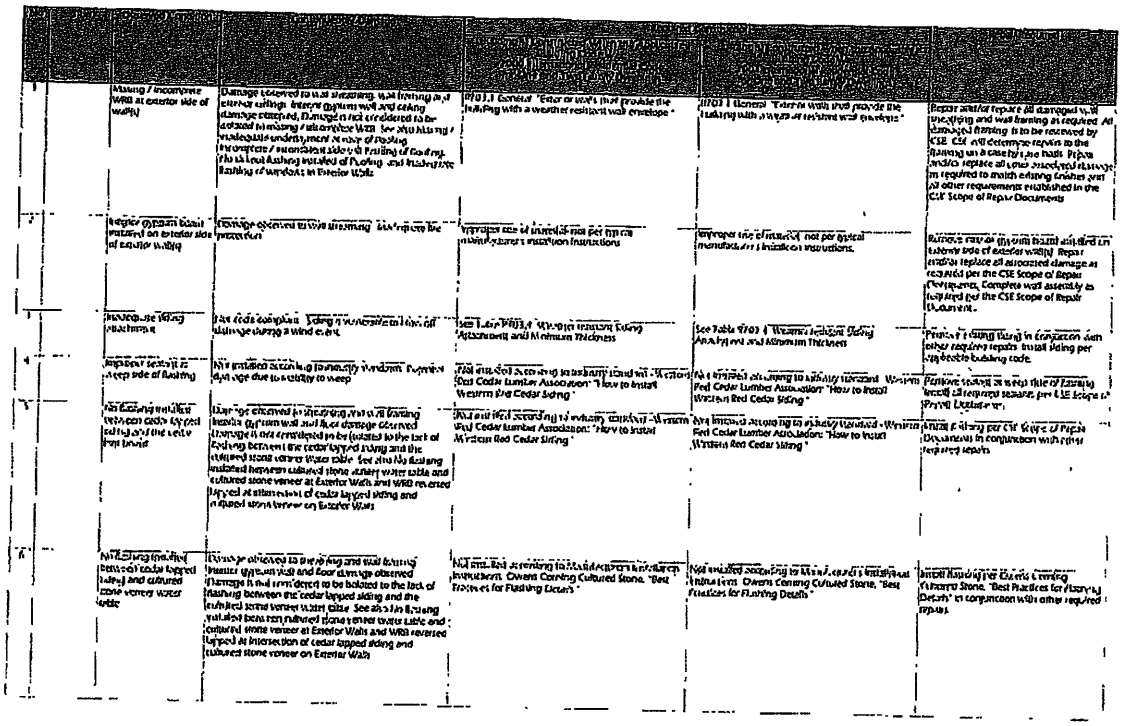
11		Inadequate construction for adjacent roof construction	Roof assemblies are vulnerable to water intrusion due to improper interface between adjacent roof construction	R905.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure." Not installed according to industry standard(s) the Asphalt Roofing Manufacturer's Association "Residential Asphalt Roofing Manual" and National Roofing Contractors Association "The NRCA Roofing and Waterproofing Manual"	2701.1 "Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure." Not installed according to industry standard(s) the Asphalt Roofing Manufacturer's Association "Residential Asphalt Roofing Manual" and National Roofing Contractors Association "The NRCA Roofing and Waterproofing Manual"	Inspect all roof slopes for improper roof integration between adjacent roof slopes. Repair as required to provide proper continuity.
g	Attics					
1		Broken truss	Not code compliant. Potential damage due to inadequate structural capacity	R802.10.1 Alterations to trusses. Trusses shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional."	R802.10.1 Alterations to trusses. "Trusses shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional."	All broken trusses are to be reviewed by registered engineer. Repairs to be determined on a case by case basis
2		Truss web member removed/cut.	Not code compliant. Potential damage due to inadequate structural capacity	R802.10.1 Alterations to trusses. Trusses shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional."	R802.10.1 Alterations to trusses. "Trusses shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional."	All broken trusses are to be reviewed by registered engineer. Repairs to be determined on a case by case basis
c	Life safety / Fire Protection					
1		2 hour fire protection between adjacent units. Fire protection is not continuous for entire wall	Not code compliant. Potential damage or loss of life due to inadequate fire protection	R317.2.1 Continuity. "The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall."	R317.2.1 Continuity. "The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall."	As required, sustain all fire protection rated wall assemblies per UL #U305 Config. B per design requirements. Construct all exterior rated wall assemblies per either UL #U109 or UL #U301, using Detroit Fireguard Insulating on exterior side of wall.
2		Incomplete fire protection between adjacent units. Fire rated gypsum board is not taped or mudded per wall assembly requirements	Not code compliant. Potential damage or loss of life due to inadequate fire protection	R317.2.1 Continuity. "The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall."	R317.2.1 Continuity. "The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall."	Tape and mud all joint and interior fasteners as required per wall assembly requirements
3		Windows installed in fire rated wall separating adjacent units	Not code compliant. Potential damage or loss of life due to inadequate fire protection	R317.2.1 Continuity. "The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall."	R317.2.1 Continuity. "The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall."	Windows to be removed as required to allow wall assembly to integrate with surrounding wall assembly
D	Exterior Walls					



	Missing / incomplete WRB at exterior side of wall(s)	Damage observed to wall sheathing, wall framing and interior ceilings. Interior gypsum wall and ceiling damage cropped. Damage is not considered to be caused by missing / inadequate WRB or lack of flashing / inadequate underlayment at base of flashing / incomplete / inconsistent side-lap flashing of flashing. Flashing should be installed at flashing and integrate flashing of WRB/AB in Exterior Walls	[illegible] General "Color or mark that provide the building with a weather resistant wall envelope."	[illegible] General "Exterior walls shall provide the building with a water resistive wall envelope."	Repair and/or replace all damaged wall sheathing and wall framing as required. All damaged framing is to be reviewed by CSE. CSE will determine repairs to the framing on a case by case basis. Repair and/or replace all cross braced wall bracing as required to match existing finishes and all other requirements established in the CSE Scope of Repair Documents
	Improper gypsum board installed on exterior side of exterior walls(s)	Damage observed to wall sheathing. Unable to be inspected	Improper use of materials not per applicable manufacturer's instruction instructions	Improper use of material not per typical manufacturer's installation instructions.	Remove cover gypsum board installed on exterior side of exterior wall(s). Repair and/or replace all associated damage as required per the CSE Scope of Repair Documents. Complete wall assembly as required per the CSE Scope of Repair Document.
	Improper vertical attachment	Fiber cement siding is not secured to wall with sufficient fasteners to withstand wind event	See Table R703.4 "Weather-resistant Siding Attachment and Minimum Thickness"	See Table R703.4 "Weather-resistant Siding Attachment and Minimum Thickness"	Remove siding and install in accordance with other required repairs. Install siding per applicable building code.
	Improper install at drip edge of flashing	Not installed according to manufacturer's instructions. Fiber cement siding is not secured to wall with sufficient fasteners to withstand wind event due to inability to weep	Not installed according to manufacturer's instructions. "Western Red Cedar Lumber Association" "How to Install Western Red Cedar Siding."	Not installed according to manufacturer's instructions. "Western Red Cedar Lumber Association" "How to Install Western Red Cedar Siding."	Remove siding as required for proper flashing install as required per CSE Scope of Repair Documents.
	No flashing installed between cedar lapped siding and the cedar lapped siding and the cedar lapped siding and the cultured stone veneer water table	Damage observed to sheathing and wall framing. Interior gypsum wall and floor damage observed. Damage is not considered to be limited to the lack of flashing between the cedar lapped siding and the cultured stone veneer water table. See also No flashing installed between cultured stone veneer water table and cultured stone veneer at Exterior Walls and WRB reversed lapped at intersection of cedar lapped siding and cultured stone veneer on Exterior Walls	Not installed according to manufacturer's instructions. Owens Corning Cultured Stone. "Best Practices for Flashing Details."	Not installed according to manufacturer's instructions. Owens Corning Cultured Stone. "Best Practices for Flashing Details."	Install flashing per Owens Corning Cultured Stone. "Best Practices for Flashing Details" in conjunction with other required repairs.

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7		No flashing installed between synthetic stone veneer walls cable and cultured stone veneer	Damage observed to sheathing and wall framing Interior gypsum wall and floor damage observed Damage is not considered to be isolated to the lack of flashing between the cedar lapped siding and the cultured stone veneer water table. See also No flashing installed between cultured stone veneer water table and cultured stone veneer at Exterior Walls and WR8 reversed lapped at intersection of cedar lapped siding and cultured stone veneer on Exterior Walls	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Install flashing per Owens Corning Cultured Stone "Best Practices for Flashing Details" in conjunction with other required repairs
8		Wall reversed lapped at intersection of cedar lapped siding and cultured stone veneer	Damage observed to sheathing and wall framing Interior gypsum wall and floor damage observed Damage is not considered to be isolated to the lack of flashing between the cedar lapped siding and the cultured stone veneer water table See also No flashing installed between cultured stone veneer water table and cultured stone veneer at Exterior Walls and WR8 reversed lapped at intersection of cedar lapped siding and cultured stone veneer on Exterior Walls Not installed according to manufacturer instructions or industry standards	Not installed according to Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Repair/replace all WRB and flashing per CE Scope of Repair Documents and Owens Corning Cultured Stone, "Best Practices for Flashing Details" in conjunction with other required repairs
9		No flashing installed beneath wood trim at the head of window(s) within the cultured stone veneer	Exposure of building components to elevated moisture conditions	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Install flashing per CE Scope of Repair Documents and Owens Corning Cultured Stone "Best Practices for Flashing Details" in conjunction with other required repairs
10		No flashing installed beneath wood trim at the sill of window(s) within the cultured stone veneer	Exposure of building components to elevated moisture conditions	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Install flashing per CE Scope of Repair Documents and Owens Corning Cultured Stone, "Best Practices for Flashing Details" in conjunction with other required repairs
11		No face wall flashing at cultured stone veneer	Exposure of building components to elevated moisture conditions	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Install flashing per CE Scope of Repair Documents and Owens Corning Cultured Stone "Best Practices for Flashing Details" in conjunction with other required repairs
12		Cultured stone veneer installed below grade	Exposure of building components to elevated moisture conditions	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Install cultured stone veneer per CE Scope of Repair Documents in conjunction with other required repairs
13		Cultured stone veneer adhesion failure	Potential damage/injury due to inadequate attachment	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Not installed according to Manufacturer's installation instructions: Owens Corning Cultured Stone, "Best Practices for Flashing Details "	Install cultured stone veneer per CE Scope of Repair Documents and Owens Corning Cultured Stone, "Best Practices for Flashing Details" in conjunction with other required repairs

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[14]		Cultured stone veneer cracked / damaged	Damage to individual pieces of cultured stone observed Cracked units are vulnerable to displacement from the wall surface	Not installed according to Manufacturer's Installation Instructions Owens Corning Cultured Stone "Best Practices for Flashing Details"	Not installed according to Manufacturer's Installation Instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Install cultured stone veneer per CSE Scope of Repair Documents and Owens Corning Cultured Stone, "Best Practices for Flashing Details" in conjunction with other required repairs
[15]		Water intrusion at base of below grade wall (basement) Corroded metal at concrete wall joints/ cold joints	Damage to interior finishes observed Evidence of water observed on interior surfaces Potential air quality concern	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	To be Determined
[16]		Water intrusion at base of below grade wall (basement) Dark cell lines noted between concrete slab and cast concrete wall observed from interior	Damage to interior finishes observed Mineral growth observed on interior surfaces Potential air quality concerns	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	To be Determined
[17]		Water intrusion at base of below grade wall (basement) Open joints around pipe penetration through cast concrete wall (top of basement wall)	Damage to interior finishes observed Mineral growth observed on interior surfaces Potential air quality concern	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	To be Determined
[18]		Water intrusion at front (bay) bath Bath located partially below grade Opening at sloped drain beneath tub / tile floor is slab visible	Damage to interior finishes observed	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	R406.1 Except where required to be waterproofed by Section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade	To be Determined
[19]		Inadequate wall sheathing attachment	The structural integrity of the wall assembly is below code requirements	See Table R602.3(1) Fastener Schedule for Structural Members	See Table R602.3(1) Fastener Schedule for Structural Members	Install additional fasteners to underlying OSB wall sheathing as required
E	Window					
[1]		Incomplete / inadequate rough opening flashing at window(s)	Damage observed to sheathing, wall framing and exterior ceilings Interior gypsum wall and ceiling damage observed Damage is not considered to be limited to the incomplete / inadequate rough opening flashing at window(s) See also Incomplete / inadequate sill flashing at flooring No sill pan flashing noted at flooring Missing / incomplete WRB at exterior side of sill and inadequate flashing of window(s)	Not installed according to Industry Standards Journal of Light Construction, "A-Z Field Guide to Residential Construction" Not installed according to typical Andersen Window instructions	Not installed according to Industry Standards Journal of Light Construction, "A-Z Field Guide to Residential Construction" Not installed according to typical Andersen Window instructions	Remove window(s) (entire window) per CSE Scope of Repair Documents in conjunction with other required repairs Do not reinstall windows at the wall (insulation, flashing) or damaged window(s) to remain in-place

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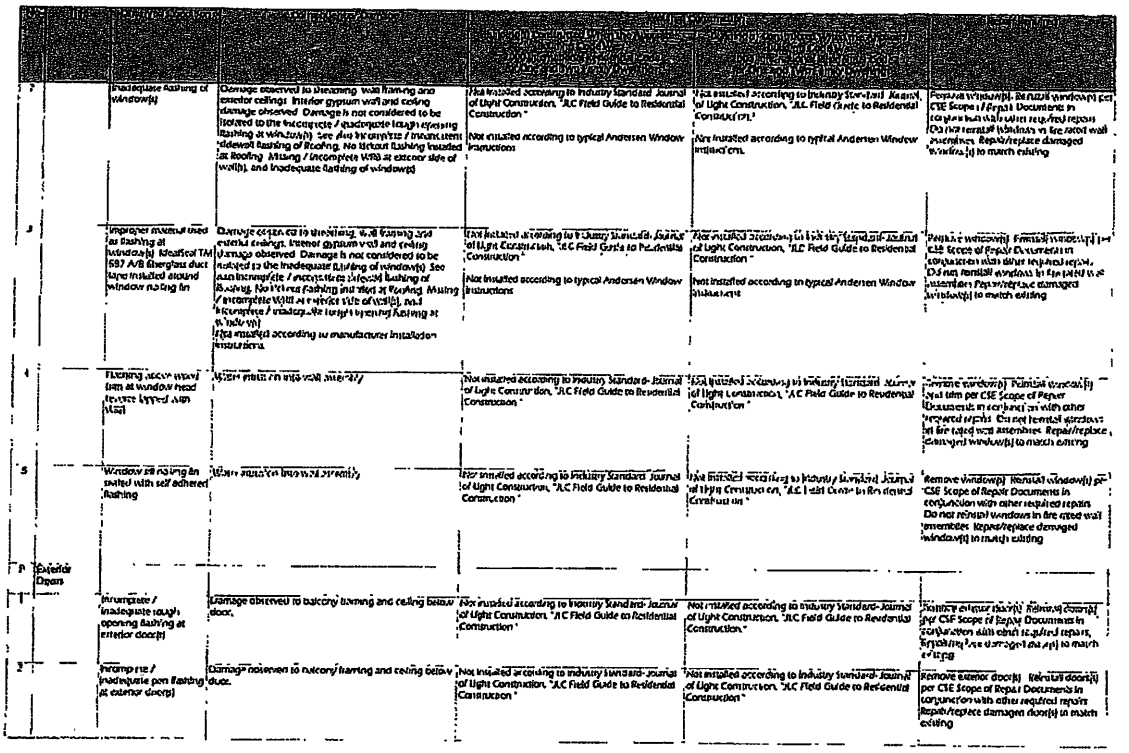

2		Inadequate flashing of window(s)	Damage observed to sheathing, wall framing and exterior ceiling. Interior gypsum wall and ceiling damage observed. Damage is not considered to be isolated to the inaccurate / inadequate rough opening flashing at window(s). See also the complete / inconsistent sidewall flashing of Roofing. No thread flashing installed at Roofing. Missing / incomplete WRB at exterior side of wall(s), and inadequate flashing of window(s)	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction." Not installed according to typical Andersen Window instructions	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction." Not installed according to typical Andersen Window instructions.	Remove window(s). Reinstall window(s) per CSE Scope of Repair Documents in conjunction with other required repairs. Do not reinstall windows in fire rated wall assemblies. Repair/replace damaged window(s) to match existing
3		Improper materials used as flashing at window(s). Installed TAM 697 A/B fiberglass duct tape installed around window nailing fin	Damage observed to sheathing, wall framing and exterior ceiling. Interior gypsum wall and ceiling damage observed. Damage is not considered to be isolated to the inadequate flashing of window(s). See also incomplete / incorrect / deficient flashing of flashing. No thread flashing installed at Roofing. Missing / incomplete WRB at exterior side of wall(s), and inadequate / inadequate flashing at window(s). Not installed according to manufacturer installation instructions.	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction." Not installed according to typical Andersen Window instructions	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction." Not installed according to typical Andersen Window instructions	Remove window(s). Reinstall window(s) per CSE Scope of Repair Documents in conjunction with other required repairs. Do not reinstall windows in fire rated wall assemblies. Repair/replace damaged window(s) to match existing
4		Flashing above wood trim at window head (recess typical with this)	Water stain on wall material	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Remove window(s). Reinstall window(s) per CSE Scope of Repair Documents in conjunction with other required repairs. Do not reinstall windows in fire rated wall assemblies. Repair/replace damaged window(s) to match existing
5		Window sill missing an outlet with self adhered flashing	Water stain on wall material	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Remove window(s). Reinstall window(s) per CSE Scope of Repair Documents in conjunction with other required repairs. Do not reinstall windows in fire rated wall assemblies. Repair/replace damaged window(s) to match existing
6	Exterior Doors					
1		Incomplete / inadequate rough opening flashing at exterior door(s)	Damage observed to balcony framing and ceiling below door.	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Remove exterior door(s). Reinstall door(s) per CSE Scope of Repair Documents in conjunction with other required repairs. Repair/replace damaged door(s) to match existing
2		Incomplete / inadequate pan flashing at exterior door(s)	Damage observed to balcony framing and ceiling below door.	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Not installed according to Industry Standard Journal of Light Construction, "ALC Field Guide to Residential Construction."	Remove exterior door(s). Reinstall door(s) per CSE Scope of Repair Documents in conjunction with other required repairs. Repair/replace damaged door(s) to match existing

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6	Balcony and Patio Area(s)					
		Incomplete / inadequate WRB at joint(s) with cultured stone veneer	Damage observed to framing and wood framing Damage observed to ceiling(s) beneath joist(s)	Not installed according to Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details."	Not installed according to Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Remove cultured stone veneer. Repair and/or replace all damaged wall sheathing and wall framing as required. All damaged framing is to be reviewed by CSE. CSE will determine repairs to the framing on a case by case basis. Install new cultured stone veneer to match existing style and color. All repairs to be performed in conjunction with other repairs per the CSE Scope of Repair Documents
		Wall reverse lapped with flashing extending less than 6" up side of the concrete slab	Damage observed to framing and wood framing Damage observed to ceiling(s) beneath joist(s)	Not installed according to Masonry Standard Journal of Light Construction, "RC Field Guide to Best Detail Construction"	Not installed according to Masonry Standard Journal of Light Construction, "RC Field Guide to Best Detail Construction"	Remove cultured stone veneer. Repair and/or replace all damaged wall sheathing and wall framing as required. All damaged framing is to be reviewed by CSE. CSE will determine repairs to the framing on a case by case basis. Install new cultured stone veneer to match existing style and color. All repairs to be performed in conjunction with other repairs per the CSE Scope of Repair Documents
		Incomplete / inadequate WRB at joint(s) with cultured stone veneer	Damage observed to framing and wood framing	Not installed according to Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details."	Not installed according to Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Remove cultured stone veneer. Repair and/or replace all damaged wall sheathing and wall framing as required. All damaged framing is to be reviewed by CSE. CSE will determine repairs to the framing on a case by case basis. Install new cultured stone veneer to match existing style and color. All repairs to be performed in conjunction with other repairs per the CSE Scope of Repair Documents.
		Cultured stone veneer placed in contact with top of concrete deck	Damage observed to framing and wood framing Damage observed to ceiling(s) beneath joist(s)	Not installed per Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Not installed according to Manufacturer's installation instructions Owens Corning Cultured Stone, "Best Practices for Flashing Details"	Remove cultured stone veneer. Repair and/or replace all damaged wall sheathing and wall framing as required. All damaged framing is to be reviewed by CSE. CSE will determine repairs to the framing on a case by case basis. Install new cultured stone veneer to match existing style and color. All repairs to be performed in conjunction with other repairs per the CSE Scope of Repair Documents.

[illegible]		Clipped stone's never applied in hanging horizontal location	Stone vulnerable to dislodging from horizontal surface causing property damage and/or injury	Not pointed according to Manufacturer's installation instructions. Owens Corning Cultured Stone, "Best Practices for Finishing Details"	Not installed according to Manufacturer's installation instructions. Owens Corning Cultured Stone, "Best Practices for Finishing Details."	Remove cultured stone veneer, flash and/or replace all damaged wall sheathing and wall framing as required. All damaged framing is to be reviewed by CSE. CSE will determine repairs to the framing on a case by case basis. Install new cultured stone veneer to match existing style and color. All repairs to be performed in compliance with all manufacturer repairs per the CSE approved Repair Documents
H	Electrical					
		No exterior electrical box has been completed. Potential of water damage / loss of life	ESSENTIAL Wet location. Where a receptacle is installed in a wet location and where the product intended to be plugged into it is not attended while in use, the receptacle shall have an enclosure that is weatherproof both when the attachment cap plug is inserted and when it is removed. Where a receptacle is installed in a wet location and where the product intended to be plugged into it will be supplied while in use, the receptacle shall have an enclosure that is weatherproof when the attachment plug is removed	ESSENTIAL Wet location. Where a receptacle is installed in a wet location and where the product intended to be plugged into it is not attended while in use, the receptacle shall have an enclosure that is weatherproof both when the attachment cap plug is inserted and when it is removed. Where a receptacle is installed in a wet location and where the product intended to be plugged into it will be supplied while in use, the receptacle shall have an enclosure that is weatherproof when the attachment plug is removed	Per environmental testing report, [illegible] to light as required. Remain per applicable building code and in accordance with the cultured stone veneer manufacturer installation instructions, as applicable

1/A1 Section Detail
Balcony to Wall Intersection at Ceiling Below Balcony Scale 1" = 6"

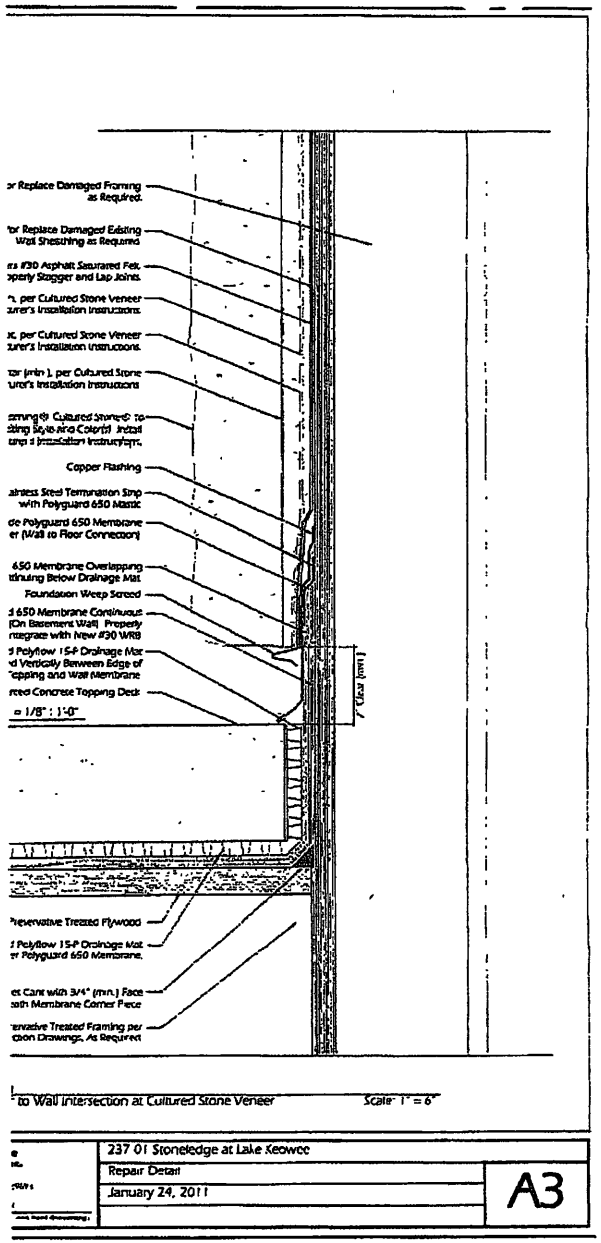
CSE Construction Science and Engineering, Inc.

237.01 Stoneledge at Lake Keowee
Repair Detail
January 24, 2011

A1

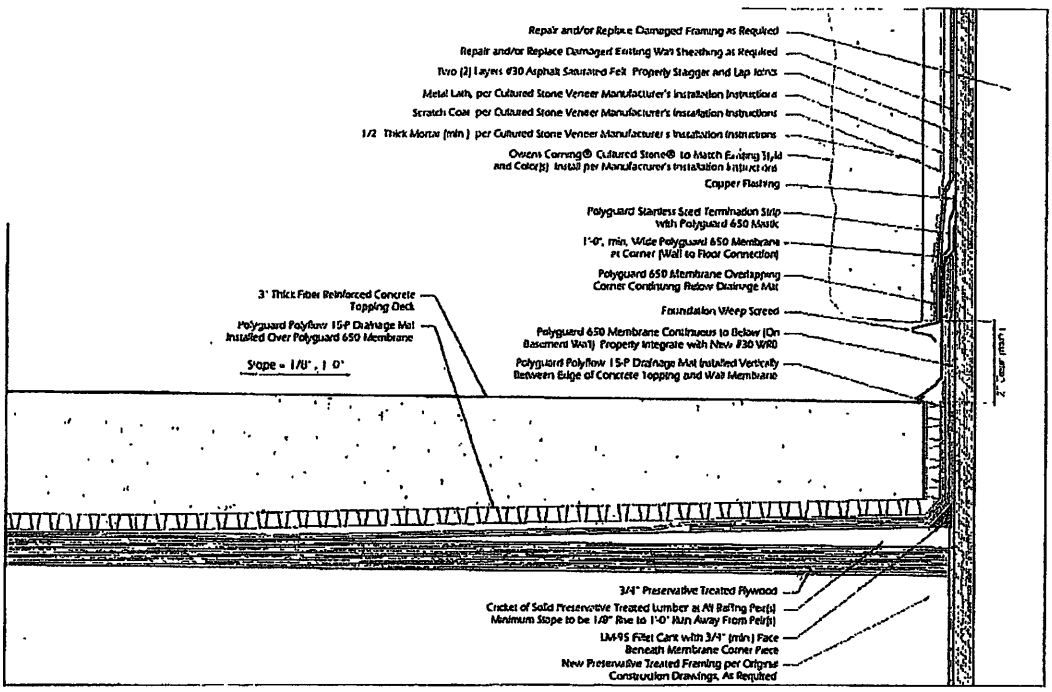
1 Section Detail
A2 Balcony Floor to Wall Intersection at Lapped Siding
Scale: 1" = 0"

CSE Construction Science and Engineering, Inc.	237 01 Stoneledge at Lake Keowee	
	Repair Detail	A2
	January 24, 2011	


or Replace Damaged Framing as Required.
for Replace Damaged Existing Wall Sheathing as Required
#30 Asphalt Saturated Felt, Properly Stagger and Lap Joints.
per Cultured Stone Veneer turer's Installation Instructions.
per Cultured Stone Veneer turer's Installation Instructions.
(min.), per Cultured Stone turer's Installation Instructions
Copper Flashing
Stainless Steel Termination Strip with Polyguard 650 Mastic
Polyguard 650 Membrane (Wall to Floor Connection)
650 Membrane Overlapping tinuing Below Drainage Mat
Foundation Weep Screed
650 Membrane Continuous (On Basement Wall) Properly integrate with New #30 WRB
Polyflow 15-P Drainage Mat Vertically Between Edge of Topping and Wall Membrane
reed Concrete Topping Deck
= 1/8" : 1'-0"
7" Clear (min.)
Preservative Treated Plywood
Polyflow 15-P Drainage Mat er Polyguard 650 Membrane.
et Cant with 3/4" (min.) Face ooth Membrane Corner Piece
ervative Treated Framing per ction Drawings, As Required
to Wall Intersection at Cultured Stone Veneer
Scale: 1" = 6"
237 01 Stoneledge at Lake Keowee
Repair Detail
January 24, 2011
A3

02924

New Preservative Treated Framing per Original Construction Drawings As Required
Repair and/or Replace Stained Tongue and Groove Wood Ceiling as Required to Match Existing Profile and Color
Closed Cell Backer Rod and Continuous Urethane Sealant
Casing Bead, per Cultured Stone Veneer Manufacturer's Installation Instructions
Owens Corning® Cultured Stone® to Match Existing Style and Color(s) Install per Manufacturer's Installation Instructions
Polyguard 650 Membrane Continuous from Above Porch Floor Framing Continue Over Two (2) Layers #30 Asphalt Saturated Felt with 6" Min. Lap
Two (2) Layers #30 Asphalt Saturated Felt Properly Stagger and Lap Joints
Metal Lath, per Cultured Stone Veneer Manufacturer's Installation Instructions
Scratch Coat, per Cultured Stone Veneer Manufacturer's Installation Instructions
1/2" Thick Mortar (min.), per Cultured Stone Veneer Manufacturer's Installation Instructions
Repair and/or Replace Damaged Existing Wall Sheathing as Required
Repair and/or Replace Damaged Framing as Required
9" (min.)
1 A4 Section Detail
Balcony to Post/Column Intersection at Ceiling Below Balcony
Scale: 1" = 6"
237.01 Stonelegge at Lake Keowee
Repair Detail
January 24, 2011
A4
CSE



A5 Section Detail
Balcony Floor to Post/Column Intersection (Slope Towards Post) Scale 1" = 6"

237.01 Stonelodge at Lake Keowee
Repair Detail
January 24, 2011
A5

Construction Science and Engineering, Inc.
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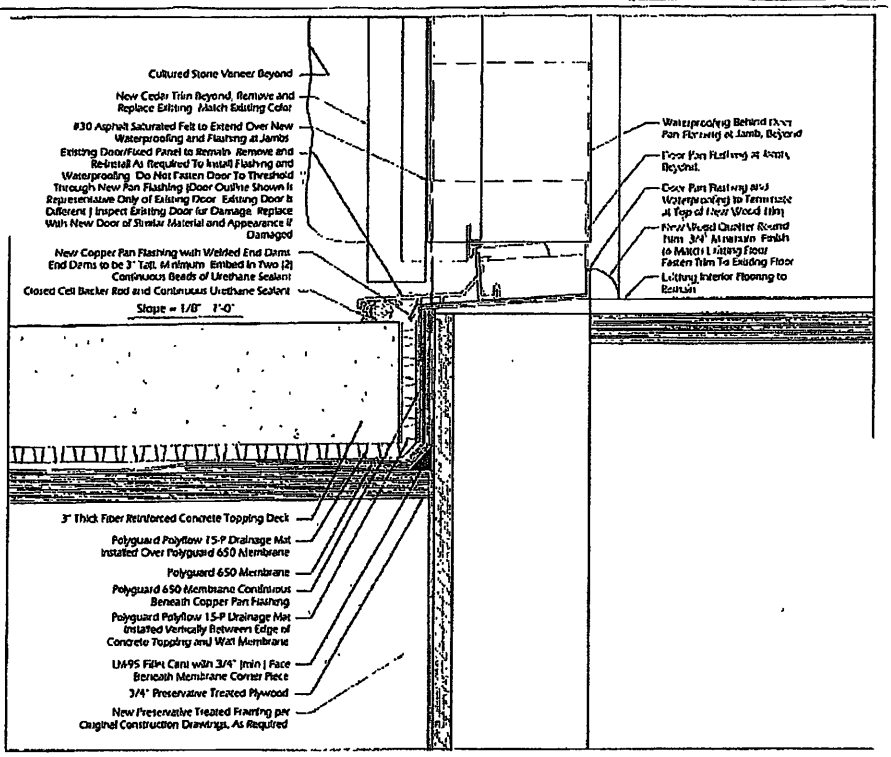
Polyguard 650 Membrane Over Felt
Repair and/or Replace Damaged Existing Wall Sheathing as Required
Two (2) Layers #30 Asphalt Saturated Felt Properly Stagger and Lap Joints
Metal Lath, per Cultured Stone Veneer Manufacturer's Installation Instructions
Scratch Coat, per Cultured Stone Veneer Manufacturer's Installation Instructions
1/2" Thick Mortar (min.), per Cultured Stone Veneer Manufacturer's Installation Instructions
Owens Corning® Cultured Stone® to Match Existing Style and Color(s) Install per Manufacturer's Installation Instructions
Wall Veneer Beyond
New Preservative Treated Framing per Original Construction Drawings, As Required
Repair and/or Replace Stained Tongue and Groove Wood Ceiling as Required to Match Existing Profile and Color
Closed Cell Backer Rod and Sealant
Casing Bead, per Cultured Stone Veneer Manufacturer's Installation Instructions
Owens Corning® Cultured Stone® to Match Existing Style and Color(s) Install per Manufacturer's Installation Instructions
Polyguard 650 Membrane Continuous from Above Porch Floor Framing Continue Over Two (2) Layers #30 Asphalt Saturated Felt with 6" Min. Lap
Two (2) Layers #30 Asphalt Saturated Felt Properly Stagger and Lap Joints
Metal Lath, per Cultured Stone Veneer Manufacturer's Installation Instructions
Scratch Coat, per Cultured Stone Veneer Manufacturer's Installation Instructions
1/2" Thick Mortar (min.), per Cultured Stone Veneer Manufacturer's Installation Instructions
6" (min.)
A6
Section Detail
Balcony to Exterior Wall Intersection at Ceiling Below Balcony
Scale: 1" = 6"
237 01 Stoneledge at Lake Keowee
Repair Detail
January 24, 2011
A6
CSE

New Railing to Match Existing Material and Color Slope All Surfaces to Drain
Slope = 1/8" : 1'-0"
3" Thick Fiber Reinforced Concrete Topping Deck
Polyguard Polyflow 15-F Drainage Mat Installed Over Polyguard 650 Membrane
Polyguard Polyflow 15-F Drainage Mat Installed Vertically Behind Cultured Stone Veneer
Formed Edge at Concrete
3/4" Formed Drip Edge at Concrete
Color-I Cell Backer Rod and Continuous Urethane Sealant
Chamfer Corner of Framing/Plywood Where Waterproofing Membrane Continues over Edge onto Wall
Polyguard 650 Membrane Continuous Over Corner
Polyguard 650 Membrane Over Fee
Repair and/or Replace Damaged Existing Wall Sheathing as Required
Two (2) Layers #30 Asphalt Saturated Felt Properly Stagger and Lap Joints
Metal Lath, per Cultured Stone Veneer Manufacturer's Installation Instructions
Scratch Coat, per Cultured Stone Veneer Manufacturer's Installation Instructions
1/2" Thick Mortar (min.), per Cultured Stone Veneer Manufacturer's Installation Instructor
Owens Corning® Cultured Stone® to Match Existing Style and Color(s) Install per Manufacturer's Installation Instructions
Wall Veneer Beyond
3/4" Preservative Treated Plywood
New Preservative Treated Framing per Original Construction Drawings As Required
Section Detail
Balcony Floor Edge at Low Slope
Scale: 1" = 1'
257 01 Stoneledge at Lake Neowee
Repair Detail
January 24, 2011
A7
CSE



A8 Section Detail
Patio Door Threshold

Scale, 1" = 6"

237.01 Stoneledge at Lake Keowee
Repair Detail
January 24, 2011

A8

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02929

1 Prepare rough opening as required to apply all new flashing and waterproofing materials

2 Install Polyguard LM-95 fillet cant with 3/4" (min.) face at corner of floor/wall framing

3 Install Polyguard 650 membrane (1'-0" wide min.) at corner of floor/wall

4 Install Polyguard 650 membrane per manufacturer's installation instructions over floor, continuing up wall

5, Install Polyguard Polyflow 15-P Drainage Mat per manufacturer's installation instructions over floor membrane

6 Install new wood trim at interior side of door frame

7 Install Polyguard preformed corners at threshold corners per manufacturer's installation instructions

8 Install Polyguard 650 membrane at rough opening threshold per manufacturer's installation instructions. Continue up vertical edge of interior trim to top of rim

9 Install Polyguard Polyflow 15-P Drainage Mat per manufacturer's installation instructions on vertical face wall and below door threshold

10 Install new 3" thick fiber reinforced concrete topping deck. Slope 1/8". 1'-0" (min.) away from rear exterior wall

11, Install new copper door pan flashing with welded end dams over two continuous beads of urethane sealant at threshold. Seal drip edge to concrete using a continuous bead of urethane sealant

12 Install new copper flashing at base of wall. Seal drip edge to concrete using a continuous bead of urethane sealant

13 Install Polyguard 650 membrane (6" min.) over top edge of all copper flashing

14 Install #30 Asphalt saturated felt on walls and into rough opening as required. Lap over Polyguard 650 membrane

15 Re-install existing door/fixed panel. Do not fasten door through new door pan flashing at threshold

16 Install new closed cell backer rod and continuous urethane sealant under door threshold. Seal to concrete

Installation Method
Patio Door Threshold

Scale: 1" = 6"

257.01 Stonebridge at Lake Keowee
Repair Detail
January 24, 2011

A9

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319 East Main Street
Easley, South Carolina 29640
T 864 847 1945
www.constructionscience.org

02930

1 Prepare framing as required to apply all new flashing and waterproofing materials Chamfer edge of plywood subfloor

2 Install new cricket at pier(s). Cricket to be constructed using preservative treated wood

3 Install two (2) layers of #30 asphalt saturated felt on walls and columns below opening between piers.

4 Install Polyguard 650 membrane per manufacturer's installation instructions over top edge of #30 asphalt saturated felt (6" min.)

5 Install Polyguard preformed corners at exterior corner per manufacturer's installation instructions

6 Install Polyguard 650 membrane per manufacturer's installation instructions lapped preformed exterior corner

7 Install Polyguard preformed corner at interior corner per manufacturer's installation instructions lapped over membrane

8 Install Polyguard 650 membrane over floor per manufacturer's installation instructions Continue down vertical edge onto wall Lap with other waterproofing

9 Install Polyguard LM-95 fillet cant with 3/4" (min.) face at corner of floor/pier over other waterproofing

10 Install Polyguard Polyflow 15-P Drainage Mat per manufacturer's installation instructions over floor membrane

11 Install Polyguard Polyflow 15-P Drainage Mat per manufacturer's installation instructions on vertical face(s) of pier

12 Install new 3" thick fiber reinforced concrete topping deck Form edge and drip

13 Install new copper flashing with hemmed edge at base of pier Seal drip edge to concrete using a continuous bead of urethane sealant

14 Install #30 asphalt saturated felt on walk, pier and column as required Lap over copper flashing

15 Install Polyguard Polyflow 15 P Drainage Mat per manufacturer's installation instructions on vertical face(s) of wall below concrete topping deck

16 Install new Owens Corning® Cultured Stone® per manufacturer's installation instructions

A10 Installation Method
Waterproofing at Low Slope Edge of Concrete Patio and Pier

Scale: 1" = 6"

237 01 Stoneledge at Lake Keowee
Repair Detail
January 24, 2011
A10

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stall two (2) layers of #30 asphalt saturated
on walls and columns between opening
ween piers

4. Install Polyguard 650 membrane per manufacturer's installation instructions over top edge of #30 asphalt saturated felt (6" min.)

stall Polyguard LM-95 fillet cant with 3/4"
) face at corner of floor/pier over other
rproofing

8. Install Polyguard 650 membrane over floor per manufacturer's installation instructions. Continue through vertical edge onto wall and up pier at
(typ.) Lap with other waterproofing.

stall new 3" thick fiber reinforced concrete
ng deck. Form edge and dam

12. Install new copper flashing with hemmed edge at base of pier. Seal top edge to concrete using a continuous bead of urethane sealant.

Type of Concrete Patio and Pier — Scale: 1" = 1'

CSE

Construction Services
and Engineering, Inc.

237.01 Stonebridge at Lake Keowee

Repair Demo

January 24, 2011

A11

02932

02933

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FOR ONE- AND TWO-FAMILY DWELLINGS

2006

02934

SECTION R315
FLAME SPREAD AND SMOKE DENSITY

R315.1 Wall and ceiling. Wall and ceiling finishes shall have a flame-spread classification of not greater than 200.

Exception: Flame-spread requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than $^1/_{28}$ inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials have a flame-spread characteristic no greater than paper of this thickness cemented to a noncombustible backing.

R315.2 Smoke-developed index. Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

R315.3 Testing. Tests shall be made in accordance with ASTM E 84.

R315.4 Alternate test method. As an alternate to having a flame-spread classification of not greater than 200 and a smoke developed index of not greater than 450 when tested in accordance with ASTM E 84, wall and ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

During the 40 kW exposure, the interior finish shall comply with Item 1. During the 160 kW exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Item 3.

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. During the 160 kW exposure, the interior finish shall comply with the following:
   2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
   2.2. Flashover, as defined in NFPA 286, shall not occur.
3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m².

SECTION R316
INSULATION

R316.1 Insulation. Insulation materials, including facings, such as vapor retarders or vapor permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame-spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84.

Exceptions:

1. When such materials are installed in concealed spaces, the flame-spread and smoke-developed limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. Cellulose loose-fill insulation, which is not spray applied, complying with the requirements of Section R316.3, shall only be required to meet the smoke-developed index of not more than 450.

R316.2 Loose-fill insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Sections R316.1 and R316.4 when tested in accordance with CAN/ULC S102.2.

Exception: Cellulose loose-fill insulation shall not be required to comply with the flame spread index requirement of CAN/ULC S102.2, provided such insulation complies with the requirements of Section R316.3.

R316.3 Cellulose loose-fill insulation. Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Parts 1209 and 1404.

R316.4 Exposed attic insulation. All exposed insulation materials installed on attic floors shall have a critical radiant flux not less than 0.12 watt per square centimeter.

R316.5 Testing. Tests for critical radiant flux shall be made in accordance with ASTM E 970.

SECTION R317
DWELLING UNIT SEPARATION

R317.1 Two-family dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than a 1-hour fire-resistance rating when tested in accordance with ASTM E 119. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend to the underside of the roof sheathing.

Exceptions:

1. A fire-resistance rating of $^1/_2$ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.
2. Wall assemblies need not extend through attic spaces when the ceiling is protected by not less than $^5/_8$-inch (15.9 mm) Type X gypsum board and an attic draft stop constructed as specified in Section R502.12.1 is provided above and along the wall assembly separating the dwellings. The structural framing supporting the ceiling shall also be protected by not less than $^1/_2$-inch (12.7 mm) gypsum board or equivalent.

R317.1.1 Supporting construction. When floor assemblies are required to be fire-resistance-rated by Section R317.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

R317.2 Townhouses. Each townhouse shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302 for exterior walls.

Exception: A common 2-hour fire-resistance-rated wall is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the

cavity of the common wall. Electrical installations shall be installed in accordance with Chapters 33 through 42. Penetrations of electrical outlet boxes shall be in accordance with Section R317.3.

R317.2.1 Continuity. The fire-resistance-rated wall or assembly separating townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed accessory structures.

R317.2.2 Parapets. Parapets constructed in accordance with Section R317.2.3 shall be constructed for townhouses as an extension of exterior walls or common walls in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

   Exception: A parapet is not required in the two cases above when the roof is covered with a minimum class C roof covering, and the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of $^5/_8$-inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 feet (1220 mm) on each side of the wall or walls.
3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall have not less than a 1-hour fire-resistence rating. The wall shall be rated for exposure from both sides.

R317.2.3 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counterflashing and coping materials. Where the roof slopes toward a parapet at slopes greater than two units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (914 mm), but in no case shall the height be less than 30 inches (762 mm).

R317.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouses separated by a common 2-hour fire-resistance-rated wall as provided in Section R317.2.

R317.3 Rated penetrations. Penetrations of wall or floor/ceiling assemblies required to be fire-resistance rated in accordance with Section R317.1 or R317.2 shall be protected in accordance with this section.

R317.3.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R317.3.1.1 or R317.3.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:

1. In concrete or masonry wall or floor assemblies where the penetrating item is a maximum 6 inches (152 mm) nominal diameter and the area of the opening through the wall does not exceed 144 square inches (92 900 mm^2), concrete, grout or mortar is permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating.
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire resistance rating of the construction penetrated.

R317.3.1.1 Fire-resistance-rated assembly. Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

R317.3.1.2 Penetration firestop system. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor/ceiling assembly penetrated.

R317.3.2 Membrane penetrations. Membrane penetrations shall comply with Section R317.3.1. Where walls are required to have a fire-resistance rating, recessed fixtures

TABLE R404.4(2)
7.5-INCH-THICK FLAT ICF FOUNDATION WALLS[a, b, c, d, e]

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[f] (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING		
		Soil classes[a] and design lateral soil load (psf per foot of depth)		
		GW, GP, SW and SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	6	N/R	N/R	#3@6″; #4@12″; #5@18″; #6@24″
	7	N/R	#3@8″; #4@14″; #5@20″; #6@28″	#3@6″; #4@10″; #5@16″; #6@20″
9	6	N/R	N/R	#3@8″; #4@14″; #5@20″; #6@28″
	7	N/R	#3@6″; #4@12″; #5@18″; #6@26″	#3@4″; #4@8″; #5@14″; #6@18″
	8	#3@8″; #4@14″; #5@22″; #6@28″	#3@4″; #4@8″; #5@14″; #6@18″	#3@4″; #4@6″; #5@10″; #6@14″
10	6	N/R	N/R	#3@6″; #4@12″; #5@18″; #6@26″
	7	N/R	#3@6″; #4@12″; #5@18″; #6@24″	#3@4″; #4@8″; #5@12″; #6@18″
	8	#3@6″; #4@12″; #5@20″; #6@26″	#3@4″; #4@8″; #5@12″; #6@16″	#3@4″; #4@6″; #5@8″; #6@12″
	9	#3@6″; #4@10″; #5@14″; #6@20″	#3@4″; #4@6″; #5@10″; #6@12″	#4@4″; #5@6″; #6@10″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa.

a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.

b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.

c. N/R denotes "not required."

d. Deflection criteria: $L/240$.

e. Interpolation between rebar sizes and spacing is not permitted.

f. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.

The sump shall be at least 24 inches (610 mm) in diameter or 20 inches square (0.0129 m²), shall extend at least 24 inches (610 mm) below the bottom of the basement floor and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge into an approved sewer system or to daylight.

SECTION R406
FOUNDATION WATERPROOFING AND DAMPPROOFING

R406.1 Concrete and masonry foundation dampproofing. Except where required by Section R406.2 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below grade shall be dampproofed from the top of the footing to the finished grade. Masonry walls shall have not less than $^3/_8$ inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

1. Bituminous coating.
2. 3 pounds per square yard (1.63 kg/m²) of acrylic modified cement.
3. 1/8-inch (3.2 mm) coat of surface-bonding cement complying with ASTM C 887.
4. Any material permitted for waterproofing in Section R406.2.
5. Other approved methods or materials.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

Concrete walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below grade shall be waterproofed from the top of the footing to the finished grade. Walls shall be waterproofed in accordance with one of the following:

1. 2-ply hot-mopped felts.
2. 55 pound (25 kg) roll roofing.
3. 6-mil (0.15 mm) polyvinyl chloride.
4. 6-mil (0.15 mm) polyethylene.
5. 40-mil (1 mm) polymer-modified asphalt.

TABLE R404.4(3)
9.5-INCH-THICK FLAT ICF FOUNDATION WALLS[a, b, c, d, e]

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[f] (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING		
		Soil classes[g] and design lateral soil load (psf per foot of depth)		
		GW, GP, SW and SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	7	N/R	N/R	N/R
9	6	N/R	N/R	N/R
	7	N/R	N/R	#3@6″; #4@12″; #5@18″; #6@26″
	8	N/R	#3@6″; #4@12″; #5@18″; #6@26″	#3@4″; #4@8″; #5@14″; #6@18″
10	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	N/R	#3@6″; #4@10″; #5@18″; #6@24″
	8	N/R	#3@6″; #4@12″; #5@16″; #6@24″	#3@4″; #4@8″; #5@12″; #6@16″
	9	#3@4″; #4@10″; #5@14″; #6@20″	#3@4″; #4@8″; #5@12″; #6@18″	#3@4″; #4@6″; #5@10″; #6@12″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa.

a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.

b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.

c. N/R denotes "not required."

d. Deflection criteria: $L/240$.

e. Interpolation between rebar sizes and spacing is not permitted.

f. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.

g. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.

6. 60-mil (1.5 mm) flexible polymer cement.
7. $^1/_8$ inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. 60-mil (0.22 mm) solvent-free liquid-applied synthetic rubber.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to type C of ASTM D 449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

R406.3 Dampproofing for wood foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be dampproofed in accordance with Sections R406.3.1 through R406.3.4.

R406.3.1 Panel joint sealed. Plywood panel joints in the foundation walls shall be sealed full length with a caulking compound capable of producing a moisture-proof seal under the conditions of temperature and moisture content at which it will be applied and used.

R406.3.2 Below-grade moisture barrier. A 6-mil-thick (0.15 mm) polyethylene film shall be applied over the below-grade portion of exterior foundation walls prior to backfilling. Joints in the polyethylene film shall be lapped 6 inches (152 mm) and sealed with adhesive. The top edge of the polyethylene film shall be bonded to the sheathing to form a seal. Film areas at grade level shall be protected from mechanical damage and exposure by a pressure preservatively treated lumber or plywood strip attached to the wall several inches above finish grade level and extending approximately 9 inches (229 mm) below grade. The joint between the strip and the wall shall be caulked full length prior to fastening the strip to the wall. Other coverings appropriate to the architectural treatment may also be used. The polyethylene film shall extend down to the bottom of the wood footing plate but shall not overlap or extend into the gravel or crushed stone footing.

R406.3.3 Porous fill. The space between the excavation and the foundation wall shall be backfilled with the same material used for footings, up to a height of 1 foot (305 mm) above the footing for well-drained sites, or one-half the total back-fill height for poorly drained sites. The porous fill shall be covered with strips of 30-pound (13.6 kg) asphalt paper or 6-mil (0.15 mm) polyethylene to permit water seepage while avoiding infiltration of fine soils.

2.4. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate: control joints in the exterior wall envelope; joints at the perimeter of openings penetration; or intersections of terminations with dissimilar materials.

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: Omission of the water-resistive barrier is permitted in the following situations:

1. In detached accessory buildings.
2. Under exterior wall finish materials as permitted in Table R703.4.
3. Under paperbacked stucco lath when the paper backing is an approved weather-resistive sheathing paper.

R703.3 Wood, hardboard and wood structural panel siding.

R703.3.1 Panel siding. Joints in wood, hardboard or wood structural panel siding shall be made as follows unless otherwise approved. Vertical joints in panel siding shall occur over framing members, unless wood or wood structural panel sheathing is used, and shall be shiplapped or covered with a batten. Horizontal joints in panel siding shall be lapped a minimum of 1 inch (25 mm) or shall be shiplapped or shall be flashed with Z-flashing and occur over solid blocking, wood or wood structural panel sheathing.

R703.3.2 Horizontal siding. Horizontal lap siding shall be lapped a minimum of 1 inch (25 mm), or 0.5 inch (13 mm) if rabbeted, and shall have the ends caulked, covered with a batten, or sealed and installed over a strip of flashing.

R703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table R703.4 or with other approved aluminum, stainless steel, zinc-coated or other approved corrosion-resistive fasteners. Where the basic wind speed per Figure R301.2(4) is 110 miles per hour (49 m/s) or higher, the attachment of wall coverings shall be designed 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).

R703.5 Wood shakes and shingles. Wood shakes and shingles shall conform to CSSB *Grading Rules for Wood Shakes and Shingles.*

R703.5.1 Application. Wood shakes or shingles shall be applied either single-course or double-course over nominal $^1/_2$-inch (13 mm) wood-based sheathing or to furring strips over $^1/_2$-inch (13 mm) nominal nonwood sheathing . A permeable water-resistive barrier shall be provided over all sheathing, with horizontal overlaps in the membrane of not less than 2 inches (51mm) and vertical overlaps of not less than 6 inches (152 mm). Where furring strips are used, they shall be 1 inch by 3 inches or 1 inch by 4 inches (25 mm by 76 mm or 25 mm by 102 mm) and shall be fastened horizontally to the studs with 7d or 8d box nails and shall be spaced a distance on center equal to the actual weather exposure of the shakes or shingles, not to exceed the maximum exposure specified in Table R703.5.2. The spacing between adjacent shingles to allow for expansion shall not exceed $^1/_4$ inch (6 mm), and between adjacent shakes, it shall not exceed $^1/_2$ inch (13 mm). The offset spacing between joints in adjacent courses shall be a minimum of $1^1/_2$ inches (38 mm).

R703.5.2 Weather exposure. The maximum weather exposure for shakes and shingles shall not exceed that specified in Table R703.5.2.

R703.5.3 Attachment. Each shake or shingle shall be held in place by two hot-dipped zinc-coated, stainless steel, or aluminum nails or staples. The fasteners shall be long enough to penetrate the sheathing or furring strips by a minimum of $^1/_2$ inch (13 mm) and shall not be overdriven.

R703.5.3.1 Staple attachment. Staples shall not be less than 16 gage and shall have a crown width of not less than $^7/_{16}$ inch (11 mm), and the crown of the staples shall be parallel with the butt of the shake or shingle. In single-course application, the fasteners shall be concealed by the course above and shall be driven approximately 1 inch (25 mm) above the butt line of the succeeding course and $^3/_4$ inch (19 mm) from the edge. In double-course applications, the exposed shake or shingle shall be face-nailed with two casing nails, driven approximately 2 inches (51 mm) above the butt line and $^3/_4$ inch (19 mm) from each edge. In all applications, staples shall be concealed by the course above. With shingles wider than 8 inches (203 mm) two additional nails shall be required and shall be nailed approximately 1 inch (25 mm) apart near the center of the shingle.

R703.5.4 Bottom courses. The bottom courses shall be doubled.

R703.6 Exterior plaster. Installation of these materials shall be in compliance with ASTM C 926 and ASTM C 1063 and the provisions of this code.

R703.6.1 Lath. All lath and lath attachments shall be of corrosion-resistant materials. Expanded metal or woven wire lath shall be attached with $1^1/_2$-inch-long (38 mm), 11 gage nails having a $^7/_{16}$-inch (11.1 mm) head, or $^7/_8$-inch-long (22.2 mm), 16 gage staples, spaced at no more than 6 inches (152 mm), or as otherwise approved.

R703.6.2 Plaster. Plastering with portland cement plaster shall be not less than three coats when applied over metal lath or wire lath and shall be not less than two coats when applied over masonry, concrete, pressure-preservative treated wood or decay-resistant wood as specified in Section R319.1 or gypsum backing. If the plaster surface is completely covered by veneer or other facing material or is completely concealed, plaster application need be only two coats, provided the total thickness is as set forth in Table R702.1(1).

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL		NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b,c,d]					
					Wood or wood structural panel sheathing	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Horizontal aluminum[e]	Without insulation	0.019[f]	Lap	Yes	0.120 nail 1½" long	0.120 nail 2" long	0.120 nail 2" long	0.120 nail[y]	Not allowed	Same as stud spacing
		0.024	Lap	Yes	0.120 nail 1½" long	0.120 nail 2" long	0.120 nail 2" long	0.120 nail[y]	Not allowed	
	With insulation	0.019	Lap	Yes	0.120 nail 1½" long	0.120 nail 2½" long	0.120 nail 2½" long	0.120 nail[y]	0.120 nail 1½" long	
Brick veneer[z] Concrete masonry veneer[z]		2 2	Section R703	Yes (Note l)	See Section R703 and Figure R703.7[z]					
Hardboard[k] Panel siding-vertical		7/16	—	Yes	Note n	Note n	Note n	Note n	Note n	6" panel edges 12" inter. sup.[o]
Hardboard[k] Lap-siding-horizontal		7/16	Note q	Yes	Note p	Note p	Note p	Note p	Note p	Same as stud spacing 2 per bearing
Steel[h]		29 ga.	Lap	Yes	0.113 nail 1¾" Staple–1¾"	0.113 nail 2¼" Staple–2½"	0.113 nail 2½" Staple–2¼"	0.113 nail[y] Staple[y]	Not allowed	Same as stud spacing
Stone veneer		2	Section R703	Yes (Note l)	See Section R703 and Figure R703.7[z]					
Particleboard panels		3/8 – 1/2	—	Yes	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	box nail[y]	6d box nail (2" × 0.099"), 3/8 not allowed	6" panel edge, 12" inter. sup.
		5/8	—	Yes	6d box nail (2" × 0.099")	8d box nail (2½" × 0.113")	8d box nail (2½" × 0.113")	box nail[y]	6d box nail (2" × 0.099")	
Plywood panel[j] (exterior grade)		3/8	—	Yes	0.099 nail–2"	0.113 nail–2½"	0.099 nail–2"	0.113 nail[y]	0.099 nail–2"	6" on edges, 12" inter. sup.
Vinyl siding[m]		0.035	Lap	Yes	0.120 nail 1½" Staple–1¾"	0.120 nail 2" Staple–2½"	0.120 nail 2" Staple–2½"	0.120 nail[y] Staple[y]	Not allowed	Same as stud spacing
Wood[l] rustic, drop		3/8 Min	Lap	Yes	Fastener penetration into stud–1"				0.113 nail–2½" Staple–2"	Face nailing up to 6" widths, 1 nail per bearing; 8" widths and over, 2 nails per bearing
Shiplap		19/32 Average	Lap	Yes						
Bevel		7/16								
Butt tip		3/16	Lap	Yes						
Fiber cement panel siding[r]		5/16	Note s	Yes Note x	6d corrosion-resistant nail[t]	6d corrosion-resistant nail[t]	6d corrosion-resistant nail[t]	6d corrosion-resistant nail[t,v]	4d corrosion-resistant nail[u]	6" o.c. on edges, 12" o.c. on intermed. studs
Fiber cement lap siding[r]		5/16	Note v	Yes Note x	6d corrosion-resistant nail[t]	6d corrosion-resistant nail[t]	6d corrosion-resistant nail[t]	6d corrosion-resistant nail[t,v]	6d corrosion-resistant nail[w]	Note w

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of 7/16-inch outside diameter and be manufactured of minimum 16 gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs for fiberboard or gypsum backing.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.

(continued)

Footnotes to Table R703.4—continued

i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^1/_2$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.

j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^1/_2$ inches into studs, studs and wood sheathing combined, or blocking. A weather-resistive membrane shall be installed weatherboard fashion under the vertical siding unless the siding boards are lapped or battens are used.

k. Hardboard siding shall comply with AHA A135.6.

l. For masonry veneer, a weather-resistive sheathing paper is not required over a sheathing that performs as a weather-resistive barrier when a 1-inch air space is provided between the veneer and the sheathing. When the 1-inch space is filled with mortar, a weather-resistive sheathing paper is required over studs or sheathing.

m. Vinyl siding shall comply with ASTM D 3679.

n. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.

o. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.

p. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.

q. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.

r. Fiber cement siding shall comply with the requirements of ASTM C 1186.

s. See Section R703.10.1.

t. Minimum 0.102" smooth shank, 0.255" round head.

u. Minimum 0.099" smooth shank, 0.250" round head.

v. See Section R703.10.2.

w. Face nailing: 2 nails at each stud. Concealed nailing: one 11 gage $1^1/_2$ galv. roofing nail (0.371" head diameter, 0.120" shank) or 6d galv. box nail at each stud.

x. See Section R703.2 exceptions.

y. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.

z. Adhered masonry veneer shall comply with the requirements in Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS-402.

TABLE R703.6.2
MAXIMUM WEATHER EXPOSURE FOR WOOD SHAKES AND SHINGLES ON EXTERIOR WALLS[a,b,c]
(Dimensions are in inches)

LENGTH	EXPOSURE FOR SINGLE COURSE	EXPOSURE FOR DOUBLE COURSE
Shingles[a]		
16	$7^1/_2$	12[b]
18	$8^1/_2$	14[c]
24	$11^1/_2$	16
Shakes[a]		
18	$8^1/_2$	14
24	$11^1/_2$	18

For SI: 1 inch = 25.4 mm.

a. Dimensions given are for No. 1 grade.

b. A maximum 10-inch exposure is permitted for No. 2 grade.

c. A maximum 11-inch exposure is permitted for No. 2 grade.

On wood-frame construction with an on-grade floor slab system, exterior plaster shall be applied to cover, but not extend below, lath, paper and screed.

The proportion of aggregate to cementitious materials shall be as set forth in Table R702.1(3).

R703.6.2.1 Weep screeds. A minimum 0.019-inch (0.5 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed or plastic weep screed, with a minimum vertical attachment flange of $3^1/_2$ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C 926. The weep screed shall be placed a minimum of 4 inches (102 mm) above the earth or 2 inches (51 mm) above paved areas and shall be of a type that will allow trapped water to drain to the exterior of the building. The weather-resistant barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

R703.6.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60 minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

R703.7 Stone and masonry veneer, general. Stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4 and Figure R703.7. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first story above-grade and shall not exceed 5 inches (127 mm) in thickness.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation. Wall bracing at exterior and interior braced wall lines shall be in accordance with Section R602.10 or R603.7, and the additional requirements of Table R703.7(1).
2. For detached one- or two-family dwellings in Seismic Design Categories D_0, D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation. Wall bracing and hold downs at exterior and interior braced wall lines shall be in accordance with Sections R602.10 and R602.11 and the additional requirements of Table R703.7(2). In Seismic Design Categories D_0, D_1 and D_2, cripple walls shall not be permitted, and required interior braced wall lines shall be supported on continuous foundations.

R703.7.1 Interior veneer support. Veneers used as interior wall finishes shall be permitted to be supported on wood or cold-formed steel floors that are designed to support the loads imposed.

R703.7.2 Exterior veneer support. Except in Seismic Design Categories D_0, D_1 and D_2, exterior masonry veneers having an installed weight of 40 pounds per square foot (195 kg/m^2) or less shall be permitted to be supported on wood or cold-formed steel construction. When masonry veneer supported by wood or cold-formed steel construction adjoins masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the wood or cold-formed steel construction and the veneer supported by the foundation. The wood or cold-formed steel construction supporting the masonry veneer shall be designed to limit the deflection to $^1/_{600}$ of the span for the supporting members. The design of the wood or cold-formed steel construction shall consider the weight of the veneer and any other loads.

R703.7.2.1 Support by steel angle. A minimum 6 inches by 4 inches by $^5/_{16}$ inch (152 mm by 102 mm by 8 mm) steel angle, with the long leg placed vertically, shall be anchored to double 2 inches by 4 inches (51 mm by 102 mm) wood studs at a maximum on-center spacing of 16 inches (406 mm). Anchorage of the steel angle at every double stud spacing shall be a minimum of two $^7/_{16}$ inch

TABLE R703.7(1)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, WOOD OR STEEL FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

SEISMIC DESIGN CATEGORY	NUMBER OF WOOD OR STEEL FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION[a] (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)[b]	WOOD OR STEEL FRAMED STORY	MINIMUM SHEATHING AMOUNT (percent of braced wall line length)[c]
A or B	Steel: 1 or 2 Wood: 1, 2 or 3	30	5	50	all	Table R602.10.1 or Table R603.7
C	1	30	5	50	1 only	Table R602.10.1 or Table R603.7
	2	30	5	50	top	Table R602.10.1 or Table R603.7
					bottom	1.5 times length required by Table R602.10.1 or 1.5 times length required by Table R603.7
	Wood only: 3	30	5	50	top	Table R602.10.1
					middle	1.5 times length required by Table R602.10.1
					bottom	1.5 times length required by Table R602.10.1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa.

a. An Additional 8 feet is permitted for gable end walls. See also story height limitations of Section R301.3.

b. Maximum weight is installed weight and includes weight of mortar, grout, lath and other materials used for installation. Where veneer is placed on both faces of a wall, the combined weight shall not exceed that specified in this table.

c. Applies to exterior and interior braced wall lines.

TABLE R703.7(2)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, ONE- AND TWO-FAMILY DETACHED DWELLINGS, WOOD FRAMING, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2

SEISMIC DESIGN CATEGORY	NUMBER OF WOOD FRAMED STORIES[a]	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)[b]	WOOD FRAMED STORY	MINIMUM SHEATHING AMOUNT (percent of braced wall line length)[c]	MINIMUM SHEATHING THICKNESS AND FASTENING	SINGLE STORY HOLD DOWN FORCE (lb)[d]	CUMULATIVE HOLD DOWN FORCE (lb)[e]
D_0	1	20[f]	4	40	1 only	35	$^7/_{16}$-inch wood structural panel sheathing with 8d common nails spaced at 4 inches on center at panel edges, 12 inches on center at intermediate supports. 8d common nails at 4 inches on center at braced wall panel end posts with hold down attached.	N/A	—
	2	20[f]	4	40	top	35		1900	—
					bottom	45		3200	5100
	3	30[g]	4	40	top	40		1900	—
					middle	45		3500	5400
					bottom	60		3500	8900
D_1	1	20[f]	4	40	1 only	45		2100	—
	2	20[f]	4	40	top	45		2100	—
					bottom	45		3700	5800
	3	20[f]	4	40	top	45		2100	—
					middle	45		3700	5800
					bottom	60		3700	9500
D_2	1	20[f]	3	30	1 only	55		2300	—
	2	20[f]	3	30	top	55		2300	—
					bottom	55		3900	6200

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.

a. Cripple walls are not permitted in Seismic Design Categories D_0, D_1 and D_2.

b. Maximum weight is installed weight and includes weight of mortar, grout and lath, and other materials used for installation.

c. Applies to exterior and interior braced wall lines.

d. Hold down force is minimum allowable stress design load for connector providing uplift tie from wall framing at end of braced wall panel at the noted story to wall framing at end of braced wall panel at the story below, or to foundation or foundation wall. Use single story hold down force where edges of braced wall panels do not align; a continuous load path to the foundation shall be maintained. [See Figure R703.7(1)(b)].

e. Where hold down connectors from stories above align with stories below, use cumulative hold down force to size middle and bottom story hold down connectors. [See Figure R703.7(1)(a)].

f. The veneer shall not exceed 20 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls, or 30 feet in height with an additional 8 feet for gable end walls where the lower 10 feet has a backing of concrete or masonry wall. See also story height limitations of Section R301.3.

g. The veneer shall not exceed 30 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls. See also story height limitations of Section R301.3.

(11 mm) diameter by 4 inch (102 mm) lag screws. The steel angle shall have a minimum clearance to underlying construction of $^1/_{16}$ inch (2 mm). A minimum of two-thirds the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer wythe in accordance with Figure R703.7.2.1. The maximum height of masonry veneer above the steel angle support shall be 12 feet, 8 inches (3861 mm). The air space separating the masonry veneer from the wood backing shall be in accordance with Sections R703.7.4 and R703.7.4.2. The method of support for the masonry veneer on wood construction shall be constructed in accordance with Figure R703.7.2.1.

The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum 3 inch × 3 inch × $^1/_4$ inch (76 mm × 76 mm × 6 mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as approved by the building official.

R703.7.2.2 Support by roof construction. A steel angle shall be placed directly on top of the roof construction. The roof supporting construction for the steel angle shall consist of a minimum of three 2-inch by 6-inch (51 mm by 152 mm) wood members. The wood member abutting the vertical wall stud construction shall be anchored with a minimum of three $^5/_8$-inch (16 mm) diameter by 5-inch (127 mm) lag screws to every wood stud spacing. Each additional roof member shall be anchored by the use of two 10d nails at every wood stud spacing. A minimum of two-thirds the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer wythe in accordance with Figure R703.7.2.2. The maximum height of the masonry veneer above the steel angle support shall be 12 feet, 8 inches (3861 mm). The air space separating the masonry veneer from the wood backing shall be in accordance with Sections R703.7.4 and R703.7.4.2. The support for the masonry veneer on wood construction shall be constructed in accordance with Figure R703.7.2.2.

CHAPTER 9
ROOF ASSEMBLIES

SECTION R901
GENERAL

R901.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies.

SECTION R902
ROOF CLASSIFICATION

R902.1 Roofing covering materials. Roofs shall be covered with materials as set forth in Sections R904 and R905. Class A, B or C roofing shall be installed in areas designated by law as requiring their use or when the edge of the roof is less than 3 feet (914 mm) from a property line. Classes A, B and C roofing required to be listed by this section shall be tested in accordance with UL 790 or ASTM E 108. Roof assemblies with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or sheets, and metal sheets and shingles, shall be considered Class A roof coverings.

R902.2 Fire-retardant-treated shingles and shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall also be labeled to identify the classification of the material in accordance with the testing required in Section R902.1, the treating company and the quality control agency.

SECTION R903
WEATHER PROTECTION

R903.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure.

R903.2 Flashing. Flashings shall 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.

R903.2.1 Locations. Flashings shall be installed at wall and roof intersections, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.5 mm) (No. 26 galvanized sheet).

R903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall.

R903.4 Roof drainage. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof. Where required for roof drainage, scuppers shall be placed level with the roof surface in a wall or parapet. The scupper shall be located as determined by the roof slope and contributing roof area.

R903.4.1 Overflow drains and scuppers. Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2 inches (51 mm) above the low point of the roof, or overflow scuppers having three times the size of the roof drains and having a minimum opening height of 4 inches (102 mm) shall be installed in the adjacent parapet walls with the inlet flow located 2 inches (51 mm) above the low point of the roof served. The installation and sizing of overflow drains, leaders and conductors shall comply with the *International Plumbing Code*.

Overflow drains shall discharge to an approved location and shall not be connected to roof drain lines.

R903.5 Hail exposure. Hail exposure, as specified in Sections R903.5.1 and R903.5.2, shall be determined using Figure R903.5.

R903.5.1 Moderate hail exposure. One or more hail days with hail diameters larger than 1.5 inches (38 mm) in a 20-year period.

R903.5.2 Severe hail exposure. One or more hail days with hail diameters larger than or equal to 2.0 inches (51 mm) in a 20-year period.

SECTION R904
MATERIALS

R904.1 Scope. The requirements set forth in this section shall apply to the application of roof covering materials specified herein. Roof assemblies shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof assemblies shall comply with the applicable provisions of Section R905.

R904.2 Compatibility of materials. Roof assemblies shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

R904.3 Material specifications and physical characteristics. Roof covering materials shall conform to the applicable standards listed in this chapter. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved testing agency shall be required by the building official to determine the character, quality and limitations of application of the materials.

R904.4 Product identification. Roof covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels when required.

Bulk shipments of materials shall be accompanied by the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

SECTION R905
REQUIREMENTS FOR ROOF COVERINGS

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. Unless otherwise specified in this section, roof coverings shall 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).

R905.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

R905.2.1 Sheathing requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

R905.2.2 Slope. Asphalt shingles shall be used only 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 R905.2.7.

R905.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226 Type I, ASTM D 4869 Type I, or ASTM D 6757.

Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

R905.2.4 Asphalt shingles. Asphalt shingles shall have self-seal strips or be interlocking, and comply with ASTM D 225 or D 3462.

R905.2.4.1 Wind resistance of asphalt shingles. Asphalt shingles shall be installed in accordance with Section R905.2.6. Shingles classified using ASTM D 3161 are acceptable for use in wind zones less than 110 mph (49 m/s). Shingles classified using ASTM D 3161, Class F, are acceptable for use in all cases where special fastening is required.

R905.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (3 mm)] shank with a minimum $^3/_8$-inch (10 mm) diameter head, ASTM F 1667, of a length to penetrate through the roofing materials and a minimum of $^3/_4$ inch (19 mm) into the roof sheathing. Where the roof sheathing is less than $^3/_4$ inch (19 mm) thick, the fasteners shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer. For normal application, 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 (167 percent slope), special methods of fastening are required. For roofs located where the basic wind speed per Figure R301.2(4) is 110 mph (49 m/s) or higher, special methods of fastening are required. Special fastening methods shall be tested in accordance with ASTM D 3161, Class F. Asphalt shingle wrappers shall bear a label indicating compliance with ASTM D 3161, Class F.

R905.2.7 Underlayment application. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) 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 (51 mm), fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be offset by 6 feet (1829 mm).

R905.2.7.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a 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 lowest edges of all roof surfaces 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.

R905.2.7.2 Underlayment and high wind. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) per Figure R301.2(4)] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

R905.2.8 Flashing. Flashing for asphalt shingles shall comply with this section.

R905.2.8.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with manufacturer's installation instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.5 mm) thickness or mineral surface roll roofing weighing a minimum of 77 pounds per 100 square feet (4 kg/m^2). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.5 mm) thickness.

R905.2.8.2 Valleys. Valley linings shall be installed in accordance with the manufacturer's installation instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valley (valley lining exposed) lined with metal, the valley lining shall be at least 24 inches

(610 mm) wide and of any of the corrosion-resistant metals in Table R905.2.8.2.

2. For open valleys, valley lining of two plies of mineral surfaced roll roofing, complying with ASTM D 3909 or ASTM D 6380 Class M, shall be permitted. The bottom layer shall be 18 inches (457mm) and the top layer a minimum of 36 inches (914 mm) wide.
3. For closed valleys (valley covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 6380 Class S Type III, Class M Type II, or ASTM D 3909 and at least 36 inches wide (914 mm) or valley lining as described in Items 1 and 2 above shall be permitted. Specialty underlayment complying with ASTM D 1970 may be used in lieu of the lining material.

TABLE R905.2.8.2
VALLEY LINING MATERIAL

MATERIAL	MINIMUM THICKNESS (inches)	GAGE	WEIGHT (pounds)
Cold-rolled copper	0.0216 nominal	—	ASTM B 370, 16 oz. per square foot
Lead-coated copper	0.0216 nominal	—	ASTM B 101, 16 oz. per square foot
High-yield copper	0.0162 nominal	—	ASTM B 370, 12 oz. per square foot
Lead-coated high-yield copper	0.0162 nominal	—	ASTM B 101, 12 oz. per square foot
Aluminum	0.024	—	—
Stainless steel	—	28	—
Galvanized steel	0.0179	26 (zinc coated G90)	—
Zinc alloy	0.027	—	—
Lead	—	—	2½
Painted terne	—	—	20

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

R905.2.8.3 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

R905.2.8.4 Sidewall flashing. Flashing against a vertical sidewall shall be by the step-flashing method.

R905.2.8.5 Other flashing. Flashing against a vertical front wall, as well as soil stack, vent pipe and chimney flashing, shall be applied according to the asphalt shingle manufacturer's printed instructions.

R905.3 Clay and concrete tile. The installation of clay and concrete shall comply with the provisions of this section. Clay roof tile shall comply with ASTM C 1167.

R905.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing or spaced structural sheathing boards.

R905.3.2 Deck slope. Clay and concrete roof tile shall be installed on roof slopes of two and one-half units vertical in 12 units horizontal (2½:12) or greater. For roof slopes from two and one-half units vertical in 12 units horizontal (2½:12) to four units vertical in 12 units horizontal (4:12), double underlayment application is required in accordance with Section R905.3.3.

R905.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226 Type II; ASTM D 2626 Type I; or ASTM D 6380 Class M mineral surfaced roll roofing.

R905.3.3.1 Low slope roofs. For roof slopes from two and one-half units vertical in 12 units horizontal (2½:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be a minimum of two layers underlayment 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.

R905.3.3.2 High slope roofs. For roof slopes of four units vertical in 12 units horizontal (4:12) 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 sufficiently in place.

R905.3.3.3 Underlayment and high wind. Underlayment applied in areas subject to high wind [over 110 miles per hour (49 m/s) per Figure R301.2(4)] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

R905.3.4 Tile. Clay roof tile shall comply with ASTM C 1167.

R905.3.5 Concrete tile. Concrete roof tile shall comply with ASTM C 1492.

R905.3.6 Fasteners. Nails shall be corrosion resistant and not less than 11 gage, $^5/_{16}$-inch (11 mm) head, and of sufficient length to penetrate the deck a minimum of $^3/_4$ inch (19 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 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.

R905.3.7 Application. Tile shall be applied in accordance with this chapter and the manufacturer's installation instructions, based on the following:

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

Clay and concrete roof tiles shall be fastened in accordance with this section and the manufacturer's installation instructions. Perimeter tiles shall be fastened with a minimum of one fastener per tile. Tiles with installed weight less than 9 pounds per square foot (0.4 kg/m²) require a minimum of one fastener per tile regardless of roof slope. Clay and concrete roof tile attachment shall be in accordance with the manufacturer's installation instructions where applied in areas where the wind speed exceeds 100 miles per hour (45 m/s) and on buildings where the roof is located more than 40 feet (12 192 mm) above grade. In areas subject to snow, a minimum of two fasteners per tile is required. In all other areas, clay and concrete roof tiles shall be attached in accordance with Table R905.3.7.

TABLE R905.3.7
CLAY AND CONCRETE TILE ATTACHMENT

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

R905.3.8 Flashing. At the juncture of roof vertical surfaces, flashing and counterflashing shall be provided in accordance with this chapter and the manufacturer's installation instructions and, where of metal, shall not be less than 0.019 inch (0.5 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 greater, 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, metal valley flashing underlayment shall be solid-cemented to the roofing underlayment for slopes less than seven units vertical in 12 units horizontal (58-percent slope) or be of self-adhering polymer modified bitumen sheet.

R905.4 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

R905.4.1 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.

R905.4.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

R905.4.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I.

R905.4.3.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer modified bitumen sheet shall be used in place of normal underlayment and extend from the lowest edges of all roof surfaces 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.

R905.4.4 Material standards. Metal roof shingle roof coverings shall comply with Table R905.10.3(1). The materials used for metal roof shingle roof coverings shall be naturally corrosion resistant or be made corrosion resistant in accordance with the standards and minimum thicknesses listed in Table R905.10.3(2).

R905.4.5 Application. Metal roof shingles shall be secured to the roof in accordance with this chapter and the approved manufacturer's installation instructions.

R905.4.6 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 R905.10.3(1). The valley flashing shall extend at least 8 inches (203 mm) from the center line each way and shall have a splash diverter rib not less than $^3/_4$ inch (19 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). 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. In areas where the average daily temperature in January is 25°F (-4°C) or less , 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 self-adhering polymer modified bitumen sheet.

R905.5 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

R905.5.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

R905.5.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

R905.5.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I.

R905.5.3.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer modified bitumen sheet shall be used in place of normal underlayment and extend from the lowest edges of all roof surfaces 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.

R905.5.4 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D 3909 or ASTM D 6380, Class M.

R905.5.5 Application. Mineral-surfaced roll roofing shall be installed in accordance with this chapter and the manufacturer's installation instructions.

R905.6 Slate and slate-type shingles. The installation of slate and slate-type shingles shall comply with the provisions of this section.

R905.6.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

R905.6.2 Deck slope. Slate shingles shall be used only on slopes of four units vertical in 12 units horizontal (33-percent slope) or greater.

R905.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I.

R905.6.3.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces 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.

R905.6.4 Material standards. Slate shingles shall comply with ASTM C 406.

R905.6.5 Application. Minimum headlap for slate shingles shall be in accordance with Table R905.6.5. Slate shingles shall be secured to the roof with two fasteners per slate. Slate shingles shall be installed in accordance with this chapter and the manufacturer's installation instructions.

TABLE R905.6.5
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.

R905.6.6 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 (0.5 mm) zinc coated G90. Chimneys, stucco 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).

R905.7 Wood shingles. The installation of wood shingles shall comply with the provisions of this section.

R905.7.1 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 (25.4 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

R905.7.1.1 Solid sheathing required. 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.

R905.7.2 Deck slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25-percent slope) or greater.

R905.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I.

R905.7.3.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces 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.

R905.7.4 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table R905.7.4.

TABLE R905.7.4
WOOD SHINGLE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	Cedar Shake and Shingle Bureau

R905.7.5 Application. Wood shingles shall be installed according to this chapter and the manufacturer's installation instructions. Wood shingles shall be laid with a side lap not less than $1\frac{1}{2}$ inches (38 mm) between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall not be less than $\frac{1}{4}$ inch to $\frac{3}{8}$ inch (6 mm to 10 mm). Weather exposure for wood shingles shall not exceed those set in Table R905.7.5. Fasteners for wood shingles shall be corrosion resistant with a mini-

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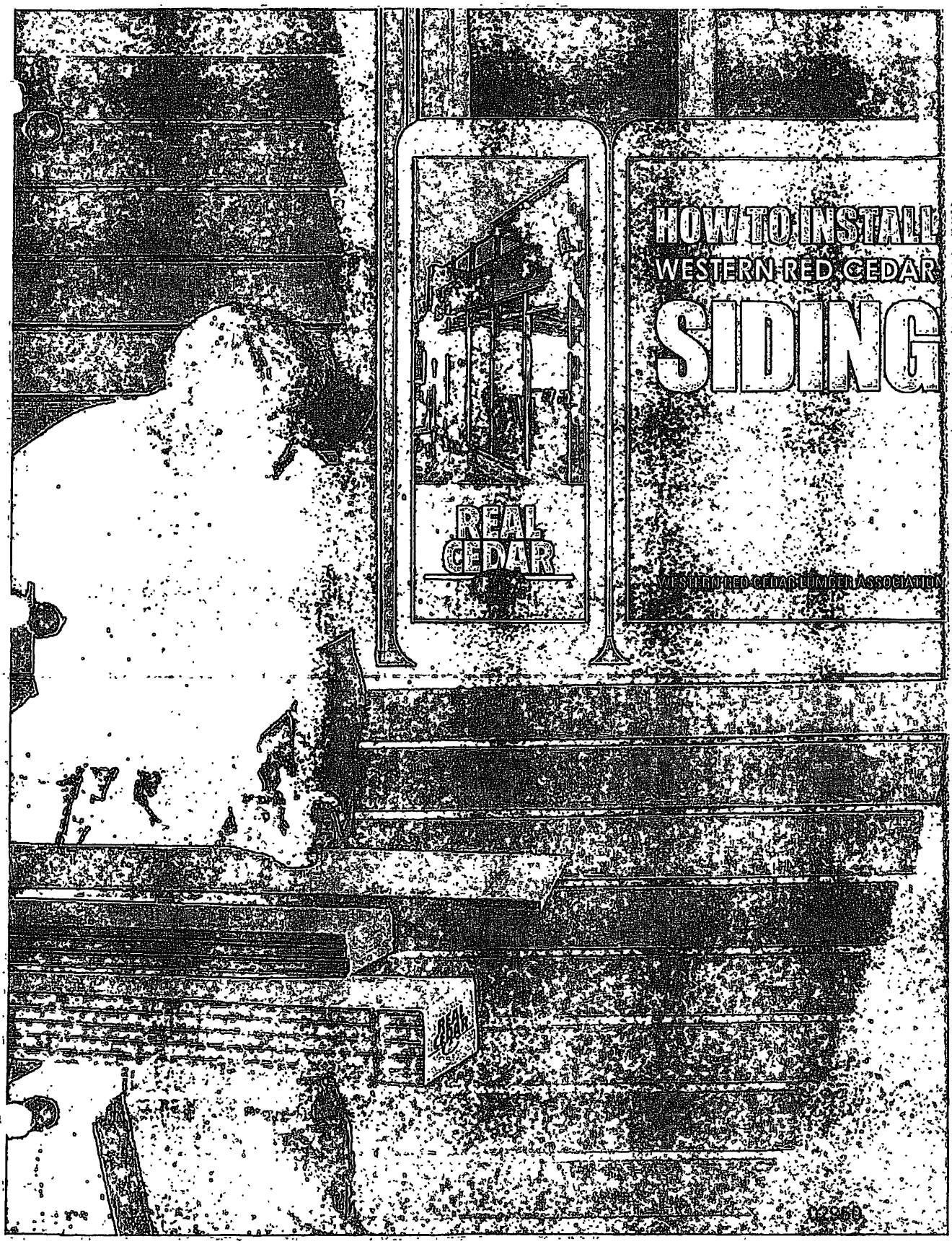
HOW TO INSTALL
WESTERN RED CEDAR
SIDING
REAL CEDAR
WESTERN RED CEDAR LUMBER ASSOCIATION

Congratulations on your choice of Western Red Cedar siding. Western Red Cedar is one of the world's premier quality woods noted for its appearance, durability, light weight, insulation value and dimensional stability. It will provide your home with character and a distinction that other sidings cannot match. Properly installed and finished, it will provide years of low maintenance performance.

Before beginning your siding project read this brochure thoroughly – it contains useful information to ensure the siding is installed correctly and will perform as intended. This brochure is organized into three sections.

Section I. Before You Start deals with numerous considerations which you should be aware of before you start installing Western Red Cedar Siding.

Section II. Outlines proper installation techniques.

Section III. Provides a list of industry best practices for Western Red Cedar siding installation.

Note that these are general guidelines that are minimum standards to be followed with confidence in most areas. However, severe local climatic conditions such as extreme heat and dryness; high winds; seacoast exposure; and, areas with wide climatic swings may necessitate additional provisions for the installation of the siding. Your national and local building code requirements always supersede these instructions. A detailed siding installation DVD is available from the WRCLA. Call 1-866-778-9096 for a copy.

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SECTION I BEFORE YOU START

1. INSPECT MATERIAL

Always purchase recognized grades such as those from WRCLA members and ensure you understand the grade of material you've purchased. Grades are designed for specific appearances and uses. Before installing, be sure the siding you've selected meets your requirements. Any product found to be damaged or visually unacceptable for any reason should not be installed; if you encounter any such product STOP and call your supplier immediately.

2. ACCLIMATIZE SIDING BEFORE INSTALLING

One of the most stable softwoods, Western Red Cedar is nevertheless a natural material and it responds to the environment. Cedar siding can swell or shrink as it gains or loses moisture to reach equilibrium with the moisture content of the surrounding air. Ensuring that the moisture content of cedar siding is at equilibrium before it is installed will minimize movement later on. Recommended moisture content for sidings are given in the table below.

	Average	Individual Pieces
Most Areas	12%	9-14%
Dry Areas	9%	7-12%
Damp, Warm Coastal	>12%	9-20%

1) To calculate average, test 10% or more of pieces.
2) Source: Wood Handbook 1987.

The following procedures are suggested for different siding specifications:

Kiln Dried Clear Siding

Kiln dried siding products are the preferred choice for consistency, stability, paintability and overall performance. These siding products have been dried at the mill to 12-15% moisture content. They are the most ready-to-use of all siding products. If the siding has not been wetted prior to arrival on the job site it may be applied upon arrival except in hot and dry conditions where 3 to 5 days of well ventilated storage away from direct sunlight is generally required. If the siding has been wetted it must be separated and allowed to dry to the local equilibrium moisture content.

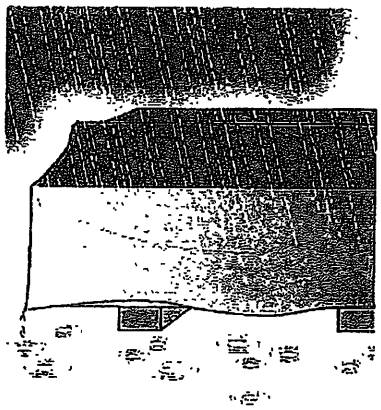
Dry Knotty Sidings

Some knotty sidings are air or kiln dried to less than 19% moisture content. These products should be acclimatized to ambient moisture conditions by stacking the siding on evenly spaced, vertically aligned stickers in a dry storage area for 7-10 days. More time may be required in damp or humid conditions.

Green (Unseasoned) Sidings

Unseasoned or green sidings have not been dried prior to delivery and require a longer time to acclimatize than seasoned sidings. Separate the siding with vertically aligned stickers, keeping two pieces stacked face to face between stickers and store in a well ventilated dry location for a minimum of 30 days, or longer in damp or humid conditions. If specifying unseasoned siding, patterns such as channel, bevel and board-and-batten are recommended since these allow for shrinkage. Narrower widths are also recommended since they move less overall than wider widths. Note the WRCLA discourages the use of green sidings.

3. JOB SITE STORAGE



Until installed, Western Red Cedar siding needs protection from direct sunlight, water saturation, snow, ice, dirt, and other elements. Store the siding flat and off the ground on stickers and a vapor barrier so that moisture is not absorbed through the bottom boards of the stack. Protect with a waterproof covering elevated in the center so that water does not pool on the cover. Do not completely seal the bundle, as good air circulation is required. Ideally, the siding should be stored in an enclosed building such as a garage prior to use.

4. FINISH SIDING PRIOR TO INSTALLATION

Before installation (job site), applying a finish to all surfaces (including ends) is recommended. Factory applied finishes are best. They ensure the best performance of the finish. The type of coating will be determined by final finish and look selected. The finish protects the wood from moisture absorption and UV degradation, helps prevent staining caused by mildew and extractives and will increase the service life of top coats.

Recommended Priming Procedures for Western Red Cedar Siding

Type of Finish Coat	Recommended Priming Coat
Natural and semitransparent stains	Apply the oil based stain to all surfaces.
100% arcylic solid color stains and paints	Apply an alkyd oil, stain-blocking primer (preferred) to all surfaces. High quality water based stain blocking primers may also be used.
Bleaching oils	Apply the bleaching oil to all surfaces.

More information about finishing is available on the WRCLA's website and in the "Guide to Finishing" publication.

5. FIELD CUTS

Regardless of the time of the year of the installation, all field cuts must be finished. The end grain of all wood products absorbs liquids up to 250 times more rapidly than other wood surfaces. 100% acrylic-latex primer is acceptable as long as it is able to properly cure according to the primer manufacturer's instructions. However, where temperatures drop below 50 degrees Fahrenheit either during application or within the curing period, use an alkyd oil wood primer to coat end grain exposed by jobsite cuts. Siding with end cuts coated with alkyd oil primer can be installed before drying without compromising the coating's effectiveness. Above 50 degrees, a high quality 100% acrylic-latex primer will suffice to coat exposed end grain if allowed to dry before installation. With either primer, follow manufacturer's recommendations.

6. FASTENERS

Stainless steel nails are the best choice, especially if the siding is to be finished with transparent or semitransparent stain. Use No. 304 stainless for general siding applications and No. 316 for seacoast exposures.

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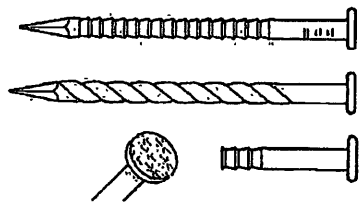
Hot-dipped galvanized as per ASTM A 153, aluminum and stainless steel fasteners are all corrosion-resistant and all can be used to fasten Western Red Cedar. Other types of fasteners (including electroplated and mechanically galvanized) are not recommended. They can rust and disintegrate and react adversely with the natural preservative present in cedar resulting in stains and streaks.

Type

For best result use "splitless" ring-shank siding nails. These have thin shanks and blunt points to reduce splitting. Textured heads should be used to reduce the glossy appearance of the nail head.



Hand Nailing is Preferred.

Nails should be driven with care into the framing members. To ensure nailing accuracy run chalk lines to mark framing locations. Heavy nailing distorts the wood and may cause splitting. At mitred corners, near edges and near ends, nail holes may need to be pre-drilled to avoid splitting. Avoid the use of pneumatic nailers if possible. If a pneumatic nailer must be used, reduce the air pressure and tap nails flush.

Overdriven nails must be remedied immediately. Fill overdriven nail holes with exterior grade wood putty specifically designed for filling exterior nail holes.

Placement

Siding should be fastened to each stud or blocking with nails spaced at a maximum of 24 inches on center. Nail placement depends on the siding pattern and width. The key is to fasten the siding securely without preventing it from moving in response to the moisture content in the air. In general, each piece of siding must be nailed independently. Nailing overlapping pieces together restricts the natural movements of each piece and may cause splitting.

Size

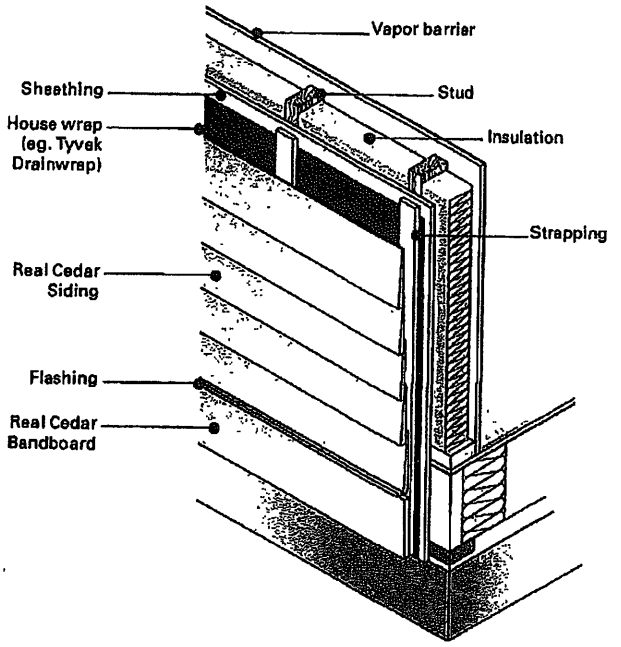
The size of nails to use depends on the type and thickness of siding. Use nails long enough so that they penetrate solid wood by a minimum of 1 ¼ inches.

Siding Type*	Nominal Thickness (in.)	Spiral/Ring shank Nail Length (in.)
Bevel	1/2	2 (6d)
	5/8	2 (6d)
	3/4	2-1/4 (7d)
	7/8 to 15/16	3 (10d)
	5/4	3 (10d)
Boards, T&G and Lap	5/8	2 (6d)
	3/4	2 (6d)
	7/8	2-1/4 (7d)
Battens for Board and Batten	3/4	3 (10d)

** Important: For application over foam sheathing, add the thickness of the foam to the tabulated nail length.*

02954

7. CONTROLLING MOISTURE: VAPOR BARRIERS AND BUILDING PAPER



High humidity output from washers, dryers, showers, kitchens and other sources, combined with today's energy-efficient construction, can result in a build-up of interior moisture vapor. This vapor migrates through the fabric of a building from the warm interior to the cold exterior, and when it condenses to water can cause structural damage and damage to sidings and finishes. Vapor barriers installed on the warm side of the wall largely prevent the migration of moisture vapor but they are not perfect. Residual vapor must be allowed to escape to the outside. Housewrap installed on the outside face of the sheathing helps prevent rain and snow from penetrating the walls but allows the escape of moisture vapor. The WRCLA recommends the use of rainscreen wall construction (see diagram and related section later in this publication) especially when installing over rigid foam.

Proper wall construction includes the use of housewrap (such as DuPont Tyvek's Drainwrap) or gas permeable building paper and interior vapor barriers. These are extremely effective in helping to prevent moisture problems.

8. WALL CONSTRUCTION

Stud Walls

Like all siding materials, Western Red Cedar performs best when installed properly on a suitable frame. Cedar siding should be securely nailed to framing members, furring members or to blocking between framing members. Standard stud walls generally require no special preparation for horizontal siding installation. Siding should be nailed into studs or blocking at maximum of 24 inches on center when applied over wood based sheathing and 16 inches on center when siding is installed without sheathing. In instances where an air space between siding and sheathing is desired (see rain screen wall construction) nail siding to furring strips. Maximum spacing for furring strips is 16 inches on center. Spacing for furring strips should match the spacing of the studs.

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Vertical siding applications require horizontal nailers, blocking or other wood framing members spaced no more than 24 inches on center. Check your building code to verify requirements in your area.

Lumber Size and Spacing for Blocking and Furring[1]

	Nominal Size (inches)	Actual Size (inches)	Preferred Spacing (inches)	Maximum Spacing (inches)
Blocking	2x2	1 ½x1 ½	16	24
Furring over plywood/ OSB sheathing[2]	1x2	¾x1 ½	16	24
Furring over masonry walls	2x2	1 ½x1 ½	16	24

1. Furring must be securely fastened to studs.
2. Can be used in moist and severe climates to form an air space between siding and sheathing (ie. rainscreen).

Rainscreen Construction

The basic rainscreen wall configuration, incorporating two layers, or wythes, separated by an air space, has variations that provide different levels of rain protection effectiveness. A distinction should be made between the drained cavity wall, the simple or open rain screen, and the pressure-equalized rain screen wall. What is usually meant by a "rain screen wall" is generally the latter: an exterior cladding, a cavity behind the cladding, drained and vented to the outside; an inner wall plane incorporating an air barrier; and a set of compartment seals limiting the cavity size. The outer "screen" layer of cladding deflects the kinetic force of the rain, while the inner wythe remains protected. The vented cavity uses gravity and flashings to drain water that penetrates the outer wall, away from vulnerable surfaces and joints. The cavity is sufficiently wide that surface tension and capillary action are not able to move water across the cavity.

Step by step construction tips for basic rainscreen construction (check with local building codes for the appropriate techniques in your area):

1. Drill holes (approximately 1") in the exterior wall sheathing (if plywood or OSB sheating is used) to permit residual moisture to escape.
2. Install housewrap (such as DuPont Tyvek's Drainwrap) or gas permeable building paper.
3. Install vertical furring strips. Ensure they are lined up with the studs.
4. Install screen materials under the ends of the furring strips. Fold the screen material over the furring strips and staple to the front of the furring strips.
5. Install Western Red Cedar siding over the furring strips.

More information about rainscreen construction techniques is available from Canada Mortgage and Housing Corporation (www.cmhc-schl.gc.ca).

Masonry Walls

Masonry walls require furring strips for horizontal and vertical siding installation. Furring strips must be thick enough to allow for nail penetration of 1 ¼ inches into solid wood.

Structural Insulated Panels (S.I.P.)

Structural Insulated Panels require furring strips for horizontal and vertical siding installation. Furring strips must be thick enough to allow for nail penetration of 1¼ inches into solid wood. Typical Structural Insulated Panels

have nominal ½ inch sheathing. To ensure the appropriate nailing base, furring strips a minimum of ¾ inch thick should be installed on the outside of the sheathing at a maximum of 16 inches on center.

Insulated Concrete Forms (I.C.F.)

These systems have no wood component and the foam has no nail holding capacity. As a result, Insulated Concrete Forms require framing of a minimum of 1¼ inches thick spaced 16 inches on center on the outside of the foam. Note these will need to be securely fastened to the concrete.

Rigid Foam Sheathing

Rigid foam sheathing has an insulation value superior to that of traditional lumber and plywood sheathings. However, it has no nail holding power and using rigid foam sheathing as a nailing base for cedar siding is not recommended. Follow the nailing recommendations given in this publication as to nail type, positioning, penetration and spacing.

Foam sheathing panels vary in moisture permeability but are generally considered as good moisture barriers. They should be used with a continuous film vapor retarder on the inside wall under the interior finish. Rigid foam sheathing can cause moisture to accumulate on the back of siding and cause staining, buckling and damage to finish coats. As a result, it is recommended that furring strips are used to create an air space between the sheathing and siding (follow the rainscreen construction method).

Other recommendations that should be followed to minimize potential problems:

- Thick, narrow siding is more stable than thinner, wider patterns and better able to resist dimensional changes.
- Use kiln-dried siding over rigid foam sheathing.. This is the most stable cedar siding.
- Proper prefinishing is essential.
- Use light color finish coats to maximize heat reflection and reduce dimensional movement.
- In all cases it is strongly recommended that house wrap, such as DuPont Tyvek DrainWrap, be applied over the foam sheathing.

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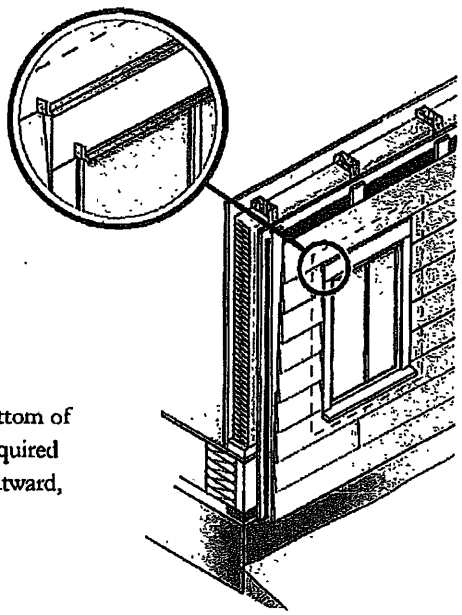
SECTION II INSTALLING WESTERN RED CEDAR SIDING

I. FLASHING

Before installing siding, make sure that flashings are installed to prevent moisture from entering wall and roof spaces. Flashing is an important line of defense in controlling moisture in wall assemblies. Flashing intercepts and directs the flow of water away from the building to designed drainage paths. Install horizontal flashing extending from the top of all wall penetrations (ie all windows and doors) and at any material or material directional change (ie. bandboards, water tables or the introduction of any alternative material). The flashing should tilt downward to allow water to drain away from the wall. Siding or trim should be ¼ inch above the flashing ledge. Do not caulk where the flashing and trim or other materials meet. Note that caulking in lieu of flashing is not acceptable.

Door and Window Flashing

The purpose of flashing window and door headers is to intercept water behind the siding and direct it to the outside, and to redirect water flowing down the face of the wall to flow away from the wall opening.

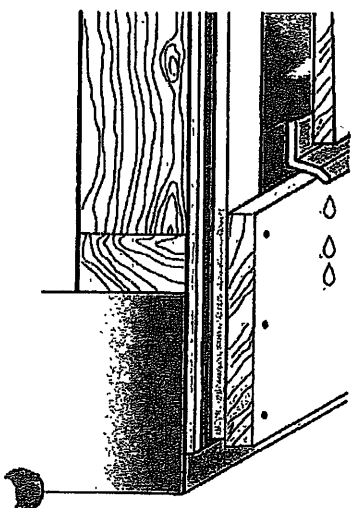


Moisture can accumulate behind the siding as a result of:

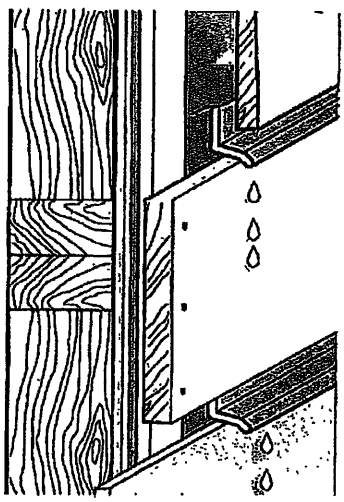
- rain penetration through the siding;
- water vapor diffusion;
- leakage of moist air from the interior or condensation.

Some moisture will drain through the weepholes at the bottom of each piece of siding. An additional head trim flashing is required at the head of the window/door to direct water further outward, beyond the thickness of the window

Skirt and Bandboards



Ground Level Skirtboard

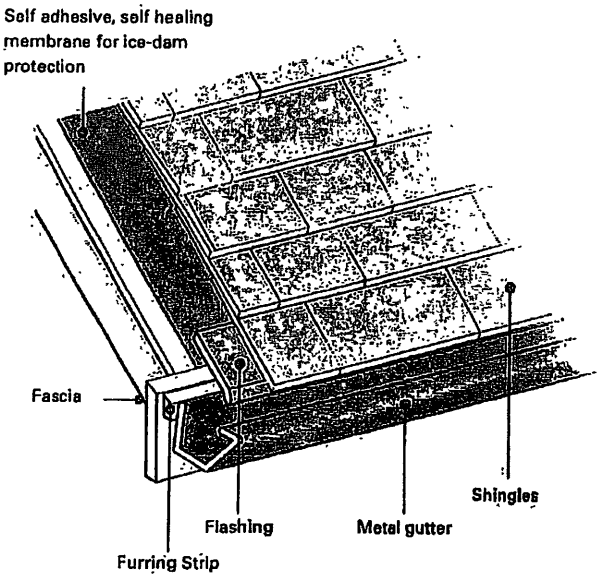


Second Story Bandboard

Fascia Flashing

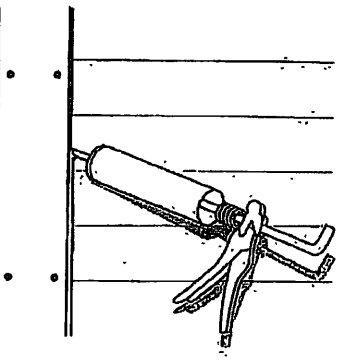
The purpose of fascia flashing is to support the shingle edge and to provide a drip edge to prevent water from running back underneath the roofing shingles and down along the fascia and soffit

Preformed eaves flashing/drip edge should be installed under the starter course of the shingle roofing. The extension of flashing supports the edge of shingles. If eaves troughs (rain gutters) are used, the flashing edge also helps to direct the water into troughs. Fascia flashing protects both the soffit and the fascia board, and provides a drip edge at the bottom edge to direct water away from the building.



2. CAULKING

Use high-performance acrylic-latex, acrylic, acrylic-silicone, polyurethane, polysulfide or terpolymer rubber caulks or sealants to seal gaps around windows, doors, corners, and other exterior joints that are exposed to potential water intrusion. Pure silicone and clear caulks do not work well on Western Red Cedar and are not recommended. Caulking is not a permanent solution and as such requires regular maintenance. If not inspected and maintained, caulking may fail and trap water, creating severe moisture problems. Do not rely on it as the only barrier to moisture penetration. Do not caulk areas that will prevent moisture from escaping the wall cavity (e.g., under windows and around flashing).



3. ROOF AND GROUND CLEARANCE

Trim that extends down to a roof (dormers, second floors, etc.) and decks requires a minimum of a 2 inch gap to avoid wicking. Trim, such as water table or skirt boards must be a minimum of 6 inches above the grade.

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4. INSTALLING BEVEL SIDING (ALSO KNOWN AS CLAPBOARDS)

Spacing for the siding should be laid out beforehand. The number of board spaces between the soffit and bottom of the lowest piece of siding at the foundation should be such that the overlap is as per the table.

Start with the bottom course using a furring strip to support the lower edge. Each succeeding course overlaps the upper edge of the previous one by a minimum of 1 inch. Rabbeted patterns are self-spacing, but leave 1/8 inch expansion clearance. Where possible, the bottom of the board that is placed across the top of the windows should coincide with the window cap.

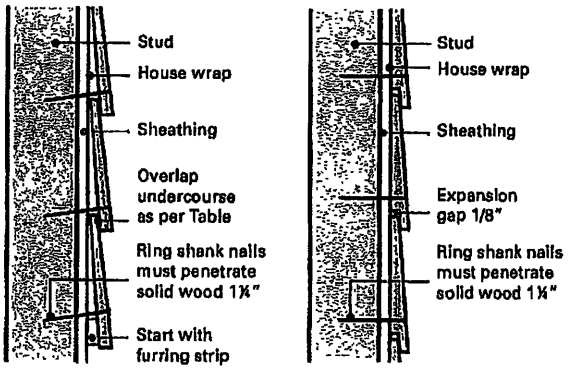
Bevel siding should be face nailed to studs with 1-1/4 inch penetration into solid wood using one nail per piece spaced at a maximum of 24 inches on center. Place nail just above the overlap. Take care not to nail through the overlap of two pieces.

Do not reduce the siding overlap recommendations given in the installation sections of this publication. Doing so could result in damage from wind-driven water. Use the larger overlaps for unseasoned sidings to allow for shrinkage and expansion. Take care not to overdrive fasteners when using larger overlaps. Butt joints between boards should be staggered and meet on studs. Fit siding snugly to other pieces and to trim, allowing for expansion and an adequate caulking bead.

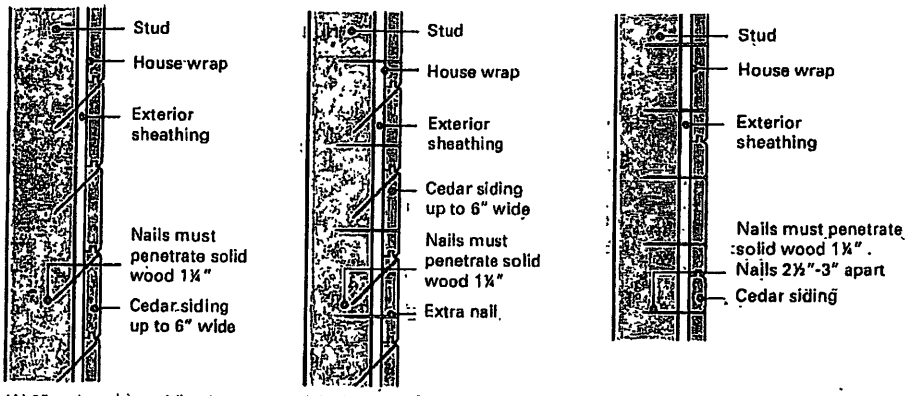
Recommended Overlap

Nominal Width	Overlap (inches)
4	1
6	1
8	1 to 1 1/8
10	1 to 1 1/2
12	1 to 2

** These overlap recommendations must be followed for proper installation.*



5. INSTALLING TONGUE AND GROOVE



(A) 6" and narrower siding in normal climatic conditions

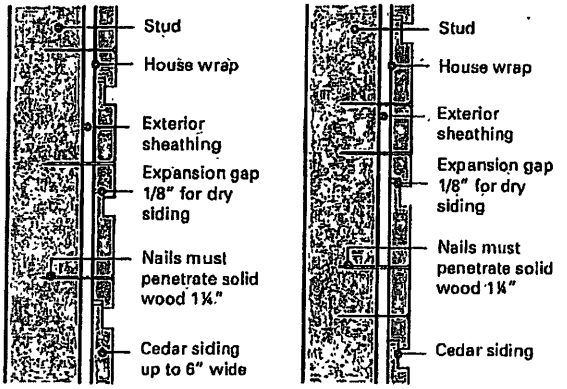
(B) 6" and narrower siding in hot, dry, windy or seacoast climates

(C) 8" and wider siding

Tongue and groove siding can be installed horizontally or vertically. In horizontal application, start at the bottom and work up with the groove edges facing downwards. Siding up to 6 inches wide can be blind nailed with one siding nail per bearing toe-nailed through the base of each tongue. Wider siding should be face nailed using two nails per piece. Nails must penetrate 1¼ inches into solid wood.

In vertical application, start at one corner with grooved edge toward the adjacent wall. Use a level or plumb line to ensure that the first board is installed plumb. The grooved edge of the first board may have to be trimmed to ensure a flush fit. Siding is nailed to horizontal blocking lines installed between studs or to furring strips. As with horizontal installation, pieces up to 6 inches can be blind nailed and wider pieces should be face nailed.

6. INSTALLING LAP SIDINGS



(A) 6" and narrower lap siding

(B) 8" and wider lap siding

Lap sidings can be installed horizontally or vertically. For horizontal applications, start with the bottom course and work up with the channels pointing upwards. Allow a 1/8 inch expansion gap between pieces if the siding is air or kiln-dried. Do not nail through overlaps. For siding up to 6 inches wide, use one nail one inch up from the lap. Face nail with two nails per piece for 8 inches patterns and wider, keeping nails 2-1/2 to 3 inches apart to allow for dimensional movement without splitting. For vertical applications, siding should be nailed to horizontal blocking or furring strips.

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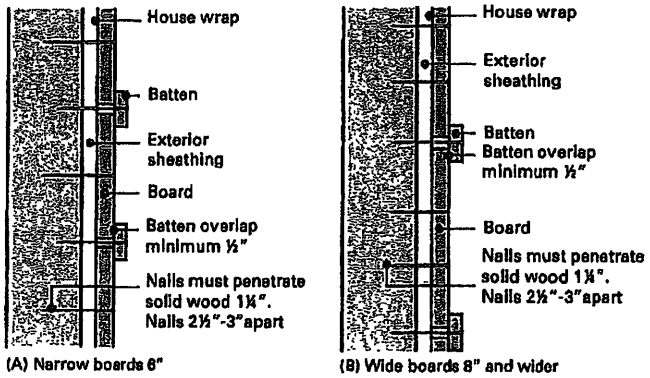
. INSTALLING BOARD-AND-BATTEN SIDING



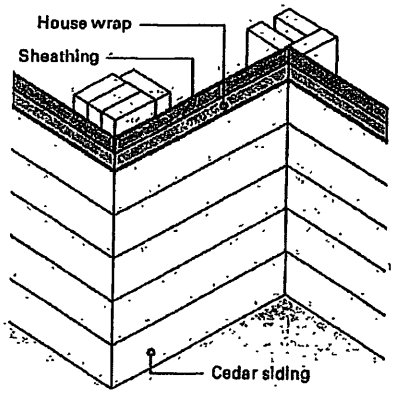
Board-and-Batten is a vertical pattern created using cedar boards and battens of various widths for a wide range of appearances. For nominal 6 inch boards spaced ½ inch apart, battens should overlap by a least ½ inch. With wider boards, increase batten overlap proportionately. While there are no set widths for board and batten siding, an attractive combination is 1x3 battens with 1x10 boards.

Siding should be nailed to horizontal blocking lines or to furring strips. Boards up to 6 inches wide should be fixed with one nail per bearing driven through the center of the board. The overlying batten covering the gap between boards should be attached with one nail per bearing, the shank passing between the edges of the under boards. Use two nails per bearing on boards 8 inches and wider placing the nails 2-1/2 to 3 inches apart.

8. OUTSIDE AND INSIDE CORNERS

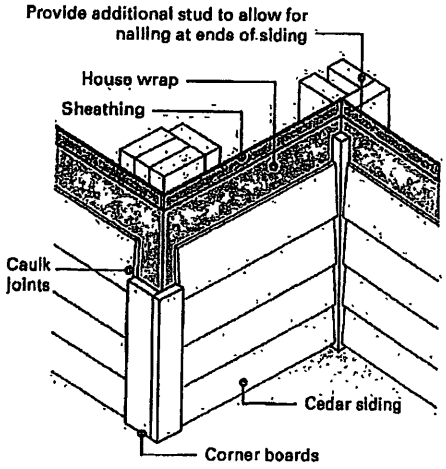
There are two main methods used for outside corners. The choice depends primarily on the desired appearance but also the experience and skill of the installer.

Mitered corners offer a professional looking finish. They are most commonly used with horizontally applied siding applications such as bevel. Mitered corners require good carpentry skills. They must fit tightly for the full depth of the miter.

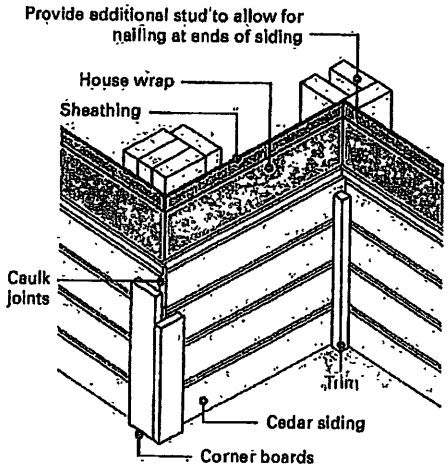


(A) Mitered Corners

Corner boards are a popular and easier alternative to mitered corners. Thickness of the corner board will depend on the thickness of the siding. The most common are 3/4 inch or 1-1/4 inches thick. Width is a matter of taste and proper proportion. Corner boards are applied to the sheathing with siding fitting tightly against the narrow edge of the boards, allowing for expansion and an adequate caulking bead. The corner boards and the ends of the siding are nailed to the corner studs which anchors the wood for a maintenance-free joint. Designing roofs with an eaves overhang to protect corners from weathering also helps ensure trouble-free joints. Always apply primer or stain end cuts. With corner boards, there is the choice of applying them next to the siding or over top of the siding as shown here.



(B) Corners boards



(C) Trim boards

As in the above illustration, at inside corners, siding is frequently butted against a 2 x 2 trim strip. It can also be butted against adjoining walls with a trim strip used to cover the joint.

9. FIELD JOINTS

When butt jointing siding, cut ends at 45 degree angles to form an overlapping joint. This is particularly important for vertical installation. Ensure joints meet on studs, blocking or furring strips with the nail penetrating solid wood at least 1¼ inches.

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SECTION III SIDING INSTALLATION QUICK TIPS

All installers should learn and follow "best practices" in order to deliver a better job for their customer and reduce call backs.

DO:

- Follow local and national building codes.
- Follow WRCLA installation instructions.
- Purchase from WRCLA members, distributors and retailers.
- Use construction techniques to create easy drainage planes to shed water accumulations.
- Finish Western Red Cedar ASAP! Factory finish or apply coatings prior to installation if possible. Always touch up field cuts.
- 'Acclimatize' Western Red Cedar siding before you install it.
- Use the correct fasteners: 304 or 316 grade stainless steel, aluminum, or hot dipped galvanized (as per ASTM 153A).
- Nail all Western Red Cedar siding into 1¼ inches of solid wood!
- Ensure butt joints are made over solid wood to provide secure nailing. Join two pieces of siding with a mitered butt joint.
- Visit: www.wrcla.org or call 866 778 9096 for more information.

DO NOT:

- Allow Western Red Cedar to 'Weather' before applying a finish coating to the Cedar.
- Use Electroplated or mechanical galvanized fasteners that do not conform to ASTM - A 153.
- Install Western Red Cedar siding without acclimatizing.
- Fasten Western Red Cedar siding only to the sheathing material.
- Nail through two layers of siding.
- Fail to finish the end cuts during installation.
- Attempt to 'Blind Nail' bevel siding/clapboards.
- Install or paint over wet siding.
- Use caulking sealant as a substitute for flashing.
- Place siding direct contact with concrete, masonry, top soil, mulch, patios, porches, and/or roofs.

MORE INFORMATION

WESTERN RED CEDAR LUMBER ASSOCIATION

The Western Red Cedar Lumber Association is an organization of Western Red Cedar producers, distributors and retailers throughout North America. Founded in 1954, the association is known worldwide as "the voice of the cedar industry." Its members account for more than 65 percent of the world's production of cedar and have an annual volume of nearly 1 billion board feet.

The mission of the WRCLA is to promote quality Western Red Cedar products and support them with a comprehensive marketing and PR program, technical services, education and training. The WRCLA works closely with architects, designers and builders to ensure the right product is specified and utilized. The association offers extensive resources for builders and installers including installation guides and DVDs available in English, Spanish and Russian.

For more information about the WRCLA and Western Red Cedar siding products, visit our website www.wrcla.org or call 1 866 778 9096.

Assure yourself of quality Western Red Cedar products, always select materials originating from these WRCLA members:

MEMBERS

- DOWNIE TIMBER
- ENYEART CEDAR
- GILBERT SMITH FOREST PRODUCTS
- HAIDA FOREST PRODUCTS
- INTERFOR
- NORTHWEST FOREST PRODUCTS
- NORTH ENDERBY TIMBER
- OREPAC BUILDING PRODUCTS
- PREMIER FOREST PRODUCTS
- POPE & TALBOT
- QUADRA WOOD PRODUCTS
- SAWARNE LUMBER
- SHAKERTOWN
- SKANA FOREST PRODUCTS
- TRI-PRO CEDAR PRODUCTS
- TYEE TIMBER PRODUCTS
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- WEISS GROUP (FACTORY FINISHING)

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02965 (FEB/07)

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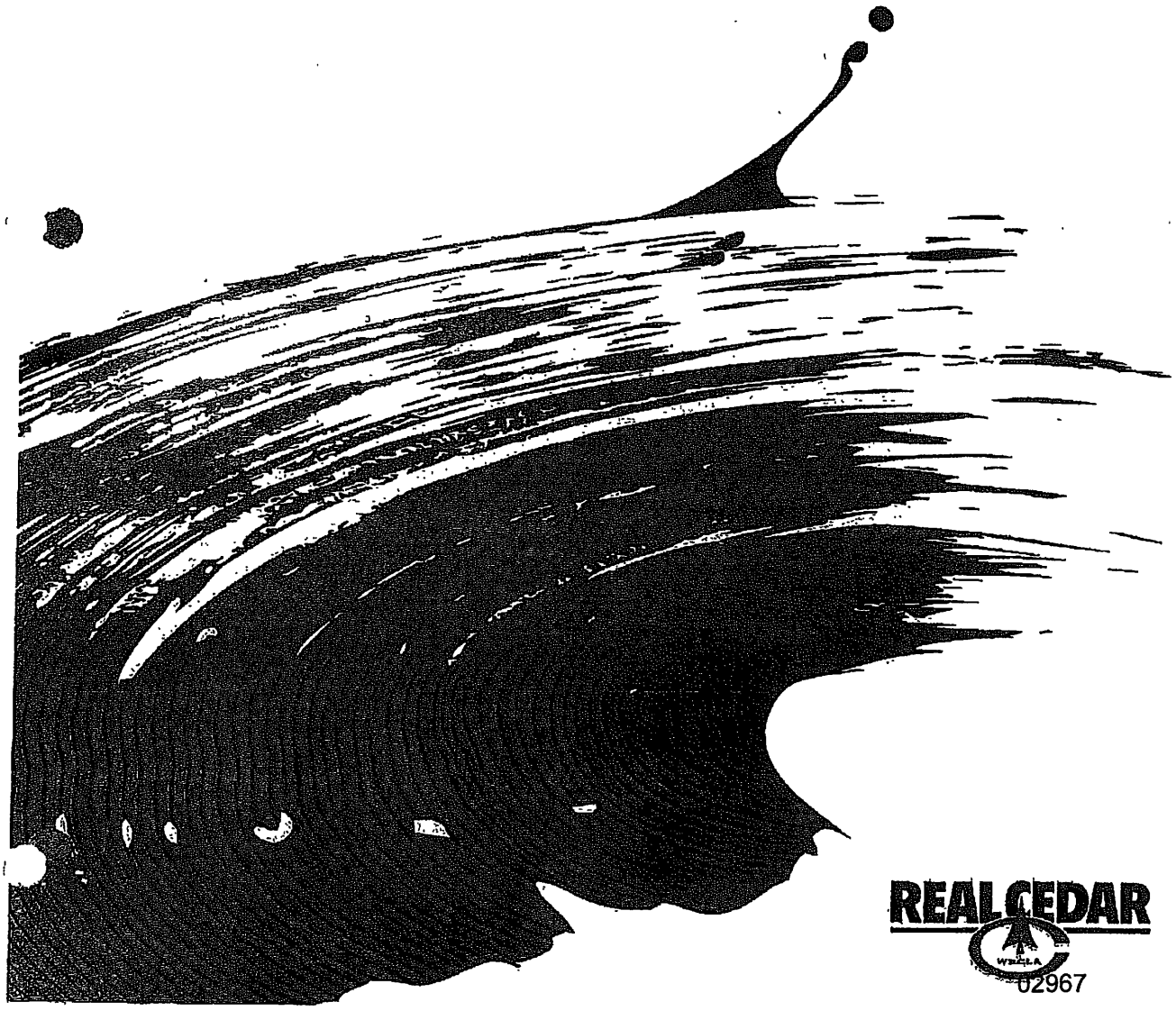
How to Finish

WESTERN RED CEDAR

This guide is intended to provide a summary of the essential "best practices" for finishing, care and maintenance that will lead to a positive experience with your Western Red Cedar.



REAL CEDAR

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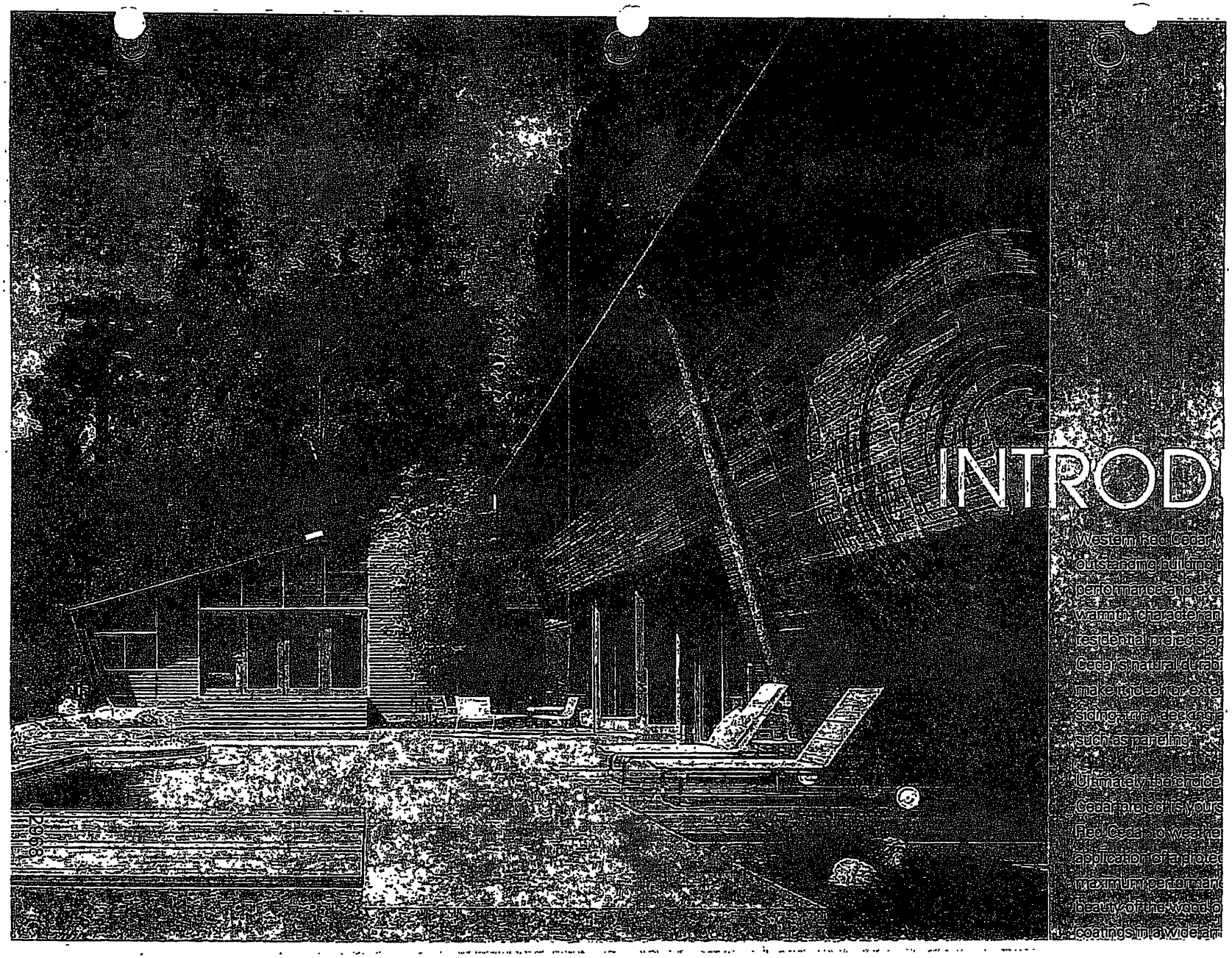
INTROD
Western Red Cedar
outstanding building
performance and exc
warmth, character an
residential projects a
Cedar's natural durab
make it ideal for exte
Siding, trim, decking a
such as paneling
Ultimately, the decide
Cedar an aspect is yours
Red Cedar to wear ne
application of a finish
maximum performan
beauty of this wood p
coatings in a wide ar

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...dCedar can form. It's not a coating as it is a ...siding product that is left unfinished to ...rally.

...ose this option due to ...

...ence for the silvery grey look of ...athered Western Red Cedar.

...not to invest time and effort ...maintain the finish on cedar product...

...accessibility, causing difficulty in ...the finish on a Western Red Cedar ...example, siding on very tall buildings.

...about the environmental impact of ...nish on your Western Red Cedar ...

...eral valid considerations and that Western Red Cedar siding and ...can have a long service life without ...coating in many environments – as ...long as good design, installation ... and maintenance practices are followed.

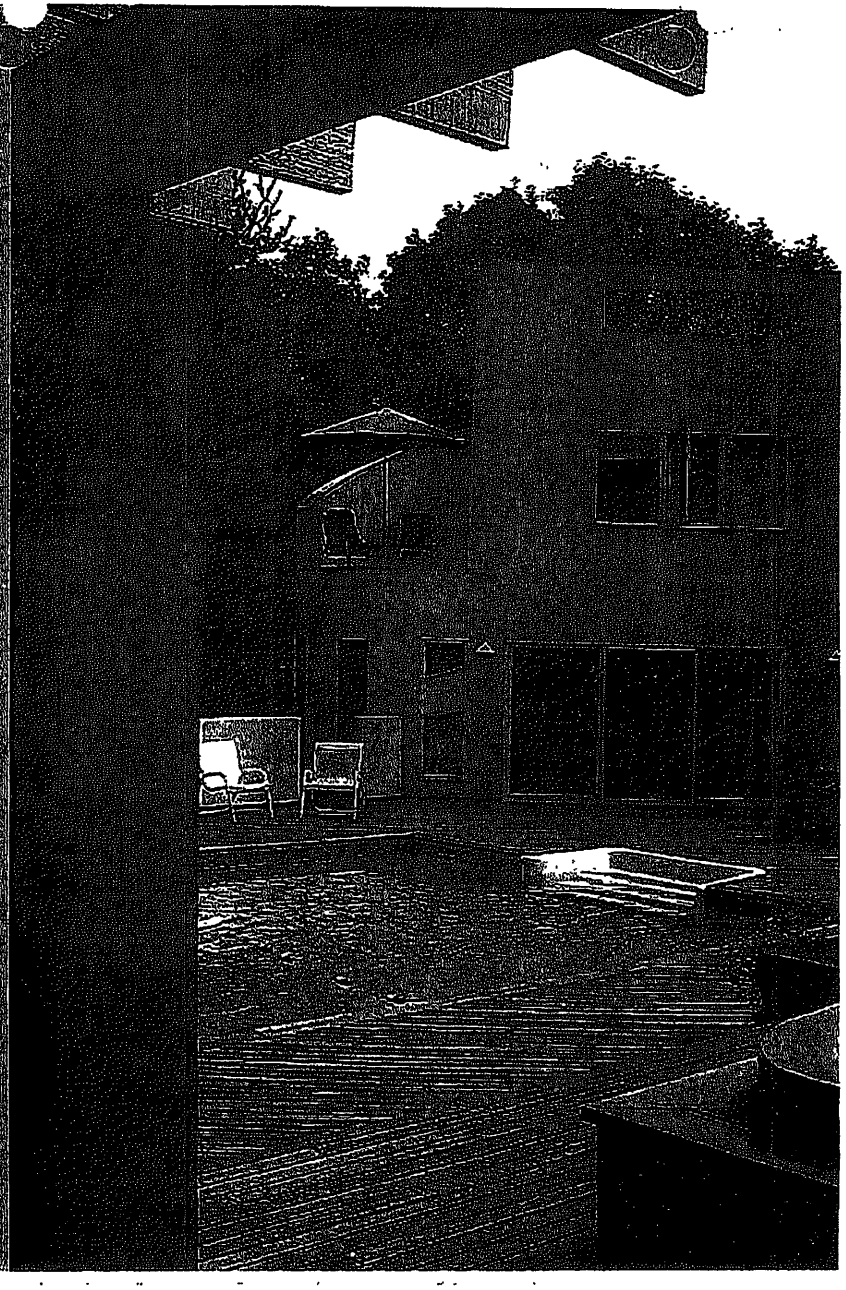
...It is important to understand that this choice not to apply a finish to your cedar product has long-term implications. This choice requires advance consideration ...low natural weathering to begin. ...Red Cedar weathers, it will lose ...color and become grey. In very dry ...weathers to a silvery grey color but in ...climates, because of varying moisture

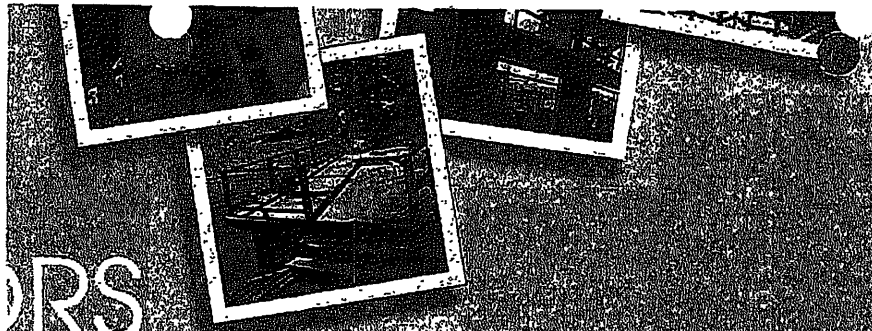
Should you wish to see your weathered cedar to a state where it can be painted or stained, however, significantly more effort will be required to prepare the surface of the wood for coating. If a truly uniform grey appearance is desired, then this effect can be achieved by the use of a commercially prepared bleaching oil or grey weathering stain. This is essentially a water-repellent finish containing pigments and other additives which is most effective on textured cedar. To maintain this look, the bleaching stain may have to be re-applied periodically.

Although the natural weathering effect is usually only 1/8th deep (less than 1-2 mm), with the cedar largely unchanged beneath, extra care must be given to the design of the project, the installation of the cedar and routine maintenance. Without the protection provided by a coating against moisture intrusion, (especially end grain sealing), steps must be taken during the installation process to allow Western Red Cedar to readily dry following exposure to moisture, otherwise the risk of decay increases.

All cedar products used in exterior applications require a degree of maintenance to keep them looking their best. Even if the choice is made not to apply a finish to Western Red Cedar, contaminants such as dirt and mildew should be regularly removed to maintain its beautiful, natural appearance.

Life Cycle Assessment (LCA) for Western Red Cedar siding and decking shows it has the most benign environmental impact of all the alternative product choices for those building applications. Coatings, especially the solvent borne finishes and the frequency of their application negatively impact the LCA of cedar siding and decking. This impact may influence a decision not to apply a finish. Fortunately, a new generation of more environmentally friendly, water borne, coatings are emerging and these products should be considered.





ORS

ECTING FINISH RETENTION

or factors affect the performance of finishes including Western Red Cedar's operties, manufacturing characteristics, and construction practices.

operties

mportant characteristics of Western re: its outstanding dimensional texture, pattern of growth, ntrol pitch, and resin. These ics contribute to its exceptional ability d retain many different types of

al stability is the resistance of elling and shrinkage when it gains isture. Light, low-density woods stern Red Cedar shrink less than ty woods. It is excellent dimensional

Pitch or resin which can interfere with the bonding or penetration of a finish can be found in most softwoods but are absent in Western Red Cedar.

Manufacturing Characteristics

Surface Texture: Western Red Cedar products are available with a smooth (planed) or a textured (sawn or rough sanded) surface. As a rule, textured surfaces provide the best mechanical adhesion of the finish to the wood for smooth-surfaced Western Red Cedar, a two coat paint system is preferred.

Moisture Content: Finishing wood that is wet (above 20% moisture content) may increase the risk of coating failure. It is best to finish Western Red Cedar when its moisture content has stabilized at the level that will prevail during the service life of the product. In North America this level is approximately 12% moisture content. The best product choice is Western Red Cedar that is kiln dried at the time of manufacture.

Construction Practices

Construction practices have a significant influence on the performance of cedar and the finish over it. Care should be taken from the time the Western Red Cedar is delivered to the job site through to its installation and finishing. The moisture content of the wood both prior to and

While it is not within the scope of this publication to describe in detail the many construction techniques necessary to maximize performance, the following brief checklist is helpful:

- Use stainless steel, hot-dipped galvanized or aluminum fasteners.
- Install flashing over all openings and above skirt and band boards.
- Provide adequate eave overhangs at eaves and gables.
- Install drip caps over windows and door frames.
- Allow at least 6 inches of clearance between the bottoms of siding and trim boards and the ground line.
- Allow at least 2 inches of clearance between the bottoms of the siding and trim boards and roofing materials.
- Install vapor barriers on the warm side of walls to minimize condensation within walls.
- Vent high humidity areas such as kitchens, laundries and bathrooms.
- Vent attics and crawl spaces.
- Keep cedar protected from the elements on the job site.
- Acclimatize Western Red Cedar to local humidity conditions before installing.
- Apply primer or stain to all six sides, including surfaces exposed after they are fieldcut, before installing. Note that the end grain may require 2 coats to fully protect.

Installing siding over a rain screen greatly decreases the chance that the back of the siding will get wet and retain that water. This ensures that any water that penetrates the wall assembly will drain down and away from the walls. Rain screens also minimize moisture imbalances within the siding. This reduces the potential for cupping and extractive bleeding. As a result, coating performance is markedly improved.

For more comprehensive information on installing Western Red Cedar siding, request a copy of the

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RED CEDAR SIDING AND

to finish your Western Red Cedar
nish should not be left unfinished and
rect sunlight and moisture for any
ride or time prior to stain or paint.
Weathered surfaces, even if only
he elements for a few weeks, will
Western Red Cedar's ability to hold
d stain. The longer the period of the
Cedar is left to weather, the more
nish may fail.

ation of newly milled cedar can
wrapping finishes that contain
ckers. Finishes containing both a
dewicide and ultraviolet protection are
d. Since these finishes contain a low
f solids, they tend to require higher
. Penetrating oil-based stains or light
atural tones can also be applied to
m color and wood protection.

Siding and Trim Finishes

or an exterior wood finish for
d Cedar depends upon the desired
e and the degree of protection.
Finished wood is a combination
dely different materials and the
sion both must be considered to
achieve the most durable wood finish
ystem. Note, however, that with all
ypes of finishes, the manufacturer's
ecommendations should be
llowed. Western Red Cedar's
xcellent finishing characteristics
annot compensate for finishing
oducts that are unsuitable or inferior.

In general, finishes for Western Red Cedar can be grouped into four categories: (1) opaque coatings such as paints and solid-color stains; (2) semi-transparent stains; (3) natural finishes such as transparent stains; and (4) oils. Wood preservatives and fire-retardant coatings may also be classified as finishes in some respects but are not within the scope of this publication. The expected service lives of different exterior finishes for Western Red Cedar siding and trim are summarized below.

Figure 1. Suitability and Expected Service Life of Exterior Finishes on Western Red Cedar Siding & Trim

Finish	On Planed, Smooth WRC	Expected Life (yrs)	On Textured WRC	Expected Life (yrs)
Paint[3]	High	Up to 10	High	Up to 12
Solid-color stain	Moderate	3 to 5	High	4 to 6
Bleaching Oil	Moderate	3 to 5	High	5 to 8
Semi-transparent stain	Moderate	1 to 3	High	2 to 4
Water-repellent preservative and oil	High	1 to 2	High	1 to 2

Data compiled from research observations.

Expected lives are predictions for an average location in the continental United States.

Expected life will vary in extreme climates or exposures such as desert, seashore, and deep woods or according to the building's orientation.

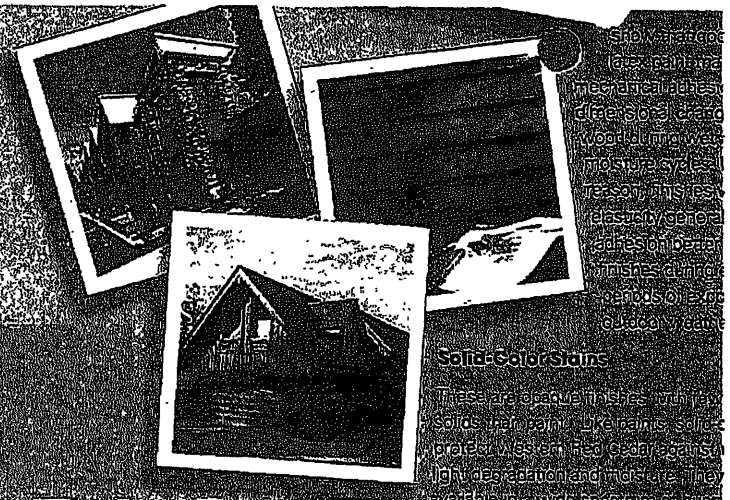
Vertical grain cedar.

Expected life of two coats: one primer and one top coat. Applying a second top coat will increase the life of the coating.

Follow manufacturer's recommendations for the number of coats.

Development of mildew on surface indicates need for cleaning and possible refinishing.

You Get What You Pay For



OPAQUE FINISHES

Primers

Western Red Cedar contains water-soluble extractives that are responsible for its attractive color, exceptional stability, and natural decay resistance. However, these extractives may discolor latex paints and solid-color stains unless a primer coat is used that is specifically formulated to help control extractive bleeding. These stain-blocking primers are available in alkyd-oil and water-based formulations. Alkyd-oil based primers usually offer the best shield against discoloration by water-soluble extractives. The label on the container should indicate that the coating is recommended for use as a stain-blocking primer for Western Red Cedar.

Paint

Paint provides the most surface protection against weathering and wetting by water, while providing color and concealment of some of the wood's characteristics. Although paint can reduce wood's absorption of water, paint itself is not a preservative.

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Solid-Color Stains

These are opaque finishes with less solids than paint. Like paints, solid-color stains protect cedar against light degradation and moisture. They are available in a wide spectrum of hues to obscure the wood's true color but allow the cedar's natural characteristics and texture to remain. These finishes are non-penetrating, like paints, form a film, and therefore a stain-blocking primer should be applied first, before applying the color stain. Solid-color stains are available in oil or oil-based formulations.

Solid-color stains have been developed to mimic the wood grain. These are known as "semi-transparent" stains and their effect on the appearance of cedar lies between those of solid-color and clear transparent stains, as described below.

TURAL

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of Western Red Cedar prefer a
reserves the wood's natural color.
nce, to maintain the natural look of
d cedar that is exposed outdoors,
ntenance will be required. The
oducts provide varying degrees of
against weathering while maintaining
s natural beauty.

arent Stains

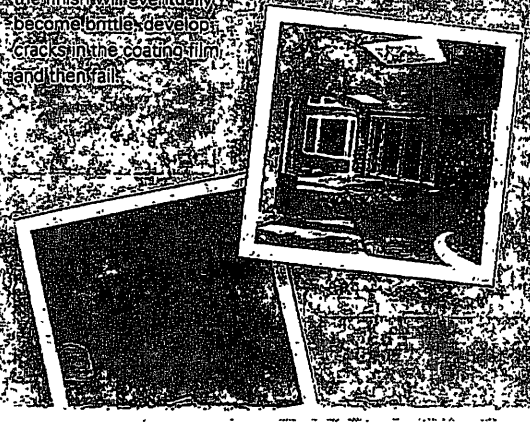
tains do not alter the appearance
edar; they only slightly modify the
one of the wood. Transparent
are similar in composition to semi-
arent stains, but they contain fewer
nts. Transparent stains formulated
a fungicide that inhibits the growth
nd decay causing fungi will further
wood's durability. Waterborne and
e formulations are available, however
mented or lightly pigmented finishes
ted protection against the sun's
ht and moisture related damage
y require frequent refinishing.
stains are, however easily refinished
l surface preparation.

sparent Stains

ne oil-based semi-transparent
stains penetrate the wood surface
and do not form a surface film like
e finishes are the best choice for
d Cedar which is fully exposed to the
ner's natural look is desired. Although
can be used on both smooth and
stern Red Cedar, they will perform
and last longer when applied to a
face. These stains contain pigments
from the damaging effects of the sun's ultraviolet rays. Service life on siding applications may vary from 3-6 years, depending on the cedar surface texture, quantity of stain applied, and the intensity of the sunlight on the wood surface.

Latex semi-transparent stains are similar in appearance to the solvent-borne stains, however their look is achieved by the formation of a thin film with little penetration. This film is often not thick enough to provide the same durability as solvent borne stains and tends to degrade by flaking from the wood's surface. Refinishing cedar that has been coated with a latex semi-transparent stain may require more substantial surface preparation. Currently, efforts are underway by many stain manufacturers to develop water-borne stains that penetrate cedar. However, to date, moderate success has been experienced in duplicating the properties of traditional oil-based solvent borne stains. As increasingly restrictive environmental standards reduce the availability of solvent borne stains, ongoing research suggests that penetrating, erodible latex semi-transparent stain finishes for cedar will be available in the near future.

Note: Transparent, non-flexible film-forming finishes such as lacquer, shellac, urethane, and varnish are not recommended for exterior use on Western Red Cedar. Ultraviolet radiation can penetrate the transparent film and damage the wood. Regardless of the number of coats, the finish will eventually become brittle, develop cracks in the coating film and then fail.



FACTORY

FINISHING/PRIMING

For optimum performance, the WRCLA recommends that Western Red Cedar is pre-primed or pre-finished prior to job site delivery.

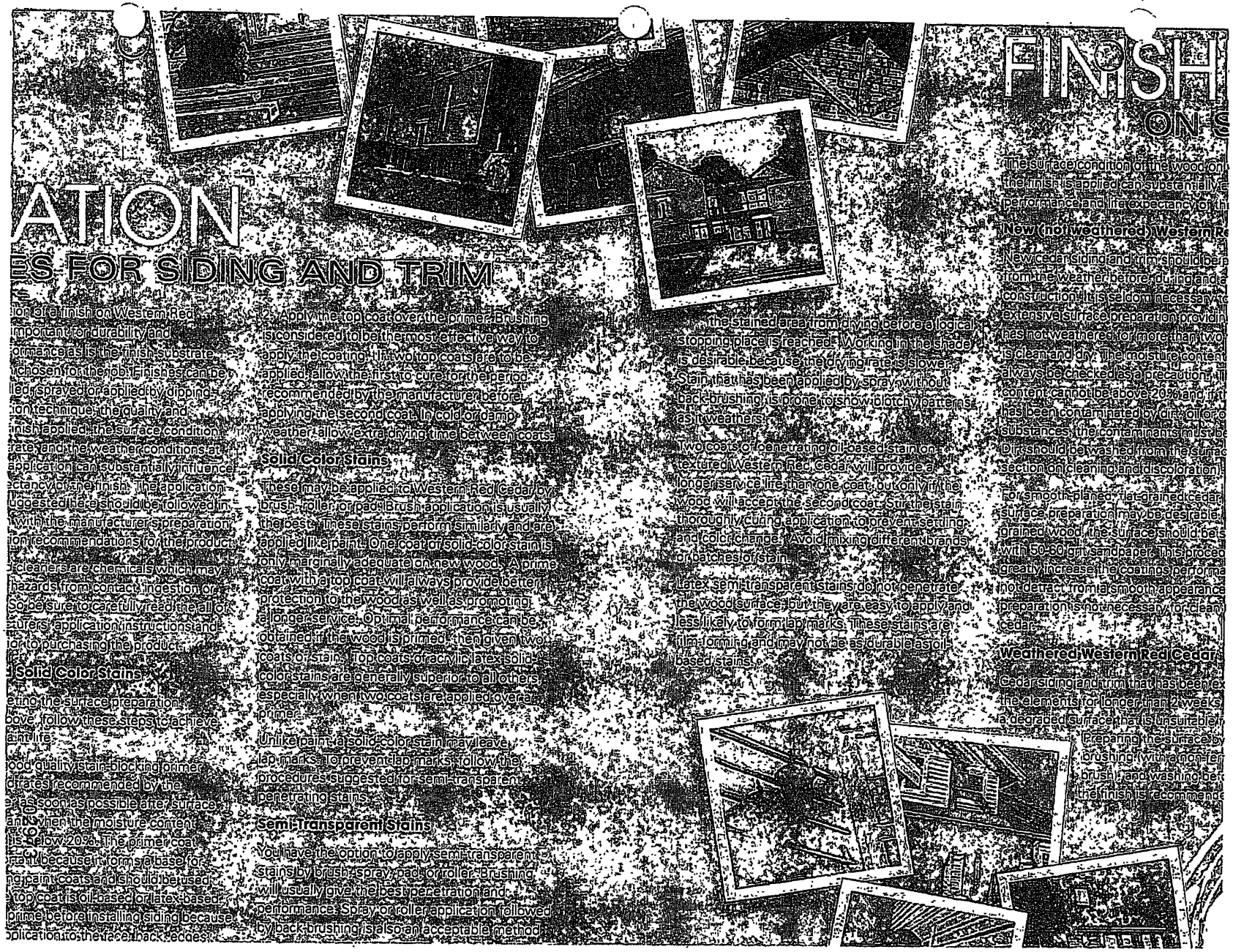
Factory priming, as the name implies, is performed in an industrial setting where a machine coating process applies a coating to all six sides of each board. The coated boards are then dried prior to shipment to the job site. Pre-primed siding and trim boards delivered to a job site should be kept dry and clean prior to installation. All field cuts should be re-sealed with a primer prior to the boards being installed. Top coating should be completed as quickly as possible, as most primers are not intended to be exposed to natural weathering for more than 90 days.

Factory-finishing is similar to the above process, however it allows for the additional application of one or two topcoats of acrylic latex paint, solid stains or natural stains in job lot quantities and in the colors selected by the builder/homeowner.

It is important not to overdrive nails during installation of factory finished siding, as this

touch up any repairs or field cuts, taki
to smear the top coat.

Properly done factory priming/finishi
- the application of a uniform coating
recommended coverage of the primer
six surfaces of each piece (face, back,
ends).
- a controlled environment to permi
curing of the finish.
- the wood with a coating to protect
exposure to sunlight (UV degradation)
surface contamination by mildew and
- an elimination of lap marks, streak
shrink lines after installation.
- an ability to install products at any
year.
- a product that often comes with a
warranty.



ATION

ES FOR SIDING AND TRIM

ion of finish on Western Red
important for durability and
ormance is: is the finish substrate
chosen for the job. Finishes can be
lled, sprayed or applied by dipping
ion technique, the quality and
inish applied, the surface condition
rate and the weather conditions at
application can substantially influence
ctancy of the finish. The application
uggested here should be followed in
with the manufacturer's preparation
ion recommendations for the product.
cleaners are chemicals which may
hazards from contact, ingestion or
so be sure to carefully read the all or
acturers' application instructions and
or to purchasing the product.

Solid Color Stains

eting the surface preparation
bove, follow these steps to achieve
aint life:
ood quality stain-blocking primer
d rates recommended by the
er as soon as possible after surface
and when the moisture content
is below 20%. The primer coat
tant because it forms a base for
ng paint coats and should be used.
top coat is oil-based or latex-based
prime before installing siding because
pplication to the face, back, edges

2. Apply the top coat over the primer. Brushing is considered to be the most effective way to apply the coating. The two top coats are to be applied, allow the first to cure for the period recommended by the manufacturer before applying the second coat. In cold or damp weather, allow extra drying time between coats.

Solid Color Stains

These may be applied to Western Red Cedar by brush, roller or pad. Brush application is usually the best. These stains perform similarly and are applied like paint. One coat of solid color stain is only marginally adequate on new wood. A prime coat with a top coat will always provide better protection to the wood as well as promoting a longer service. Optimal performance can be obtained if the wood is primed, then given two coats of stain. Top coats of acrylic latex solid color stains are generally superior to all others, especially when two coats are applied over a primer.

Unlike paint, a solid color stain may leave lap marks. To prevent lap marks, follow the procedures suggested for semi-transparent penetrating stains.

Semi-Transparent Stains

You have the option to apply semi-transparent stains by brush, spray, pad or roller. Brushing will usually give the best penetration and performance. Spray or roller application followed by back-brushing is also an acceptable method.

the stained area from drying before a logical stopping place is reached. Working in the shade is desirable because the drying rate is slower.

Stain that has been applied by spray without back-brushing is prone to show blotchy patterns as it weathers.

Two coats of penetrating oil-based stain on a textured Western Red Cedar will provide a longer service life than one coat, but only if the wood will accept the second coat. Stir the stain thoroughly during application to prevent settling and color change. Avoid mixing different brands or batches of stain.

Latex semi-transparent stains do not penetrate the wood surface, but they are easy to apply and less likely to form lap marks. These stains are film-forming and may not be as durable as oil-based stains.

FINISH

ON S

The surface condition of the wood on
the finish is applied can substantially
performance and life expectancy of th

New (not weathered) Western Re

New cedar siding and trim should be p
from the weather before, during and a
construction. It is seldom necessary to
extensive surface preparation providin
has not weathered for more than two
is clean and dry. The moisture content
always be checked as a precaution. I
content cannot be above 20% and if
has been contaminated by dirt, oil or o
substances, the contaminants must be
Dirt should be washed from the surfac
Section on cleaning and discoloration).
For smooth-planed, flat-grained cedar
surface preparation may be desirable.
grained wood, the surface should be s
with 50-80 grit sandpaper. This proced
greatly increase the coating's performa
not detract from a smooth appearance
preparation is not necessary for clean
cedar.

Weathered Western Red Cedar

Cedar siding and trim that has been ex
the elements for longer than 2 weeks
a degraded surface that is unsuitable f
Preparing the surface by
brushing with a non-fer
brush, and washing be
the finish is recommende

OR

FOR

RED CEDAR DECKS

ks for Optimal Performance

estern Red Cedar is a naturally
ideal for decks. Its performance
When protected by an appropriate
stain, subjected to the most
exposure conditions. The
or a horizontal surface, the abrasive
ot traffic, pounding rain and full
sun make deck finishing more
ding than other finishing applications
such as siding. This is important to
ensure that the finish you apply to
your Western Red Cedar decking
boards has been specifically
rmulated for this end use.

nseasoned decking should be air dried
ot exposed to direct sunlight and
nished on all sides prior to installation.

oice of Deck Finishes

full range of both penetrating and lap
shes are available for cedar decks.
do not form a film, the penetrating
vide better overall performance and
est to maintain and refinish.

finishes do not flake, crack or
treatment is the prepeel water repellent
with a mildewcide, slow down the
ict organisms like mildew. The
finishes are often used as a natural
dar decks. There are three types of
finishes: water repellents, water
servatives, and solvent-borne semi-
stains. The best of these finishes are
e semi-transparent ones.

decks. These natural finishes enhance the appearance and service life of cedar decks. The water-repellent preservatives are preferable to the water-repellents because they contain a mildewcide and other fungicides that help inhibit surface mildew growth. Many of these water-repellents contain ultraviolet light blockers or absorbers that help protect the Western Red Cedar from damaging sunlight, to date the best of the mineral spirit solvent-borne semi-transparent stains. The water-repellent preservative finishes are very effective in stopping the absorption of liquid water thus reducing swelling and shrinking of the wood. Water-repellents should be used only on newly manufactured bare cedar, or restored bare cedar, or on cedar previously treated with the same type of product. When used as a natural finish, the service life of a water-repellent is only one to two years depending on the wood and exposure conditions.

Semi-Transparent Stains

Semi-transparent stains have pigments which provide color and greatly increase the durability of the finish. The pigments help block sunlight and protect the cedar surface, thus increasing service life. The better products contain water-repellents and mildewcides or fungicides. The solvent-borne semi-transparent stains penetrate into the cedar without forming a film and do not blister or peel even if excessive moisture enters the cedar. However, latex semi-transparent stains can sometimes build up a film, especially on recoating, which can lead to peeling. Latex stain formulations currently being developed may correct this problem.

It is possible to switch to a semi-transparent stain when the deck needs to be refinished. Even if the deck has been coated with a clear or transparent stain for many years, an oil-based semi-transparent stain can be applied, provided the wood surface is cleaned.

Note: Film-forming finishes are normally not recommended for use on Western Red Cedar decks because they can readily crack, flake and peel, and can be very difficult to refinish and maintain.

APPLICATION

TECHNIQUES FOR DECKS

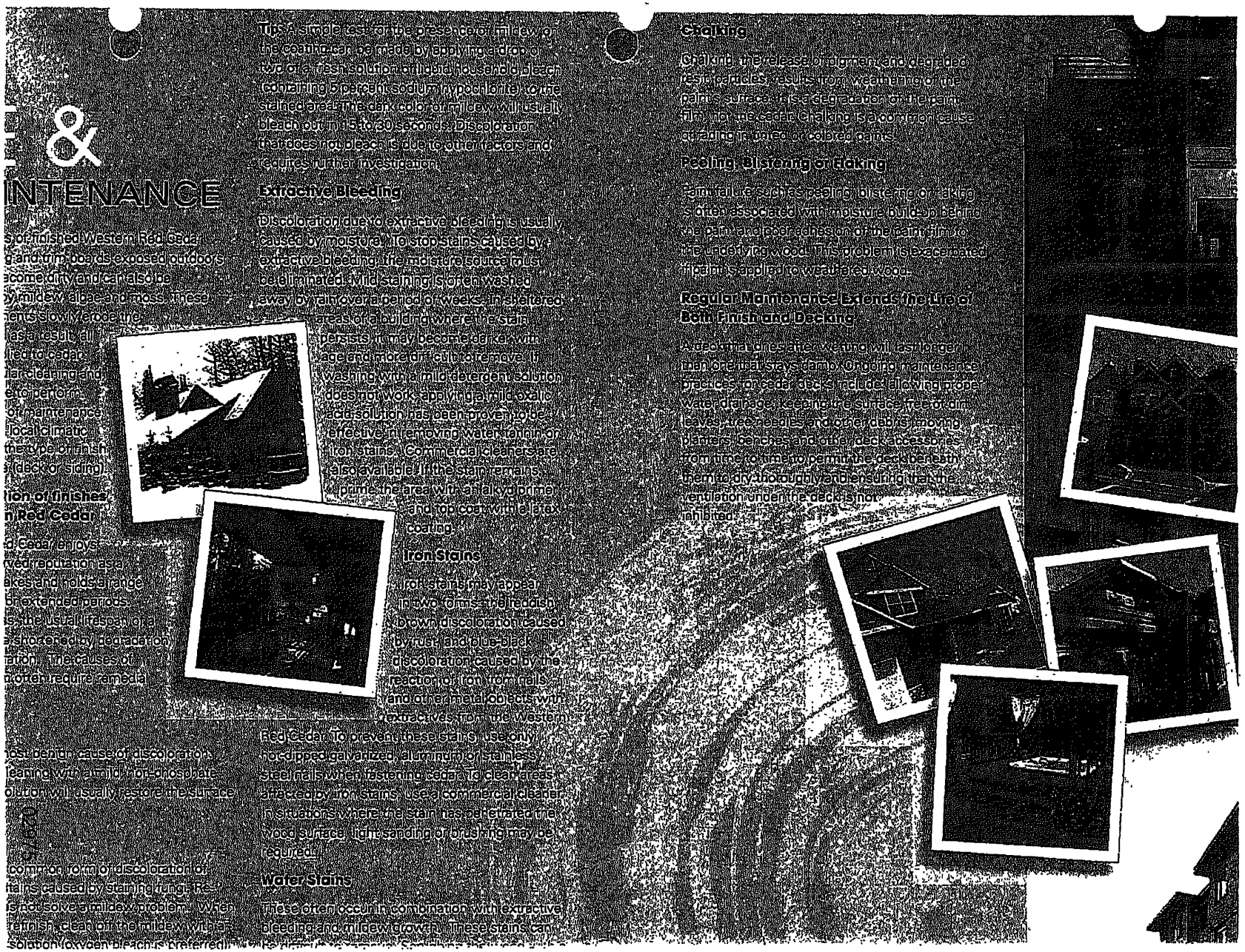
The first finish applied to cedar decks is the most important one. If the first finish is not done can be difficult to correct problems that develop later. The finish should be applied as soon as surface is dry. The deck should be cleaned, but power washing should never be used on clea decks because this process can damage the wood surface fibers and make it difficult for the bond. Factory finishing is the best option and is available in most markets.

Semi-Transparent Stains

Semi-transparent stains are best applied to decking by brush because the stain is worked into the wood surface promoting the achievement of even finish penetration into the wood. Apply the stain liberally by brushing in the direction of the wood's grain. Apply finishes to the full length of only two or three boards at a time to avoid lap marks. Try to avoid overlapping areas that contain dry stain with fresh stain which can also create lap marks. Working in the shade can help reduce lapping because the drying rate of the stain is slower. Water-based stains are less likely to form lap marks than solvent-based stains because they are slower drying but they form a thinner film on the surface than solvent-based stains and may not last as durable. Do not apply more stain than the cedar will absorb because the excess stain will appear as dull shiny areas on the surface.

Application of Transparent Stain Water-Repellent Preservatives

The method of applying transparent st wood is similar to that described above transparent stains. Water-repellents h are more forgiving and can be applied each roller followed by a brush. Bec Repeated brush reapplication of Western until the wood will no longer absorb a water-repellent. Knowing when to stop will enhance the durability of the finish water-repellent finish absorbed by the the longer the service life. Like stains, water-repellent should be applied to all boards, edges and ends. Ov vulnerable to moisture penetration, su holes and cracks as soon as they appear



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INTENANCE

of finished Western Red Cedar

g and trim boards exposed outdoors

acome dirty and can also be

by mildew, algae and moss. These

ents slowly erode the

last, result in

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llar cleaning and

ete to perform

of maintenance

l local climatic

the type of finish

(deck or siding).

tion of finishes

n Red Cedar

d Cedar enjoys

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akes and holds a range

r extended periods.

s the usual lifespan of a

short-ended by degradation

ation. The causes of

often require remedial

st beneath causes of discoloration

leaning with a mild, non-phosphate

olution will usually restore the surface.

R

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common form of discoloration of

tains caused by staining fungi. Re-

s not solve a mildew problem. When

finish, clean off the mildew with a

solution (oxygen bleach is preferred)

Tip: A simple test for the presence of mildew on the coating can be made by applying a drop or two of a fresh solution of liquid household bleach containing 5 percent sodium hypochlorite to the stained area. If the dark color of mildew will usually bleach out in 15 to 30 seconds. Discoloration that does not bleach is due to other factors and requires further investigation.

Extractive Bleeding

Discoloration due to extractive bleeding is usually caused by moisture. To stop stains caused by extractive bleeding, the moisture source must be eliminated. Mild staining is often washed away by rain over a period of weeks. In sheltered areas of a building where the stain persists, it may become darker with age and more difficult to remove. If washing with a mild detergent solution does not work, applying a mild oxalic acid solution has been proven to be effective in removing water stain or iron stains. Commercial cleaners are also available. If the stain remains, prime the area with a alkyd primer and top coat with a latex coating.

Iron Stains

Iron stains may appear in two forms: the reddish-brown discoloration caused by rust, and blue-black discoloration caused by the reaction of iron from nails and other metal objects with extractives from the Western Red Cedar. To prevent these stains, use only hot-dipped galvanized, aluminum or stainless steel nails when fastening cedar. To clear areas affected by iron stains, use a commercial cleaner. In situations where the stain has penetrated the wood surface, light sanding or brushing may be required.

Water Stains

These often occur in combination with extractive bleeding and mildew growth. These stains can

Chalking

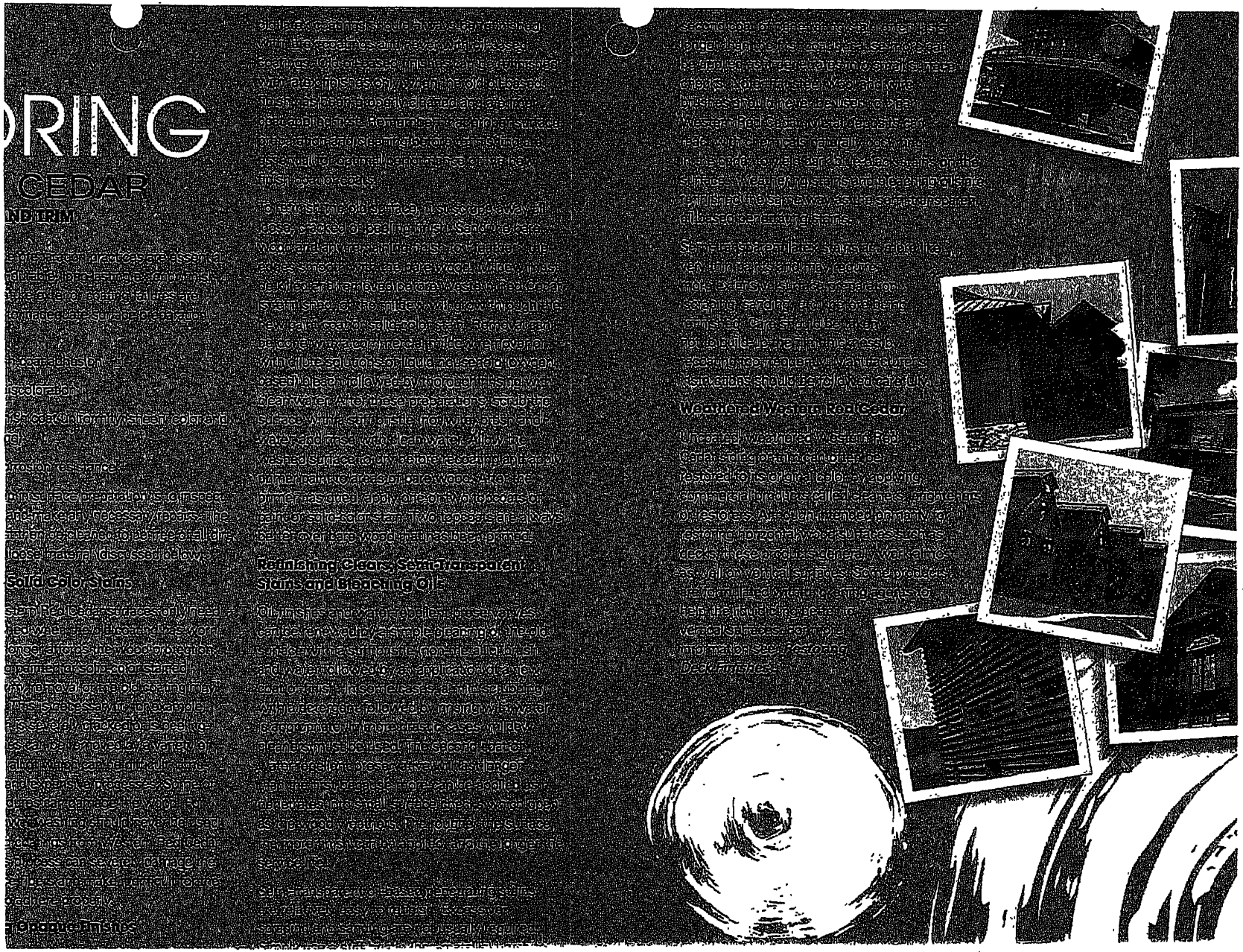
Chalking, the release of pigment and degraded resin particles, results from weathering of the paint's surface. It is a degradation of the paint film, not the cedar. Chalking is a common cause of fading in tinted or colored paints.

Peeling, Blistering or Flaking

Paint failure such as peeling, blistering or flaking is often associated with moisture build-up behind the paint and poor adhesion of the paint film to the underlying wood. This problem is exacerbated if paint is applied to weathered wood.

Regular Maintenance Extends the Life of Both Finish and Decking

A deck that dries after wetting will last longer than one that stays damp. Ongoing maintenance practices on cedar decks include: allowing proper water drainage, keeping the surface free from leaves, tree needles and other debris; moving planters, benches and other deck accessories from time to time to permit the deck beneath them to dry thoroughly and ensuring that the ventilation under the deck is not inhibited.



ORING

CEDAR

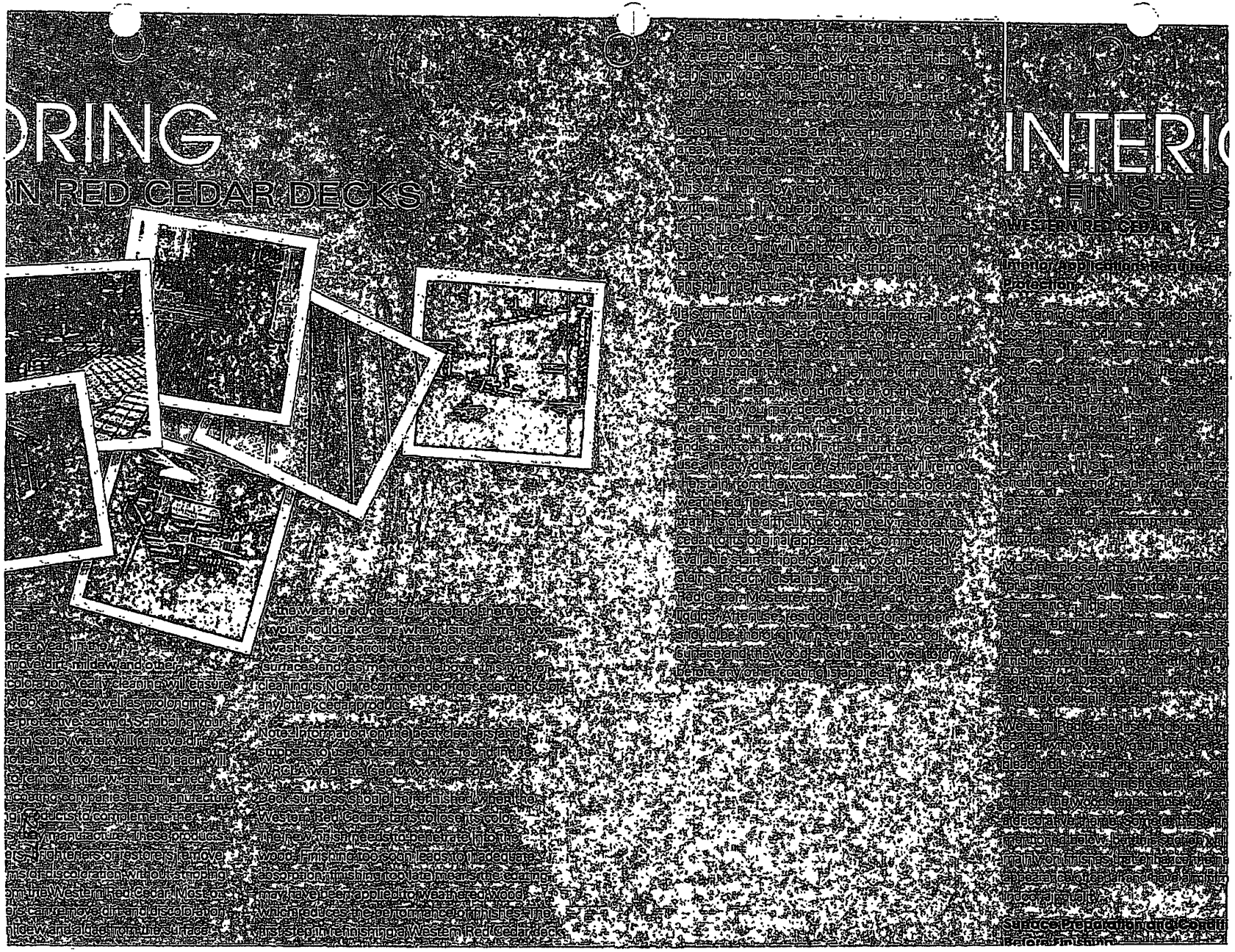
ND TRIM

Weathered Western Red Cedar

Restoring Clear, Semi-Transparent Stains and Bleaching Oils

Solid-Color Stains

Opaque Finishes



ORING

ON RED CEDAR DECKS

INTERI

FINISHES

WESTERN RED CEDAR

Interior Application Beau

Protection

3119

Choice of Finish

The [illegible] of Western Red Cedar's natural color and its [illegible] on the body [illegible] finish or coating. Some finishes will [illegible] Western Red Cedar's natural [illegible] some darkening of the wood can be expected as it ages and the color variation will become less pronounced. Any color or clear finish will [illegible] Western Red Cedar to some degree, but the wood [illegible] surface that is easier to maintain.

Preservatives [illegible] finishes [illegible] they will [illegible] with [illegible] commercially available wood preservatives. After bleaching, the Western Red Cedar [illegible] its natural state or given a coat of clear sealer.

Clear wax is [illegible] [illegible] and [illegible] cedar. Like varnish finishes, waxes [illegible] well. There are also pigmented light waxes on the market which [illegible] article.

Clear finishes or water-based acrylic polyurethane or acrylic polyurea are an excellent option on siding in Western Red Cedar or home. These finishes can be brushed on to produce a [illegible] coating that does not mask natural appearance of cedar. They emit very low levels of solvents and other compounds that can reduce indoor air quality. They are available in [illegible] semi-gloss and gloss finishes from a number of manufacturers. When choosing a finish, it is important to [illegible] unless a [illegible] in the Western Red Cedar is preferred. High gloss polyurethanes provide the most durable finish but only if [illegible] surface may be objectionable to some. These products are not suitable for decks or [illegible].

Oil finishes such as **Danish oil, tung oil and boiled linseed oil** are widely available and easily applied to smooth or textured Western Red Cedar. However they tend to take [illegible] and should be [illegible] sanded before [illegible] application.

Clear lacquer can be used on smooth surfaces [illegible] an [illegible] finish will [illegible] Western Red Cedar [illegible]

[illegible] finishes [illegible] some [illegible] are [illegible] by [illegible] finishes [illegible] Western Red Cedar's own [illegible] colors are [illegible] and [illegible] new [illegible] applications. For [illegible] finishes [illegible] policy [illegible] [illegible] [illegible]

REFERENCES

The WRCLA's "How to Finish Western Red Cedar" guide is intended to provide a summary of the essential "best practices" for finishing, care and maintenance that will lead to a positive experience with your Western Red Cedar. The subject of finishing is far more extensive than the scope of this document. For this reason, WRCLA encourages readers wishing to learn more about this interesting topic to read the following publications and websites which are the source of this guide's content.

Websites:

www.FPL.FS.FED.US

Publications:

The Joint Coatings & Forest Products Committee (2009). Improving The Performance of Painted Wood Siding: Rain Screen, End-Grain Seal, and Back Priming available in PDF at www.wrcla.org

The Joint Coatings & Forest Products Committee. Frequently Asked Questions: Wood and Coatings Application. Available in PDF at www.wrcla.org

Allen, S. (2006). The Wood Finisher's Handbook. Sterling Publishing Co. Inc., 224 p.

Charron, A. (1998). Water-Based Finishes. The Taunton Press, 156 p.

Evans, P.D., Thay, P.D., Schmalzl, K.J. (1996). Degradation of surfaces during natural weathering. Effects on lignin and cellulose and on the adhesion of acrylic latex primers. Wood Science and Technology 30(6): 411-422.

Flexner, B. (2005). Understanding Wood Finishing (2nd Ed.). Fox Chapel Publishing, 308 p.

Jewitt, J. (2004). Taunton's Complete Illustrated Guide to Finishing. The Taunton Press, 294 p.

Podgorski, L., Georges, V., Garmendia, I., Sarachu, B.S. (2009). A fast and economic method to produce grey wooden surfaces for decking and cladding: preliminary results. The International Research Group on Wood Protection Document IRG/WP 09-40474, 11 p.

Williams, R.S. (1998). Solid-color stains on western red cedar and redwood siding. The Finish Line, 2 p.

Williams, R.S., Knaebe, M.T., Feist, W.C. (1996). Finishes For Exterior Wood. Forest Products Society, 128 p.

Williams, R.S., Feist, W.C. (1999). Water repellents and water-repellent preservatives for wood. USDA Forest Service, Forest Products Laboratory Report. FPL-GTR-109, 12 p.

REAL CEDAR

WRCLA

www.wrcla.org **1.866.778.9096**

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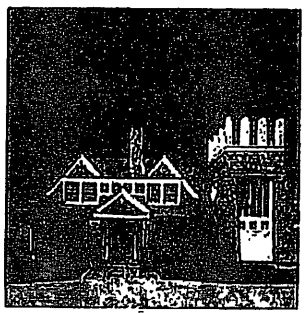
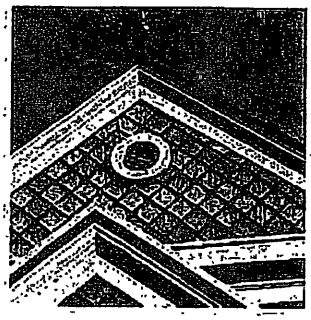
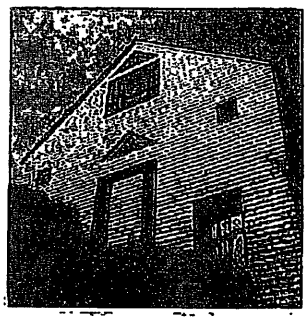
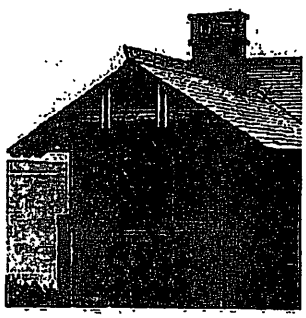
Exterior and Interior
WALL MANUAL

Cedar Shake &
Shingle Bureau

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Credits, front cover:

Left column

1. Architect: Shope Reno Wharton, Photo: Robert Benson
2. Architect: Gaylord Grainger, Libby O'Brien-Smith Architects, Photo: Eduardo Calderon
3. Architect: Meyers and D'Aleo, Inc., Photo: Otto Baitz

Centre column

1. Architect: Gary Tabasinske, AIA, Photo: Chris Eden
2. Architect: Alfredo De Vido Associates, Photo: Paul Warchol

Right column

1. Architect: Tanner and VanDine Architects, Photo: Mark Citret
2. Architect: Archimedia, Photo: George Kennedy, AIA & Cosby Bowyer, Inc.
3. Photo: Celia Pearson

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INTRODUCTION

This manual is intended for use with Western Red Cedar and Alaskan Yellow Cedar shingle and shake applications only. Western Red Cedar products manufactured by CSSB members are labeled with the "Certi" brand name. Alaskan Yellow Cedar products manufactured by CSSB members are labeled with "Yellow Cedar" at the top of their label. For ease of reference this manual refers to "Certi-label™ Western Cedar" and the term is understood to include both Western Red Cedar and Alaskan Yellow Cedar products manufactured by CSSB members.

Certi-label™ Western Cedar shingles and shakes are the ideal exterior wall cladding for new construction and remodeling. They bring life in the form of beauty, texture, durability, insulative quality, and low maintenance to any building. Restyling with Certi-label Western Cedar shingles or shakes is easily accomplished, whether replacing the previous wall material (re-walling) or applying right over the existing wall (over-walling).

Exterior and Interior Walls Construction Manual

Material for this manual has been compiled from various authoritative sources, and many of the construction methods shown herein have been developed by the shingle and shake specialists in both the United States and Canada. The design and application details and methods of construction reflect current good building practice. Other options are possible but ensure that you check with your local code jurisdiction for approval.

The information in this manual is not intended to supercede local building codes.

Cedar Shake & Shingle Bureau History

On June 9, 1915, at a meeting of the Trustees of the West Coast Lumber Manufacturers Association, it was agreed to establish a branch of the association to serve those members who manufactured shingles. The Red Cedar Shingle Bureau was formed as a separate entity on June 1, 1923. In 1956, the Hand-Split Red Cedar Shake Association was formed. Our influence grew, and as we survived both the Great Depression and World War II, manufacturers continued their quality commitment. In 1963 the shake and shingle associations merged to become the Red Cedar Shingle & Handsplit Shake Bureau.

In the late 1980s, mill quality control inspections were subcontracted to independent, third party quality control agencies.

Each year the Cedar Shake & Shingle Bureau's staff answer thousands of technical questions and product selection queries. Our proud history, quality reputation and dedicated members provide excellent Certi-label Western Cedar shingle and shake siding and roofing products.

Certi-label™ Products

Certi-label Western Cedar shingles and shakes manufactured by members of the Cedar Shake & Shingle Bureau ("CSSB") are the only products labeled with the "Certi" brand name. Certi-label Western Cedar shingles and shakes are made by experienced craftsmen who take pride in their trade and the quality of their product. Despite their varying sizes and sometimes remote locations, member mills are bound together by a rigid quality code. Unannounced independent inspections conducted by accredited third party agencies ensure that product quality is maintained. Products are inspected to conform with various local, national and international codes and standards (contact the CSSB for specific details).

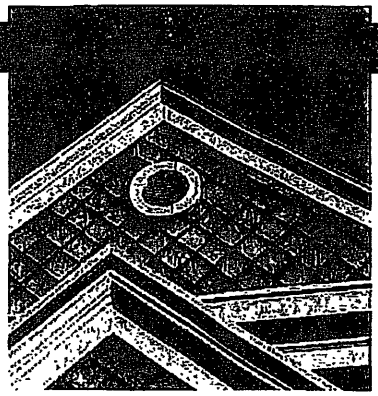
All CSSB member product has the mill's distinctive Certi-label tucked under the bundle strap or printed on the carton. Asking for "the blue label" or "number one blue label" is not specific enough: CSSB members' products are the only ones with the *Certi* brand name on the label.

Approved Installer Guidelines

Good workmanship is crucial to the integrity of any sidewall system. Installers should read this manual carefully and ensure that they follow proper workmanship practices. CSSB Approved Installers agree to follow the guidelines in this manual, or local code regulations, if stricter than the guidelines contained in this manual.

Application Note

Certi-label Western Cedar shingles and shakes are applied on walls in a different manner than on roofs. The major point of difference is in permissible weather exposures - on walls the maximum weather exposure is greater than it is on roofs. A given area of wall, therefore, will require less material than the same area of roof.



Architect: Gary Tabasinske, AIA, Photo: Chris Eden

Product Warranty

The CSSB administers a product warranty for certain product applications performed by an Approved Installer. Consult warranty documentation for specific details.

Note: This manual replaces all previous versions of the "Cedar Shake and Shingle Bureau Design and Application Manual for Exterior and Interior Walls"

CONTENTS

Certi-label Products	pages 1-3
Exterior New Wall Construction	pages 4,6,7,8,9
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Exterior Over-Wall and Re-Wall Construction	page 10
Interior Wall Construction	page 11
Sidewall Application Guidelines	page 12
Sidewall Finishing	page 13
Sidewall Coverage Tables	pages 14, 15
How to Read a Certi-label	page 16

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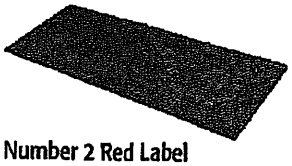
1 CERTI-LABEL WESTERN CEDAR PRODUCTS

CERTIGRADE® WESTERN CEDAR SHINGLES

Number 1 Blue Label®



The premium grade of shingles for sidewalls and roofs. These top-grade shingles are 100% heartwood, 100% clear and 100% edge grain. Available in 16" or 18" or 24" lengths.

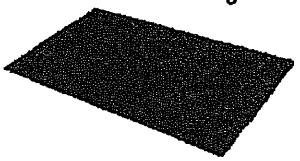
Number 2 Red Label

A good grade for many applications. Not less than 10" clear on 16" shingles, 11" clear on 18" shingles and 16" clear on 24" shingles. Flat grain and limited sapwood are permitted in this grade.

Number 3 Black Label

A utility grade for economy applications and secondary buildings. Not less than 6" clear on 16" and 18" shingles, 10" clear on 24" shingles.

Number 4 Undercoursing



A utility grade for undercoursing of double coursed sidewalls only. Not a roofing material and not to be used as a starter course for roofs.

CERTI-LABEL WESTERN CEDAR SHAKES

Certi-Split® Handsplit Shakes

These shakes have split faces and sawn backs. Cedar logs are first cut into desired lengths. Blanks or boards of proper thickness are split and then run diagonally through a bandsaw to produce two tapered shakes from each blank. Available in Premium Grade (100% edge grain) or Number 1 Grade (Up to 20% flat grain allowed in each bundle).

Certi-Sawn® Tapersawn Shakes

These shakes are sawn both sides. Premium and Number 1 Grades are the most common. Premium Grade is 100% edge grain, 100% clear and 100% heartwood. Number 1 Grade allows up to 20% flat grain in each bundle. Number 2 and 3 Grades are also available.

Certi-Split® Tapersplit Shakes

Produced by hand, using a sharp bladed steel froe and a mallet. The natural shingle-like taper is achieved by reversing the block, end-for-end, with each split. Premium Grade only.

Certi-Split® Straight-Split Shakes

Produced by machine or in the same manner as tapersplit shakes except that by splitting from the same end of the block, the shakes acquire the same thickness throughout. Premium Grade only.

Note: Western Cedar's natural color varies.

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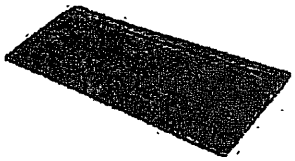
SPECIALTY CERTI-LABEL WESTERN CEDAR SIDEWALL PRODUCTS

Certigrade® Rebutted & Rejointed Shingles

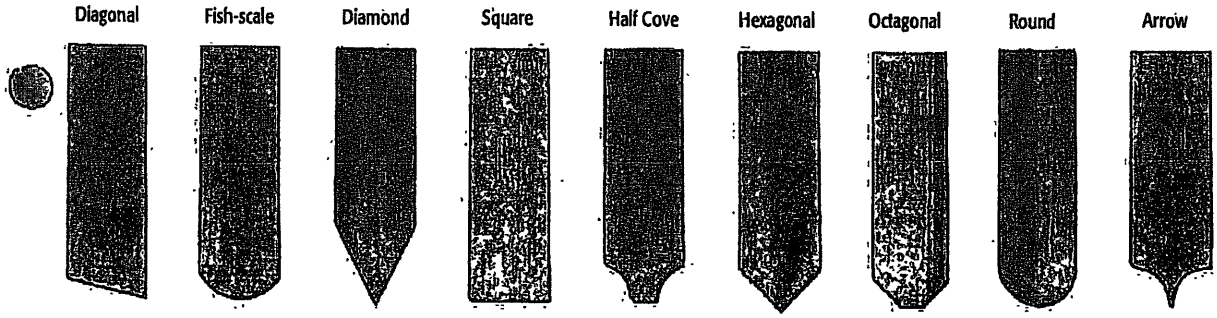
Also known as R&R products, these materials have the same specifications as Number 1 and Number 2 Certigrade shingles, but they are machine re-trimmed for parallel edges and with smooth butts sawn at right angles where a uniform appearance is desired. They are primarily used for sidewall applications. Rebutted & rejointed shingles are also available with a smooth sanded face, with the length of the sanded face at a length greater than the maximum exposure. They are manufactured from 16", 18" and 24" lengths.

Certigroove® Machine Grooved Shingles



Machine grooved shingles are manufactured as a rebutted & rejointed shingle with one face striated for a length greater than the maximum exposure. Machine grooved products are for sidewall applications only, and are remanufactured from 16", 18" and 24" shingles.

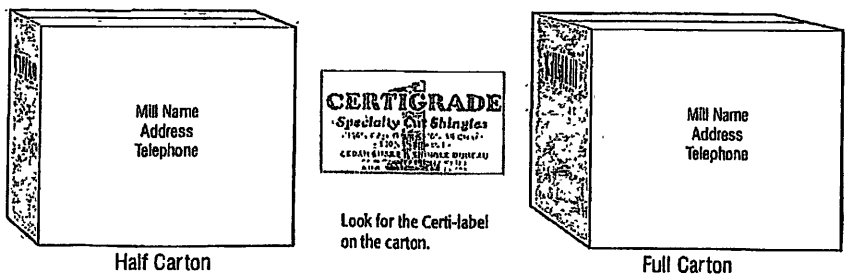
Certi-Cut™ Shingles



CERTI-CUT SHINGLES These shingles are 5" wide and are manufactured from 16" and 18" lengths. A 96 piece carton will cover 25 square feet at 7 1/2" exposure. Nine of the most popular designs are shown. Certi-Cut shingles can also be custom produced to meet individual design specifications.

Note: Western Cedar's natural color varies.

Sidewall Carton Packaging Example



Half Carton

Look for the Certi-label on the carton.

Full Carton

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Pressure-Impregnated Treated Products

Certi-label products can also be treated. Products are available either fire-retardant-treated OR preservative-treated. Special care must be taken to follow the treatment company's recommended installation instructions.

Certi-Guard® Fire-Retardant Treated Western Cedar Shingles and Shakes

Number 1 Grades of Certigrade shingles, and Premium and Number 1 Grades of Certi-Split shakes and Certi-Sawn shakes are available pressure-impregnated with fire retardants. Contact the treatment company for treatment warranty information, accessory product requirements (including recommended fastener types) and application details for treated Western Cedar material. Local code jurisdictions may have additional information regarding applications in specific areas.

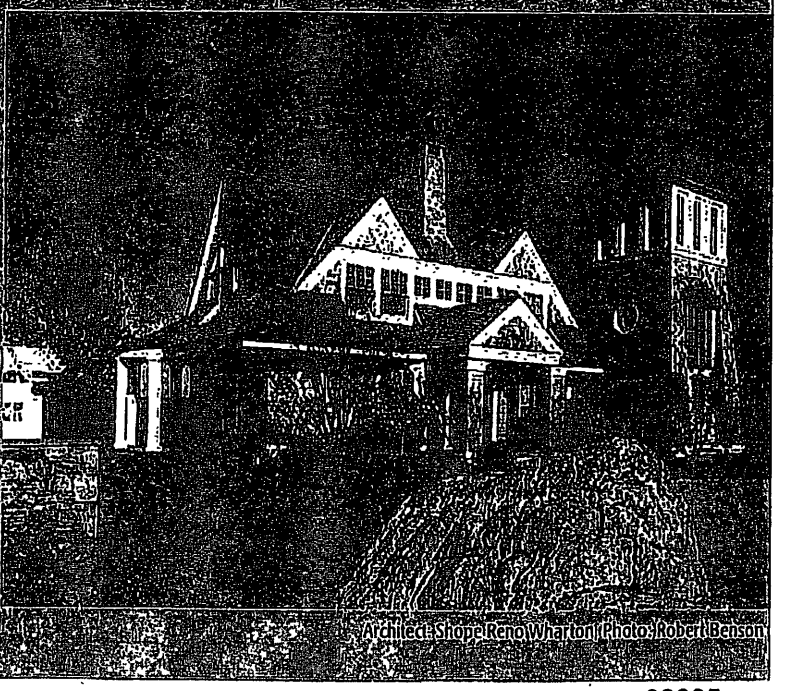
Certi-Last® .40 CCA Preservative-Treated Western Cedar Shingles and Shakes

Number 1 Grades of Certigrade shingles, and Premium and Number 1 Grades of Certi-Split shakes and Certi-Sawn shakes are available preservative-treated by pressure processes. This product is ideal in areas of high humidity. Specify the Certi-Last treating label for this extra protection. Contact the treatment company for treatment warranty information, accessory product requirements (including recommended fastener types) and application details for treated Western Cedar material.

Note: Once Western Cedar shingles and shakes are pressure-impregnated treated you must contact the treatment company to determine if a finish, such as paint or stain, is allowable.

Certi-label Sidewall Application Tips

Certi-label Western Cedar shingle and shake size, exposure, width of joints, width of product, kiln versus air drying process, moisture content and the local environment will all affect the expansion/contraction of Certi-label Western Cedar sidewall products. These factors should always be taken into consideration when determining the installation details and adequate spacing needed for your specific project. Consult with your Approved Installer and refer to page 4 of this manual for more lateral spacing details.



Architect: Shope Reno Wharton | Photo: Robert Benson

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Design and Application Details

The instructions given here are not meant to supercede local code requirements. Check with your local building official for their preference in your area.

Preparation - Be sure that the walls are smooth, without protuberances. Nail ends or points should be removed or pounded flush.

Underlayment - The CSSB recommends Type 30 felt underlayment (also known as #30 bituminous impregnated building paper). Check with your local building official for any questions about alternative underlayment materials. Apply it horizontally, with a staple gun, starting at the base of the wall, with a 2" horizontal overlap with each succeeding course, and a 6" overlap vertically when starting a new roll. Wrap the Type 30 felt underlayment 4" each way around both inside and outside corners.

Corner Boards - Install corner boards (Figure 8) at this time.

Flashing - Flashings associated with doors, windows, and penetration details should be in accordance with good building practice.

Laying Out - Determine the number of Certi-label courses by measuring the height of the wall at the lowest part of the foundation, from a point 1" below the top of the foundation, to the top of the wall. Divide the height into equal parts, corresponding closely to the weather exposure, but not exceeding the maximum weather exposure recommended. Transfer this measurement and the number of Certi-label courses to a storypole (Figure 1), to lay out courses on all other walls. Whenever possible butt lines should align with tops or bottoms of windows or other openings, and for appearance the exposure of the final course at the top should match those below.

Certi-label Western Cedar shingle and shake size, exposure, width of joints, width of product, kiln versus air-drying process, moisture content and the local environment will all affect the expansion/contraction of Certi-label Western Cedar sidewall products. These factors should always be taken into consideration when determining the installation details and adequate spacing needed for your specific project. Consult with your Approved Installer and refer to Figure 2: Spacing Detail.

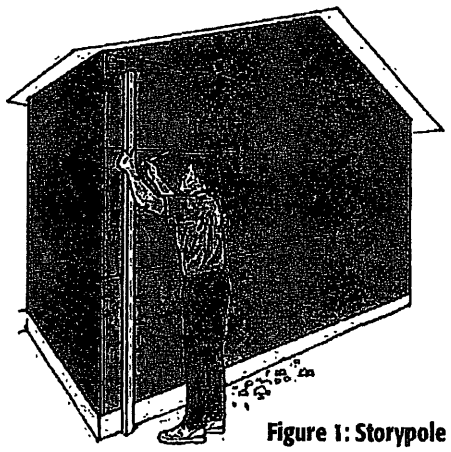

Figure 1: Storypole

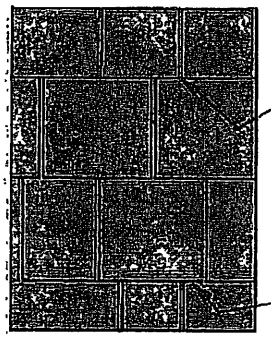

Figure 2: Spacing Detail

Figures 3a and 3b: To prevent the wicking of water, which may cause staining, keep a 1/2" clearance between the first course of Certi-label products from all surfaces below.

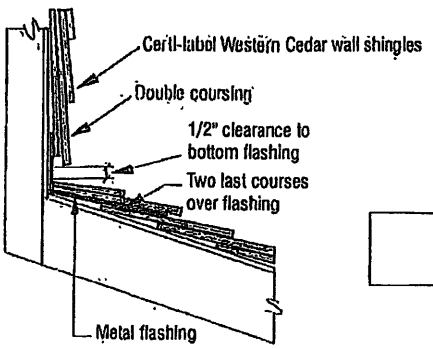

Figure 3a: Flashing

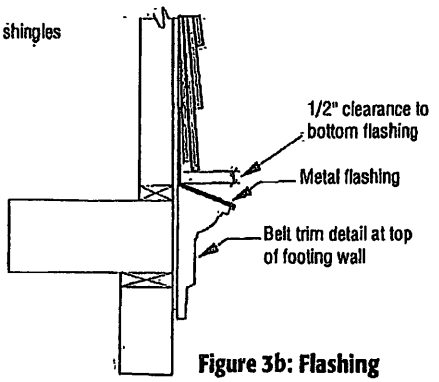

Figure 3b: Flashing

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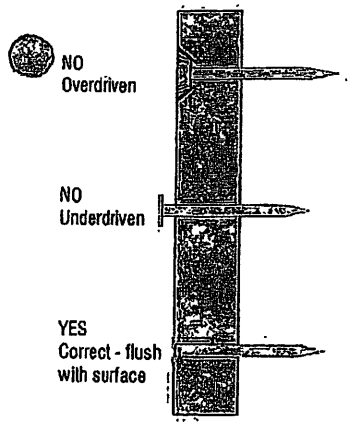


Figure 4: Nail Driving Detail

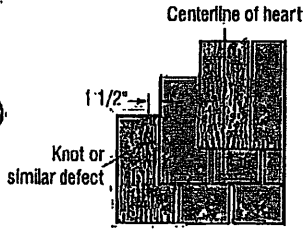


Figure 5: Course Alignment

Nails

Each Certi-label Western Cedar shingle or shake should be applied with two corrosion-resistant fasteners, such as stainless steel (type 304 or 316), hot-dipped zinc coated, or aluminum nails or other fastener as accepted by your local building official. Minimum nail lengths are shown in the fastener chart below. In double course applications, the exposed Certi-label Western Cedar shingle or shake shall be face-nailed with two hot-dipped galvanized or stainless steel casing nails, driven 2" above the butt line, and 3/4" from each edge. Certi-label Western Cedar shingles wider than 10" require 2 additional nails and these two nails are driven approximately 1" apart near the center of the shingle.

Staples

Staples should be aluminum or stainless steel (type 304 or 316) 16 gauge or other fastener as accepted by your local building official. Two staples should be driven per Certi-label Western Cedar shingle or shake with the staple crowns 7/16" minimum horizontal, maximum 3/4" horizontal, to the Certi-label Western Cedar shingle or shake butt. Staples are driven in the same location as nails relative to the sides and overlapping butt line. Certi-label Western Cedar shingles wider than 10" require 2 additional staples and these two staples are driven approximately 1" apart near the center of the shingle.

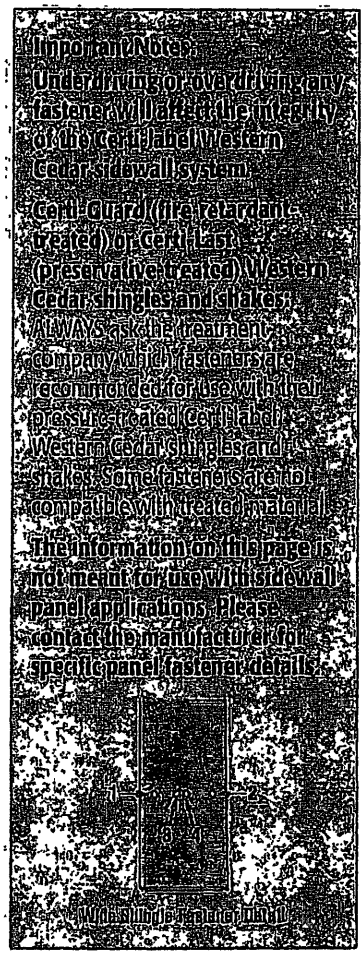
Fasteners should be long enough to penetrate into the sheathing at least 3/4" or all the way through and driven flush with the surface of the Certi-label Western Cedar shingle or shake. In all applications, staples shall be concealed by the course above. Fasteners cannot be electro-galvanized as they will cause staining. **Nails are preferred, for aesthetic reasons, in sidewall applications using exposed fasteners.**

Important Note:

Underdriving or overdriving any fastener will affect the integrity of the Certi-label Western Cedar sidewall system.

Certi-Guard (fire retardant-treated) or Certi-Last (preservative-treated) Western Cedar shingles and shakes: ALWAYS ask the treatment company which fasteners are recommended for use with their pressure-treated Certi-label Western Cedar shingles and shakes. Some fasteners are not compatible with treated material.

The information on this page is not meant for use with sidewall panel applications. Please contact the manufacturer for specific panel fastener details.



Single Course Sidewall Fasteners	
Product Type	**Nail Type & Minimum Length**
Certigrade, R&R and Sanded Shingles	**Type (in)**
16" and 18" Shingles	3d Box 1 1/4
24" Shingles	4d Box 1 1/2
Certigroove Shingles	**Type (in)**
16" and 18" Shingles	3d Box 1 1/4
24" Shingles	4d Box 1 1/2
Certi-Split & Certi-Sawn Shakes	**Type (in)**
18" Straight-Split Shakes	5d Box 1 3/4
18" and 24" Handsplit Shakes	6d Box 2
24" Tapersplit Shakes	5d Box 1 3/4
18" and 24" Tapersawn Shakes	6d Box 2

Double Course Sidewall Fasteners	
Product Type	**Nail Type & Minimum Length**
Certigrade, R&R and Sanded Shingles	**Type (in)**
16", 18" and 24" Shingles	5d Box 1 3/4 or same size casing nails
Certigroove Shingles	**Type (in)**
16", 18" and 24" Shingles	5d Box 1 3/4
Certi-Split & Certi-Sawn Shakes	**Type (in)**
18" Straight-Split Shakes	7d Box 2 1/4 or 8d 2 1/2
18" and 24" Handsplit Shakes	7d Box 2 1/4 or 8d 2 1/2
24" Tapersplit Shakes	7d Box 2 1/4 or 8d 2 1/2
18" and 24" Tapersawn Shakes	7d Box 2 1/4 or 8d 2 1/2

02987

Single Coursing

Double the starting course at the base of the wall (Figure 6). Apply with 1/8" to 1/4" keyway space between Certi-label Western Cedar shingles, giving a pronounced individual effect to each course.

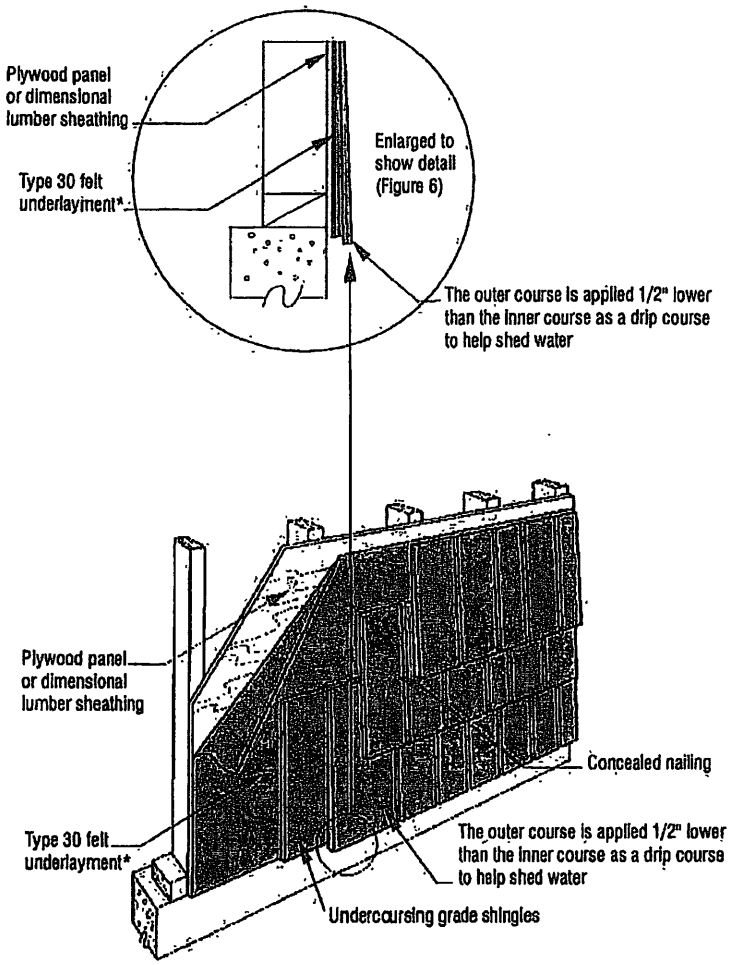
Offset the side joints in any one course at least 1 1/2" over joints in adjacent courses (Figure 2).

Use a straight edge, nailing it lightly to the wall with the edge at the butt line (to keep courses straight and level). Check for level every 3 or 4 courses.

This wall application features concealed nailing (Figure 6), with nails driven approximately 1" above the butt line of the succeeding course. For Certi-label Western Cedar shingles up to 10" wide, place two nails in each shingle 3/4" from each edge. With Certi-label Western Cedar shingles wider than 10", drive two additional nails approximately 1" apart near the center.

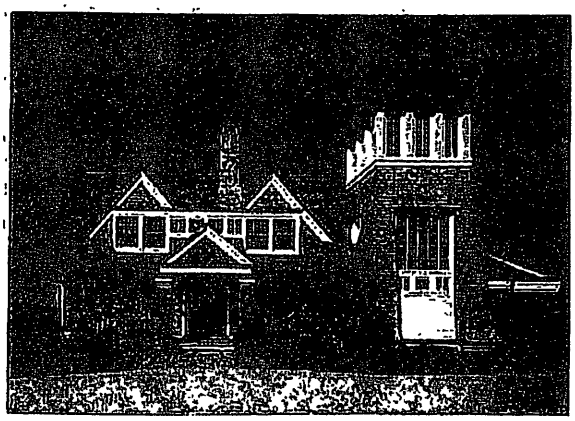
Because Certi-label Western Cedar shingles vary in width there should be little waste. At corners, or at door or window frames, you may have to trim a selected Certi-label Western Cedar shingle slightly.

The CSSB recommends installing over plywood panel or dimensional lumber sheathing. If other sheathing materials are approved for use by your local building official, the holding power of the fasteners should also be considered carefully.



*The Cedar Bureau recommends Type 30 felt underlayment and will refer to required underlayment with this description throughout this manual. Check with your local building official for any questions about alternative underlayment materials.

Figure 6: Single Coursing



Architect: Shope Reno Wharton, Photo: Robert Benson

02988

Double Coursing

To obtain an attractive wall characterized by wide weather exposures and deep shadow lines, Certi-label Western Cedar shingles and shakes can be applied double coursed. This method offers economy because of the wide exposures of the outer course and the use of less expensive undercoursing Certi-label Western Cedar shingles for the under layer (Figure 7). For double coursing exposure details refer to the chart on page 12.

In double coursing, the bottom or starter course is laid triple with two undercourse Certi-label Western Cedar shingles or one undercourse Certi-label Western Cedar shingle over a wood lath and then the outer course. This gives the bottom course the same slant as succeeding courses. All outer courses are applied 1/2" lower than the undercourse (Figure 7). A straight edge can be used to facilitate placement and nailing of both the undercourse and exposed course.

Undercourse Certi-label Western Cedar shingles are fastened at the top with one nail or staple in the center. The exposed Certi-label Western Cedar shingle or shake is face-nailed with two casing-type nails, driven approximately 2" above the butt line, 3/4" from each edge. With Certi-label Western Cedar shingles wider than 10" drive two additional nails approximately 1" apart near the center.

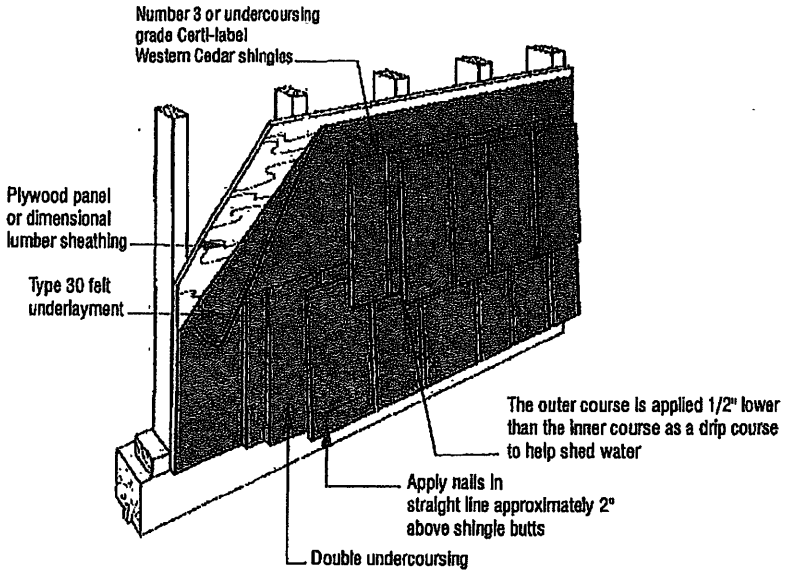
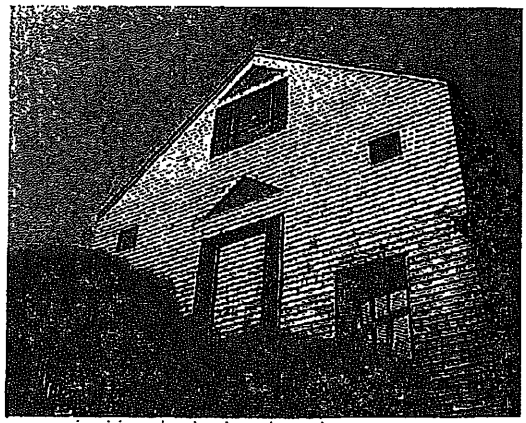


Figure 7: Double Coursing

The CSSB recommends installing over plywood panel or dimensional lumber sheathing. If other sheathing materials are approved for use by your local building official, the holding power of the fasteners should also be considered carefully.



Architect: Tanner and VanDine Architects, Photo: Mark Citret

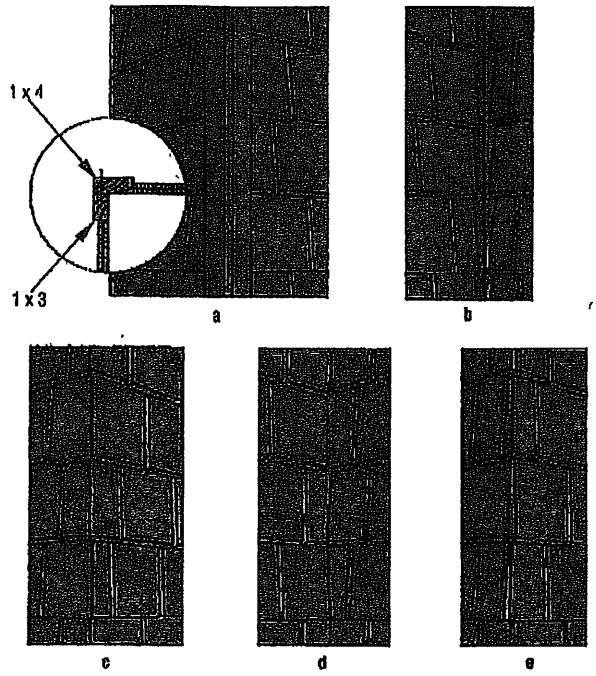
02989

Corners

Neatly fitting inside or outside corners are easily made. It is standard practice to lace outside corners (Figure 8e). On wide exposures this method requires small nails near the Certi-label Western Cedar shingle butts to tighten and hold the lapped corners. For these corners use only nails that are corrosion resistant. In double course applications, the exposed Certi-label Western Cedar shingle or shake shall be face-nailed with two hot-dipped galvanized or stainless steel casing nails, driven 2" above the butt line, and 3/4" from each edge. Certi-label Western Cedar shingles wider than 10" require 2 additional nails and these two nails are driven approximately 1 inch apart near the center of the shingle. Corner boards also can be used to advantage by nailing a 1 x 4 cedar board to a 1 x 3 cedar board, then attaching the preassembled corner to the building (Figure 8a).

It is good practice to use flashing behind Certi-label Western Cedar shingles or shakes at the inside corners. They may be butted against a square wood strip (Figure 8b), or they may be fitted one course to the other (Figure 8d). When the latter method is used, courses must be completed on each wall progressively, and can be best applied by working from the corners while alternately fitting one course to the other. (Figure 9)

It is preferred practice to install inside/outside corner flashing to safeguard against the cracking or tearing of Type 30 felt underlayment at these corners.



a) Certi-label Western Cedar shingles butted against corner boards
b) Certi-label Western Cedar shingles butted against square wood strip, flashing behind
c) Mitered corner
d) Laced inside corner with flashing behind inside strip on corner
e) Alternated laced outside corner

Figure 8: Corner Option Details

Figure 9: Fitting Laced Corner Courses

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Design and Application Instructions

Staggered Butt Coursing

For single course application, an attractive effect can be made by staggering the butt of the Certi-label Western Cedar shingle from the horizontal line. Apply the Certi-label Western Cedar shingle irregularly at variable distances below (but not above) the horizontal line.

Staggered butt applications are made by shortening the exposure less than the greater maximum exposure. No Certi-label Western Cedar shingles or shakes shall be applied greater than the maximum exposure allowed. Check with local building codes for approval of the staggered butt coursing installation method.

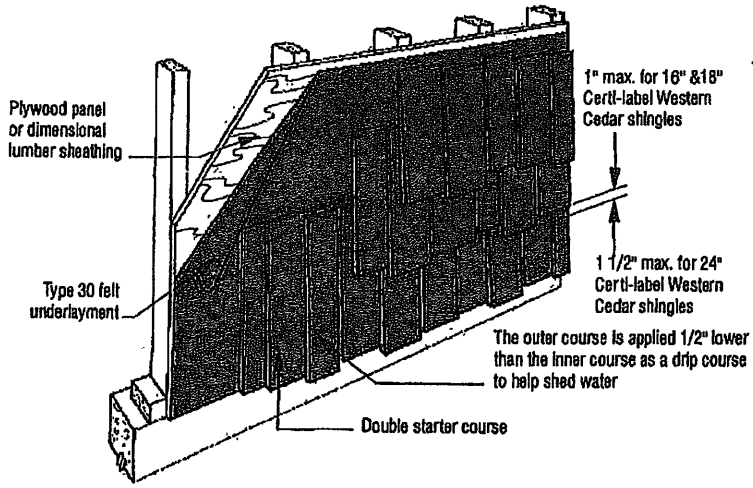
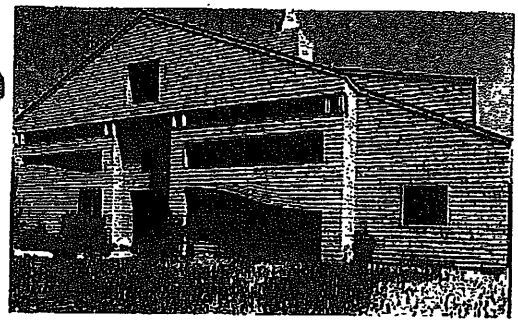


Figure 10: Staggered Coursing



Architect: Alfredo De Vido Associates, Photo: Paul Warchol

Butt nail all double coursed Certi-label Western Cedar shingles that are exposed more than their maximum single course exposure.

Ribbon Coursing

A double shadow line effect can be obtained by raising the outer course Certi-label Western Cedar shingles approximately 1" above the undercoursing. Use Number 1 Grade Certi-label Western Cedar shingles for undercoursing when applying ribbon coursing (Figure 11).

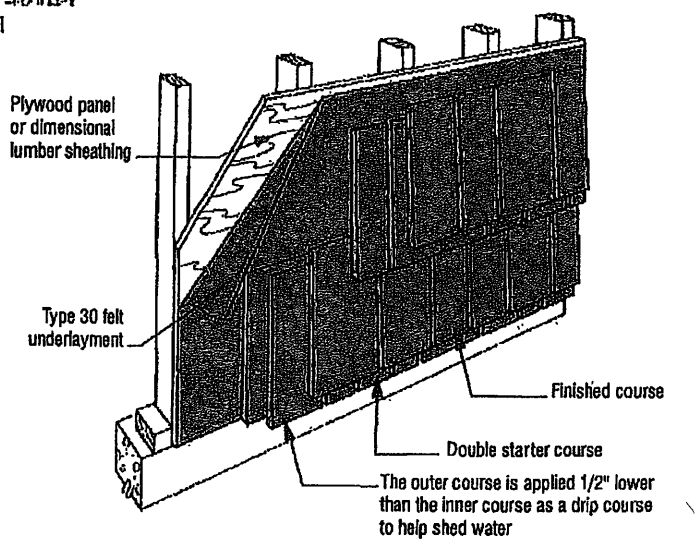


Figure 11: Ribbon Coursing

02991

Design and Application Instructions

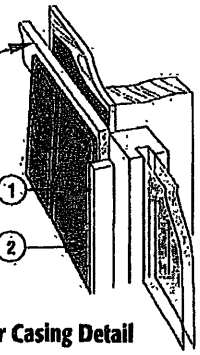
Re-walling

Once the old exterior wall material has been removed and the old nails or other protrusions cleaned away, the new wall can be applied. Type 30 felt underlayment should be applied since it is new construction.

Over-walling

Applying Certi-label Western Cedar shingles or shakes right over an old wall - whether wood, brick, stucco, or synthetic products - is easily done. It saves time involved in both removing the old exterior and in disposing of it. However, avoid nailing over vinyl or aluminum as they are not sufficiently strong to provide a proper support.

First, nail moulding strips on the face of existing window and door casings, flush with the outer edges. The Certi-label Western Cedar shingles or shakes are then joined to the mouldings (Figure 12).



1. Apply new casing to bring Certi-label Western Cedar shingles or shakes flush with surface
2. The integrity of the original flashing is to be utilized. Additional trim is considered to be decorative only. If the original window does not have good structural integrity, it must be removed and a new one installed. New casings are to be installed as part of proper wall construction as shown throughout this manual.

Figure 12: Typical Window and Door Casing Detail

Over Beveled Siding - Applying a new Certi-label Western Cedar shingle or shake wall over old beveled siding can be accomplished in either of two ways: 1) By filling in the low points of the wall with low grade lumber or plywood strips (called horse feathers) of appropriate thickness and thereby increasing the potential nailing surface, or 2) by nailing the Certi-label Western Cedar shingles or shakes to the high points of the bevels of each course of the old wall, or of alternate courses (provided it does not result in weather exposure greater than is recommended (Figure 13).

Ensure that the first course is properly attached. All Certi-label Western Cedar shingle and shake product installation must meet nailing and exposure guidelines as detailed in this manual. It may be necessary to add occasional nailing strips.

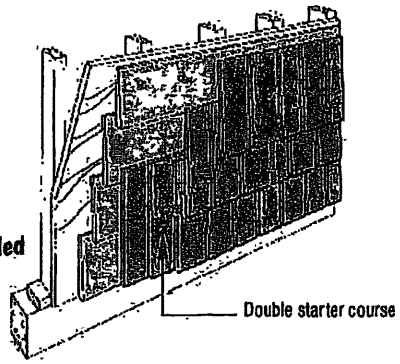


Figure 13: Over Beveled Siding Detail

Over Masonry - Masonry walls are easily covered, by vertically furring the walls and applying nailing strips (1 x 3 or 1 x 4) spaced according to the exposure and single/double course product design. The nailing strips should be fastened with special nails, driven between the bricks or blocks, so that the outer shingled wall will be firmly attached (Figure 14).

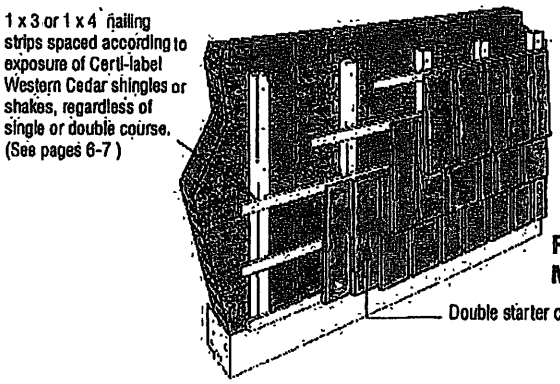


Figure 14: Over Masonry Detail

Over Stucco - Nailing strips should be attached with nails long enough to penetrate the stucco and the underlying sheathing. Do not apply directly to the stucco, which is too weak to provide a proper support. If the old stucco is removed, new Type 30 felt underlayment is then applied to the walls, and the shingling can proceed as in new construction (Figure 15).

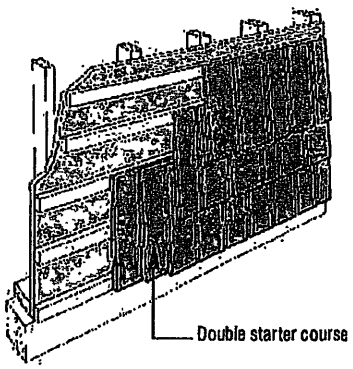


Figure 15: Over Stucco Detail

02992

Design and Application Details

Certi-label Western Cedar shingles or shakes are building materials that adapt easily to many different structural forms. Their use in interiors is practically unlimited, and a wide variety of imaginative effects can be achieved.

Certi-label Western Cedar shingles or shakes can be readily applied over almost any interior wall surface, including wood, brick, plaster, or concrete. Nails, staples, or glue may be used as fasteners on interior wall projects. Certi-label Western Cedar shingles or shakes may be attached directly to the interior wall providing it has sufficient holding qualities to support the fasteners. If this is not the case, they may be applied over spaced furring strips, which are fastened to the wall by nails or glue. As a general rule, the furring strips should be placed a distance apart equal to the desired exposure.

Calculate the number of courses by dividing the wall height (minus the height of the base board, if any) by the desired exposure. Mark the positions of the nailing strips on a furring strip, then transfer these measurements to the wall. Fasten 1" x 2" or 1" x 3" furring strips to the wall (e.g. by nailing them through the wall into the studs) at the positions marked. If the Certi-label Western Cedar shingles or shakes are to be carried around the corner, make sure the furring strips line up (Figure 16).

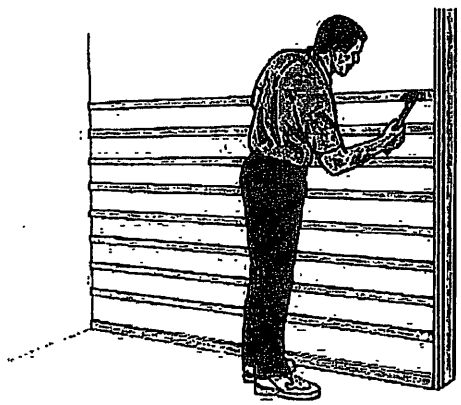


Figure 16: Furring Strip Detail

Start with a double course at the bottom of the wall. Use two nails or staples in each Certi-label Western Cedar shingle or shake placed so that the nail heads will be covered by the next course. The outer layer should overlap and conceal the side joints of the first course (Figure 17).

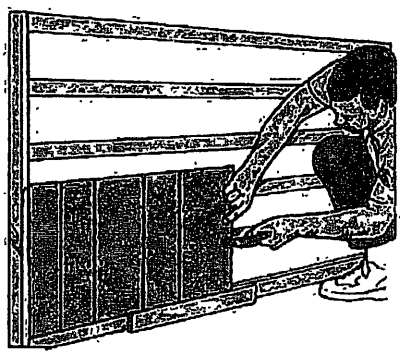


Figure 17: Starter Course

Continue with single courses to the top of the wall. A straight edge tacked to the wall will keep the courses true and the exposure consistent.

Alternately overlap the Certi-label Western Cedar shingles or shakes on the outside corner to give a "laced" effect, then trim them flush with a block plane (Figure 18).

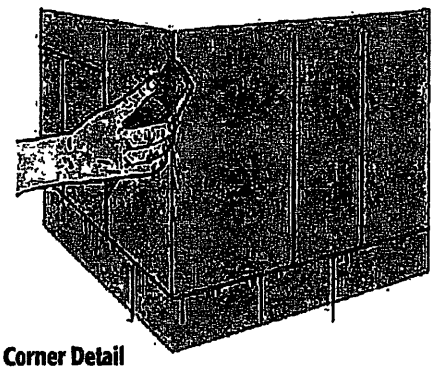


Figure 18: Corner Detail

Cut the Certi-label Western Cedar shingles or shakes for the last course and discard the thin end. Glue or nail the last course in place to make a neat top edge. A moulding strip may be applied to cover nail heads and hide any irregularities in the ceiling (Figure 19).

The interior Certi-label Western Cedar shingles or shakes can now be finished to suit almost any taste. Contact a reputable finish manufacturer for more details.

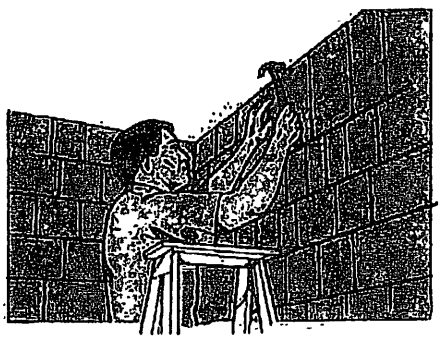


Figure 19: Top Course

02993

General Application Notes

1. The contractor shall cover all wall surfaces with Certi-label Western Cedar shingles or shakes bearing the Cedar Shake & Shingle Bureau's official grade marked label.
2. Certi-label Western Cedar shingles/shakes for outer courses shall be (specify grade and length).
3. Certi-label Western Cedar shingles/shakes for undercourses shall be (specify grade and length).

Sidewall Application

4. Certi-label Western Cedar sidewall shingles/shakes shall be (doubled or tripled) at foundation lines.
5. Certi-label Western Cedar sidewall shingles shall be spaced apart 1/8" to 1/4".
6. Joints of Certi-label Western Cedar shingles/shakes in any one course shall be offset not less than 1 1/2" from the joints in adjacent courses.
7. Certi-label Western Cedar shakes on sidewalls shall be spaced apart not more than 3/8" to 1/2".
8. Certi-label Western Cedar sidewall shingles/shakes shall be applied with a weather exposure of (specify in inches from exposure chart).

Fastening Sidewall Shingles/Shakes

9. Fasteners should be long enough to penetrate into the sheathing at least 3/4" or all the way through and driven flush with the surface of the Certi-label Western Cedar shingle or shake. In all applications, staples shall be concealed by the course above. Fasteners cannot be electro-galvanized as they will cause staining. For aesthetic reasons, nails are preferred for sidewall applications.

[**Note:** Due to the diverse range of fastener requirements, please refer to the charts on page 5 for fastener specifications].

Sidewall Guidelines

This information has been designed to aid architects, consultants and builders in specifying Certi-label Western Cedar shingles and shakes. It suggests a standardized terminology and style for ordering in the hope of improving accuracy. It incorporates a general outline of the latest application information. Please note, however, that this is an application guide only. **The information in this manual is not intended to supercede local codes.** Refer to local building codes for more information.

Maximum Sidewall Exposure Chart

Number One Grade Products

Certi-label Western Cedar Product	Grade	Single Course	Double Course
Certigrade			
16" Shingles	1	7"	12"
18" Shingles	1	8"	14"
24" Shingles	1	10 1/2"	16"
16" R&R, sanded, Certigroove Shingles	1	7"	12"
18" R&R, sanded, Certigroove Shingles	1	8"	14"
24" R&R, sanded, Certigroove Shingles	1	10 1/2"	16"
Certi-Split			
18" Handsplit Shakes	1	8"	14"
24" Handsplit Shakes	1	10 1/2"	18"
18" Straight Split Shakes	1	8"	16"
24" Tapersplit Shakes	1	10 1/2"	18"
Certi-Sawn			
18" Tapersawn Shakes	1	8"	14"
24" Tapersawn Shakes	1	10 1/2"	18"

Number Two Grade Products

Certigrade			
16" Shingles	2	6"	9"
18" Shingles	2	7"	10"
24" Shingles	2	9"	14"
16" R&R, sanded Shingles	2	6"	9"
18" R&R, sanded Shingles	2	7"	10"
24" R&R, sanded Shingles	2	9"	14"
Certi-Sawn			
18" Tapersawn Shakes	2	7"	10"
24" Tapersawn Shakes	2	9"	14"

02994

Exterior Finishes (also known as Coatings)

There are a variety of paints, stains, and preservative treatments available for Certi-label Western Cedar sidewall products. Certi-label sidewall products are available pre-finished, (pre-primed or pre-stained) and natural (unfinished).

Please note: A detailed product finishing discussion is beyond the scope of this manual; however, a brief overview is presented below. It is critical to read the instructions on the finish product's container as well as follow the finish manufacturer's directions. All areas of the world present unique painting/staining challenges. Some of the topics you should discuss with your sidewall product manufacturer, finish manufacturer, and professional contractor include the following:

1. Product coverage
2. Surface preparation
3. Qualified finish contractors in your area
4. Certi-label Western Cedar moisture content level recommended for your specific locale
5. Appropriateness of finish for Certi-label Western Cedar sidewall products
6. Drying color versus sample chip color
7. Material Safety Data Sheet
8. Mildew resistance
9. UV resistance and water repellency
10. Exterior/Interior finish usage
11. Depth of finish penetration
12. Application method, including how to cover all sides of product, mixing/stirring (to prevent lap marks), temperature, brush versus spraying tools, and recommended proper clean up and disposal of all tools; brushes and rags. Talk to your finish manufacturer if you have questions about back-priming instructions for your particular project.
13. Price. Do not be fooled by a low price. Better quality brands tend to be more expensive. A cheap finish will usually cost more in the long run through quicker weathering, poorer coverage and less pigment. Use only the highest quality products from your finish manufacturer.

Quality finish manufacturers have technical help lines you can call (some are toll-free). Advice is also available via the Internet.

The CSSB recognizes these general types of finishes:

Transparent finishes (penetrating oil-based): clear, allow natural grain to show through, may also include paintable water repellant preservatives. Such treatment can possibly, depending upon the product, inhibit mildew growth as well as rapid change in color due to weathering.

Semi-transparent and semi-solid stains (penetrating oil-based): have some pigment, but allow some wood grain to show.

Paint or solid stain: provide opaque coverage, allowing little to no wood grain to show.

Certi-label Western Cedar Sidewall Finishing Systems: Preferred Paint System

Step 1: Factory or field applied oil-based, stain-blocking primer on all surfaces.

Step 2: Field-applied top coat of highest quality 100% acrylic latex paint. This type of top coat is more flexible and more resistant to blistering and cracking. The best protection against extractive bleeding is the application of an oil-based, stain-blocking primer before the top coat is applied.

OR

Less Durable Paint System

Step 1: Factory or field applied oil-based, stain-blocking primer on all surfaces.

Step 2: Field-applied oil-based or alkyd top coat.

CSSB member manufacturers do supply factory-primed products. These products are usually more cost-effective than on-site priming.

Stains

Use oil-based stains only. CSSB member manufacturers can factory-apply a coat of semi-transparent or semi-solid oil-based stain. This process is usually more cost-effective than on-site staining. Further enhancing the natural durability of Certi-label Western Cedar shingles and shakes, some CSSB members offer pass-through finish warranties on their factory finished sidewall shingles and shakes. These can be further enhanced by application of a final, field-applied top coat. Contact participating CSSB members for details.

To Accelerate the Weathering Process

To hasten the weathering process; apply a bleaching oil finish.

How Soon to Finish

Generally finish products **IMMEDIATELY** after installation **PROVIDING** that the moisture content is appropriate for both the finish product being used and your locale. If the finish is not applied promptly, adhesion will be compromised (unless additional surface preparation is undertaken).

If you have installed a natural product (unfinished), apply your finish before rain and other moisture are absorbed. Ensure that you account for high humidity concerns.

If you are using a pre-finished product (where finish is applied at the manufacturing plant), ensure that the product is thoroughly dried before applying a top finish coat.

In all instances drying time varies from region to region. Excessive moisture will limit finish adhesion. Check with your professional contractor, finish manufacturer and/or sidewall product manufacturer for assistance.

Surface Cleaning

There are products that claim to be effective for removing dirt, airborne pollution marks, mildew and prior finishes. If you clean the surface prior to finishing, ensure that it is allowed to dry to the finish manufacturer's recommended moisture content level before applying a new finish. Contact your finish manufacturer for more details.

Extractive Bleeding

Extractive bleeding is characterized by the tannins in the wood being dissolved in moisture and migrating to the surface of the product. Rain will sometimes wash these stains away; however if left to weather, the sun can cause polymerization, thus requiring the addition of a tannin blocker and new top coat of finish (ensure proper surface preparation before applying new top coat) once the moisture problem has been solved. Compounds containing oxalic acid appear to be the most effective at removing extractive bleeding stains: ensure you use proper safety precautions and follow the oxalic acid compound manufacturer's application directions.

Extractive bleeding does not signify failure of the applied finish, but instead is found in applications where a source of moisture is present. Extractive bleeding is not a manufacturing defect nor is it a finish defect; it is a natural phenomenon that occurs in applications. Tannin blocking products help, however, the CSSB does not provide any finish warranty. Check with your sidewall product manufacturer, finish manufacturer, and professional contractor for more assistance.

The CSSB does not warrant this information or instruction regarding finishes. If you see an attractive job that has endured in your locale, inquire about the type of finish used. **Once Certi-label Western Cedar shingles and shakes are pressure-impregnated treated you must contact the treatment company to determine if a finish, such as paint or stain, is allowable. If there is any confusion whatsoever it is highly recommended that you contact both your sidewall product manufacturer and the finish manufacturer.**

02995

Certigrade Shingles - Coverage (Number 1 Grades)

Approximate coverage, in square feet, of one square (4-bundle roof-pack) of shingles, applied at indicated weather exposures. (Some exposures on this chart are not acceptable for single course application. Consult the maximum exposure table on page 12 for more details).

Exposure →	3½"	4"	4½"	5"	5½"	6"	6½"	7"	7½"	8"	8½"	9"	9½"	10"
Length and Thickness ↓														
16" x 5/2"	70	80	90	100	110	120	130	140	150	160	170	180	190	200
18" x 5/2¼"	–	72½	81½	90½	100	109	118	127	136	145½	154½	163½	172½	181½
24" x 4/2"	–	–	–	–	73½	80	86½	93	100	106½	113	120	126½	133

Certigrade Shingles - Coverage (Number 1 Grades), continued

Approximate coverage, in square feet, of one square (4-bundle roof-pack) of shingles, applied at indicated weather exposures. (Some exposures on this chart are not acceptable for single course application. Consult the maximum exposure table on page 12 for more details).

Exposure →	10½"	11"	11½"	12"	12½"	13"	13½"	14"	14½"	15"	15½"	16"
Length and Thickness ↓												
16" x 5/2"	210	220	230	240	–	–	–	–	–	–	–	–
18" x 5/2¼"	191	200	209	218	227	236	245½	254½	–	–	–	–
24" x 4/2"	140	146½	153	160	166½	173	180	186½	193	200	206½	213

Certigroove Shingles/Rebutted & Rejointed Shingles - Coverage (Number 1 Grades)

Approximate coverage, in square feet, of one single-carton sidewall square of machine grooved shingles, rebutted & rejointed shingles, and sanded face shingles applied at indicated weather exposures. (Some exposures on this chart are not acceptable for single course application. Consult the maximum exposure table on page 12 for more details).

Exposure →	6"	7"	8"	9"	10"	11"	12"	13"	14"	15"	16"
Length ↓											
16"	50	59	67	76	84	93	100	–	–	–	–
18"	43	50	57	64	72	79	86	93	100	–	–
21" (Not Suitable for Low Slope)	37	44	50	56	62	69	75	81	87	94	100
24" (Not Suitable for Low Slope)	74	88	100	112	124	138	150	162	174	188	200

Coverage Guidelines

- Sidewall squares are calculated in a different manner than roof squares. The number of cartons in a square depends upon the product type. Check with your supplier for more details.
- Remember to deduct window and door areas from coverage calculations.

Product Coverage Calculations

Ensure you have the following information:

1. Size of wall area you are trying to cover, measured in square feet.
2. Application method and exposure to be used
3. Product type used
4. Amount of product in each box (packaging)

Your supplier will be glad to assist you. As usual, always check with your local building official for requirements in your area.

Sidewall Shingle Packaging

- Cartons are made of cardboard, and must be kept dry.
- CSSB member product will be labeled with the Certi-label on the carton.
- Mills pack in 1/2 carton and full carton sizes. Check with your supplier for more details.
- **Before starting please read the instructions printed on the carton.**

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SIDEWALL COVERAGE TABLE

Certi-Split Shakes-Coverage (Number One or Premium Grades)

Approximate coverage, in square feet, of one square of shakes applied at indicated weather exposures. (Some exposures on this chart are not acceptable for single course application. Consult the maximum exposure table on page 12 for more details).

Exposure >	7"	8 1/2"	10"	11 1/2"	14"	16"	18"
Shake Type, Length and Thickness ↓							
18" x 1/2" Handsplit and Resawn Mediums	70	85	100	115	140	–	–
18" x 3/4" Handsplit-and-Resawn Heavies	70	85	100	115	140	–	–
18" Tapersawn	70	85	100	115	140	–	–
24" x 3/8" Handsplit & Resawn	70	85	100	115	140	160	180
24" x 1/2" Handsplit and Resawn Mediums	70	85	100	115	140	160	180
24" x 3/4" Handsplit-and-Resawn Heavies	70	85	100	115	140	160	180
24" Tapersawn	70	85	100	115	140	160	180
24" x 1/2" Tapersplit	70	85	100	115	140	160	180
18" x 3/8" True Edge Straight-Split (4 bundle square)	50	60	71	82	100	–	–
18" x 3/8" Straight-Split (5 bundle square)	82	100	118	135	165	–	–
24" x 3/8" Straight-Split	70	85	100	115	140	160	180

Starter Course: Underlying course can be the Number 1 Grade product used on outer course or a lower grade product.

Please note: Handsplit shakes are also known as Handsplit-and-Resawn shakes.

Coverage Guidelines

- Sidewall squares are calculated in a different manner than roof squares.
- Remember to deduct window and door areas from coverage calculations.

Product Coverage Calculations

Ensure you have the following information:

1. Size of wall area you are trying to cover, measured in square feet.
2. Application and exposure to be used
3. Product type used
4. Amount of product in each box or bundle

Your supplier will be glad to assist you. As usual, always check with your local building official for requirements in your area.

Sidewall Shake Packaging

- Shakes are packaged in bundles, secured with a metal strap. Each bundle will have a Certi-label underneath.
- While most 18" shakes are packed in bundles of 12 courses each side (12/12) they may be packed 9/9. This will alter the number of bundles required to cover 1 square.

For example: 18" shake bundles, 12/12 pack, 5 bundles, should cover 100 square feet at 7 1/2" exposure.

9/9 pack, 5 bundles, should give 75% coverage of a square at 7 1/2" exposure. When ordering check with your supplier to confirm bundle size.

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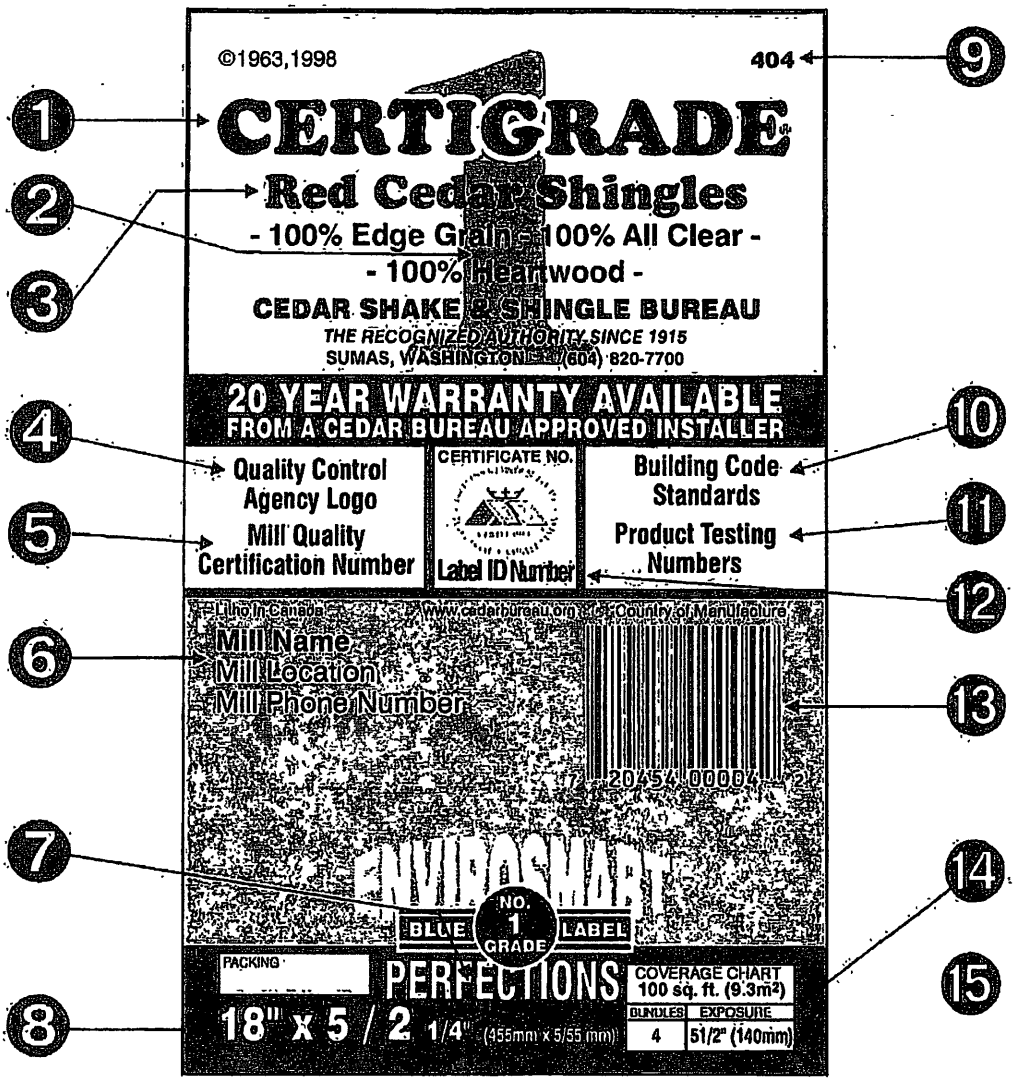

1. The "Certi" Brand Name - Your Quality Assurance
2. Product Grade
3. Product Type
4. Independent, 3rd Party, Quality Control Agency
5. Number Here Shows Compliance With Total Quality Manufacturing System
6. Mill Name, Location and Phone Number
7. Industry Product Description
8. Product Dimensions
9. Cedar Bureau Label Number
10. Building Code Compliance Numbers
11. Product Performance Tests These Materials Have Passed
12. Label Identification Number
13. UPC Code
14. Coverage Chart Showing Bundles Per 100 Square Feet And Recommended Exposure
15. Application Instructions on reverse side

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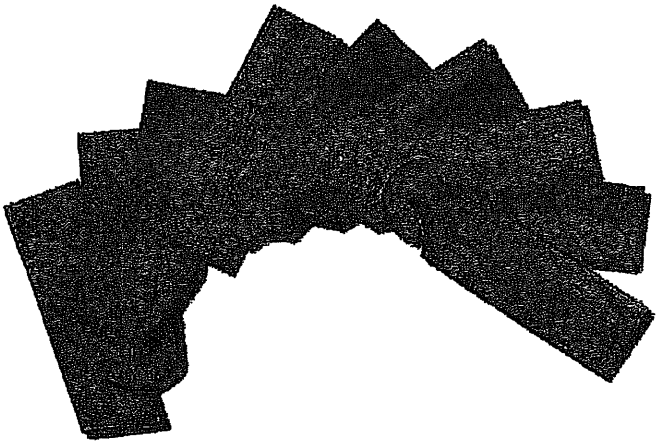

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This manual shows Cedar Shake & Shingle Bureau recommended procedures as of the manual's print date. It is advisable to contact the Cedar Shake & Shingle Bureau to ensure that you are using the latest available information.

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November 2004

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Installation Guidelines for Adhered Concrete Masonry Veneer

Masonry Veneer Manufacturers Association

03001 03/09/09

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Masonry Veneer Manufacturers Association (MVMA) represents the adhered concrete masonry veneer industry's manufacturing companies and their suppliers. The mission of the organization is: To advance the growth of the manufactured masonry veneer products industry through proactive technical, advocacy and awareness efforts.

This guide is for builders, architects, designers, masons, installers and other construction professionals to illustrate typical applications of Adhered Concrete Masonry Veneer.

It is the sole responsibility of any architectural or construction professional to apply any detail to any specific project.

Disclaimer

This guide addresses acceptable methods and details for installation of Adhered Concrete Masonry Veneer. The purpose is to serve as a guideline, and is not intended for any specific construction project. The MVMA makes no express or implied warranty or guarantee of the techniques, construction methods or materials identified herein.
This guide addresses acceptable methods and details for installation of Adhered Concrete Masonry Veneer. It is understood there are alternative ways that might be required and/or recommended based on project conditions.
Details in this guide that address the Adhered Concrete Masonry Veneer and its interface with the building components are not intended as a specific resource for the construction of the interfacing building components.

Reproduction of the material herein is not permitted without the permission of the MVMA.

To the best of our knowledge, the information in this Adhered Concrete Masonry Veneer Guide is correct and up to date.

03002 03/09/09

Definitions

Wall System- The constructed exterior or interior framework and substrate of the building.
Water Resistive Barrier- A material used to restrict the transmission of moisture to the surface behind.
Flashing- Material used to restrict the seepage of moisture around any intersection or projection of materials in an assembly.
Lath- Corrosion resistant mesh building material fastened to the substrate to act as base for adhering plaster or mortar.
Fasteners- Corrosion resistant hardware used to secure lath and flashing material to wall system.
Mortar- A workable paste mixture of cementitious material, water, and aggregate used to bond masonry construction materials together, and fill spaces between.
Mortar Scratch Coat - Base coat of mortar used in installation. Cross raked to improve bond with following mortar layers.
Mortar Setting Bed - Mortar used to adhere the ACMV to the substrate or scratch coat.
Adhered Concrete Masonry Veneer (ACMV)- lightweight, architectural, non-load bearing product that is manufactured by wet cast blending cementitious material, aggregate, iron oxide pigments, and admixtures to simulate the appearance of natural stone.

Note: The MVMA recognizes there are many names used to described Adhered Concrete Masonry Veneer products. Manufactured Stone Veneer is used commonly throughout the industry and among manufacturers. In the International Building Code, Adhered Concrete Masonry Veneer products are referred to as Adhered Masonry Veneer. In the ICC-ES Acceptance Criteria, AC51, the product is called Precast Stone Veneer. This guide will use ACMV (Adhered Concrete Masonry Veneer) when referencing the product.

Mortar Grout - Mortar mixture used to fill joints and cavities in masonry construction.
Sealer- Liquid material used over ACMV to protect against staining and moisture penetration.

Abbreviations

ACMV - Adhered Concrete Masonry Veneer
Blk'g - Blocking
GSM - Galvanized Sheet Metal
Lbs. Pounds
Mfr's - Manufacturer's

Min - Minimum
O.S.H.A. Occupational Safety and Hazard Association
psi. Pounds per square inch
Req'd - Required
SAF - Self Adhering Flashing
WRB - Water Resistive Barrier

References

International Building Code-(IBC) Building code that provides minimum requirements for safety, health, and welfare of life and property from hazards of the built environment. The provisions of this code apply to the construction, alteration, addition, replacement, repair, use and occupancy of all buildings except one and two family dwellings, and multi single-family townhomes not more than three stories in height.
International Residential Code-(IRC) Building code that provides minimum requirements for safety, health, and welfare of life and property from hazards of the built environment. The provisions of this code apply to the construction, alteration, addition, replacement, repair, use and occupancy of detached one and two story dwellings and multi single-family townhomes not more than three stories in height.
International Code Council - Evaluation Service-(ICC-ES) A non-profit organization that performs technical evaluations on building products, components, and construction methods for building code compliance. In cases where no building code covers a product or construction method, ICC-ES develops "Acceptance Criteria" (AC) for the product or construction method.
AC38- The ICC-ES Acceptance Criteria for Water Resistive Barriers.
AC51- The ICC-ES Acceptance Criteria for Pre-Cast Stone Veneer.
AC275- ICC-ES Acceptance Criteria for Glass Fiber Lath used in Cementitious Exterior Wall Coating or Exterior Cement Plaster (Stucco)
ACI530- Building code requirements for masonry structures (TMS402\ACI530\ASCE5).
ASTM International- American Society for Testing and Materials. ASTM is one of the largest developers of technical standards of products, systems and services.
ASTM C144- Standard Specification for Aggregate for Masonry Mortar
ASTM C270- Standards Specification for Mortar for Unit Masonry
ASTM C482- Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement
ASTM C847- Standard Specification for Metal Lath
ASTM C1032- Standard Specification for Woven Wire Plaster Base
ASTM C1063- Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster
ASTM D226- Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and Water Proofing

Summary Table

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Wall Type: Wood or steel stud, no more than 16" O.C. **Rigid Sheathing:** Gypsum wall board Plywood OSB Concrete Board Fiber Board Note: Non-rigid insulation board over rigid sheathing is limited to max 1/2" thick.	Minimum 2 separate layers #15 felt (ASTM D 226 No. 15, Type 1) Or Minimum 2 separate layers Grade D paper (ICC-ES Acceptance Criteria AC 38) Or 1 layer house wrap (ICC-ES Acceptance Criteria AC 38), and 1 layer Grade D paper (ICC-ES Acceptance Separate Criteria AC 38), or #15 felt ASTM D 226 No. 15, Type 1) Note: One layer of paper backed lath meeting the requirements of Grade D paper may qualify for one layer of WRB.	2.5 lb. or 3.4 lb. self-furring corrosion-resistant lath (ASTM C 847) Or 18 gauge woven wire mesh (ASTM C 1032)	Corrosion resistant fasteners (ASTM C 1063) min. 1" into wood framing member or 3/8" through metal framing member.	Mortar, nominal 3/8" thick, Type N or Type S meeting ASTM C270. "Scratch" surface when "thumbprint hard"

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
"Open Stud" construction Wood or steel, no more than 16" O.C No sheathing or insulation Board only (open studs): Note: Non-rigid insulation board over rigid sheathing is limited to max 1/2" thick.	Minimum 2 separate layers #15 felt (ASTM D 226 No. 15, Type 1) Or Minimum 2 separate layers Grade D paper (ICC-ES Acceptance Criteria AC 38) Or 1 layer house wrap (ICC-ES Acceptance Criteria AC 38), and 1 layer Grade D paper (ICC-ES Acceptance Separate Criteria AC 38), or #15 felt ASTM D 226 No. 15, Type 1) Note: One layer of paper backed lath meeting the requirements of Grade D paper may qualify for one layer of WRB.	3.4 lb. self-furring 3/8" ribbed corrosion-resistant lath (ASTM C 847) Alternate lath acceptable. Verify.	Corrosion resistant fasteners (ASTM C 1063) min. 1" into wood framing member or 3/8" through metal framing member.	Mortar, nominal 3/8" thick, Type N or Type S meeting ASTM C270.

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Clean Concrete, Masonry / CMU, or Stucco Note: walls / surfaces must be clean and free from release agents, paints, stains, sealers, or other bond-break materials, that may reduce strength of mortar adhesion.	Note: When installing stone on an inhabited area one may need to use a WRB to prevent moisture from penetrating the wall.	Install lath if any question or concern regarding ability of veneer to adhere to wall	If lath applied: Use corrosion resistant fasteners	If a scratch coat is required use a nominal 3/8" thick Type N or Type S mortar, meeting ASTM 270. "Scratch" surface when "thumbprint hard"

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Existing Concrete, Masonry / CMU, Stucco, or Brick (structurally sound) (e.g. painted or not clean)	Note: When installing stone on an inhabited area one may need to use a WRB to prevent moisture from penetrating the wall.	2.5 lb. or 3.4 lb. self-furring 3/8" ribbed corrosion-resistant lath (ASTM C 847) Or 18 gauge woven wire mesh (ASTM C 1032)	Corrosion resistant	If a scratch coat is required use a nominal 3/8" thick Type N or Type S mortar, meeting ASTM 270. "Scratch" surface when "thumbprint hard"

Wall System	Water Resistive Barrier	Lath	Fastening	Scratch Coat
Metal Buildings or other surfaces / wall construction not listed above. See manufacturer for recommendations regarding sheathing.	See manufacturer for recommendations.			

Workmanship

This Installation Guideline is prepared with the consideration that appropriate construction personnel have knowledge of the materials described and the proper methods of installation of the materials referenced.

Prior to commencing activity related to the scope of this Guideline, review all adjacent products and other subcontractor's work that precedes the installation of ACMV to ensure that proper workmanship has been exercised and there are no recognizable errors or deficiencies.

Building Code Requirements

Building code requirements vary from area to area. Check with local authorities for building code requirements for your area and application. Carefully read all sections of this guide and follow the manufacturers Installation Instructions before proceeding with your ACMV application. In the event the manufacturers' Installation Instructions conflict with the intent of statements made in this document, contact the manufacturer for additional guidance.

Project Site Requirements

Always follow proper job site safety requirements when installing ACMV . Follow all OSHA requirements when installing ACMV products.

Material Requirements

Flashing

All flashing and flashing accessories must be corrosion resistant materials and integrated with the WRB materials. Flashing must be installed at all through wall penetrations and at terminations of ACMV installations.

Rainscreen Drainage Plane Systems (Optional)

Rainscreen products (such as drainage mats or formed polymer sheeting) or construction techniques (such as strapping or furring) that create a defined capillary break space can be effectively incorporated into ACMV applications to improve the escape of incidental water from the wall. The system should create a minimum gap of 3/16" (5mm) and a maximum gap of 3/4" (19mm).

Weep Screed

Weep screeds must be of corrosion resistant material with a minimum vertical attachment flange of 3 1/2" and a minimum No. 26 corrosion resistant metal.

Lath

The MVMA recommends using the following lath materials:

- 2.5lb/yd^2 metal lath meeting ASTM C 847
- 3/8" rib, 3.4lb/yd^2 metal lath meeting ASTM C 847
- 18 gauge (or heavier) woven wire mesh meeting ASTM C 1032
- Other code approved lath: Alternate lath products not listed above are acceptable for use with ACMV provided the lath product has an ICC-ES Evaluation Service Report (ESR) and is approved for use by the ACMV manufacturer

All lath and lath accessories must be made of corrosion resistant material. All lath material must be self-furred or use self-furring fasteners. Refer to the Summary Table on page 5 and 6 for specific lath and fastener recommendations.

Fasteners

Corrosion resistant fasteners are used to secure flashing and lath. A variety of fasteners are available such as staples, screws, and nails. For specific fastener selective criteria, refer to ASTM 1063 Sec. 7.10.2.

- Wood framing - Corrosion resistant staples, corrosion resistant roofing nails, or corrosion resistant screws and washers, all to be of sufficient length to penetrate a minimum of one inch into framing members with a 6d common nail with a 7/16 inch head.
- Metal framing or panels - Corrosion resistant, self-tapping screws with a 7/16 inch head with sufficient length penetrate 3/8 inch through metal studs or panels, with heads or washers large enough to not pull through lath.
- Masonry walls or panels - Corrosion resistant concrete screws or powder actuated fasteners (or cap fastener), which are shot into the wall surface.

Mortar

Mix 1:

- 1 part portland Cement (ASTM C 150)
- 1 part Lime (ASTM C 207)
- 4.5 parts Sand (ASTM C 144)
- potable water

Mix 2:

- 1 part Type S Masonry Cement (ASTM C 91)
- 2.25 parts Sand (ASTM C 144)
- potable water

Mix 3:

- 1 part Type N Masonry Cement (ASTM C 91)
- 2.25 parts Sand (ASTM C 144)
- potable water

Mix 4

- Premixed mortars must also meet the above requirements. Check with the mortar manufacturer to determine if their product is suitable for installation manufactured stone veneer and it meets the building code requirement of 50 psi shear bond when tested in accordance with ASTM C 482.

Check with the ACMV manufacturer on additional requirements and recommendations if using color pigments, integral bonding agents, or other admixtures in your mortar mix.

Mortars mixed with higher amounts of sand will tend to be less workable. Mortar mixed with higher amounts of cement will provide a greater bond strength but may be prone to increased dry-shrinkage cracking. Type N mortars are generally easier to grout with than Type S. For the scratch coat, installation of ACMV, and grouting, Type N or Type S mortar meeting the above requirements are acceptable.

Surface Preparation

Wall system

Verify structural and surface integrity of existing wall prior to installation. ACMV units must only be applied to structurally sound walls or other structures.

Wall systems not mentioned below (e.g. structural insulated panels and insulated concrete forms) are outside the scope of this document and may require the need of a designed system.

Wall systems shown on these details are wood frame with rigid sheathing unless otherwise noted. Other wall systems that can be successfully used with ACMV include all standard wood and metal framing, rigid sheathing, and cementitious stucco scratch or brown coat that has not been slicked or burned.

Other wall systems are acceptable with qualifications.

- **Masonry walls, poured-in-place concrete walls, and concrete tilt up panels** must be free of dirt, waterproofing, paint, form oil, or any other substance that could inhibit the mortar bond. These surfaces must have a rough texture to ensure a mortar bond. Acid washing, sand/bead blasting, pressure washing, or a combination of these methods may be necessary to achieve the required bondable surface. If a bondable surface cannot be achieved, attach lath and scratch coat before installing ACMV.
- **Existing masonry surfaces** must be evaluated for mortar and face integrity and must be free of dirt, waterproofing, paint, or any other substance that could inhibit the mortar bond. Surfaces may be cleaned by pressure washing, acid washing, sand/bead blasting, or a combination of these methods to achieve a bondable surface. If the surface cannot be cleaned, attach metal lath before applying the mortar scratch coat.
- **Open studs, non-rigid sheathing and metal siding** must be prepared with 3.4 lb paper backed lath with a minimum ½" thick scratch coat and allowed to cure for a minimum of 48 hours prior to AMV installation.

The following substrates are considered unacceptable and may require designed systems: existing siding in unsound condition; EIFS; deteriorating or unsound masonry surfaces.

Water Resistive Barrier

Where a WRB is required, the MVMA recommends installing two separate layers in shingle fashion, starting from the bottom of the wall. The upper layers of the WRB should lap on top of the lower layers by a minimum of two inches. The vertical joints of the WRB must be lapped a minimum of six inches. The WRB should be installed in accordance with the manufacturer's recommendations and be integrated with all flashing accessories, adjacent WRBs, doors, windows, wall penetrations, and wall transitions.

Lath

Lath should be applied horizontally with the cups up, and should overlap a minimum of one inch on the horizontal and vertical seams. The ends of adjoining lath places should be staggered.

Lath should be wrapped around inside and outside corners with attachment every six inches at the next stud allowing a 16 inch overlap. Lath should be fastened every six inches vertically on each stud or similar spacing on concrete wall surfaces. Lap metal lath around all inside and outside corners. Do not end lath at corner framing. Effort should be made so that lath fasteners do not penetrate through the exterior sheathing between the studs.

Flashings/Weep Screeds/Casing Bead/Movement Joints

All flashing and metal detail pieces should be manufactured of corrosion resistant material.

Verify that all flashing including roofing kickout flashing has been properly installed. Although roof flashings are not part of the wall cladding system, they are necessary for proper moisture management. Flashing material should extend above horizontal terminations, roofing material, and drainage planes or vent mat products. Weep Screeds and other base flashings should be held a minimum of 4" above grade and a minimum of 2" above hard surfaces such as driveways, patios, etc. All flashing material should be integrated with water resistive barrier to prevent moisture penetration into structure.

- **Movement Joints** -Do not install ACMV over these joints.

Installation of Adhered Concrete Masonry Veneer

Prior to commencing installation of ACMV, ensure that the WRB and flashing are properly installed and integrated with each other. Refer to the flashing details, referenced in the Guideline, for detailing around windows, doors, through-wall penetrations, and ACMV terminations.

Before installing ACMV, lay out a minimum of 25 square feet at the jobsite so that you have a variety of sizes, shapes, and colors to choose from. Mixing ACMV sizes, shapes, textures and color will allow for variety and contrast in your design to achieve the desirable finished project.

Mortar Scratch Coat

After the lath is installed, apply a nominal 1/2" thick layer of mortar over the lath, ensuring the lath is completely covered with mortar to allow for scoring of the surface. The mortar should be applied with sufficient pressure and thickness to fully embed the lath in mortar. Once the mortar is thumb-print hard, scratch (score) the surface horizontally to create the mortar scratch coat.

Moist curing the mortar scratch coat will ensure there is minimal cracking and proper hydration. Before applying ACMV, the mortar scratch coat should be dampened so that the surface appears wet but without free standing water.

Grouted Adhered Concrete Masonry Veneer Application

Tip: Installing ACMV from the top down will minimize cleanup requirements.

Prior to the application of mortar to the backs of the ACMV or the scratch coat, the back of the ACMV and the scratch coat should be moistened so that the surfaces appear damp but without free standing water.

The back of each ACMV should be entirely buttered with mortar to a nominal thickness of 1/2". It is important to cover the entire back of the ACMV, not just the perimeter.

Buttered ACMV should be firmly worked onto the scratch coat and slid slightly back and forth or with a slight rotating motion to set the ACMV. With the proper mortar mix, moisture content, and scratch coat preparation, the installer will feel the mortar start to grab within a few seconds of the setting movement process. At this point, no further movement of that ACMV should be made as bonding will be broken. If the ACMV is inadvertently moved after initial set has begun, it should be removed, mortar scraped off the back of the ACMV and scratch coat, and then reinstalled following the application process.

Grouting the joints should be completed only after there is sufficient cure time of the installation of ACMV units, when mild contact will not break the bonding. Grouting may be done with a grout bag, filling joints to the desired depth, ensuring that mortar is forced into all voids. Grout should be "thumbprint" hard" before any raking is done. This curing time before the grout is ready will vary significantly with temperature and humidity. Use a wooden raking stick, or pointed tool to rake the joints to the desired depth. Extra precaution should be taken while raking so the surface of the ACMV is not damaged.Clean off remaining grout debris on the ACMV surface with a dry, soft-bristled brush.

To prevent mortar smearing, DO NOT use a wet brush to treat uncured mortar joints.

Tight Fitted Adhered Concrete Masonry Veneer Application

The back of the ACMV and the scratch coat should be moistened with the surfaces appearing damp but without free standing water.

The back of each ACMV should be entirely buttered with mortar to a nominal thickness of 1/2". It is important to cover the entire back of the ACMV, not just the perimeter. Buttered ACMV should be firmly worked onto the scratch coat and slid slightly back and forth to set the ACMV. With the proper mortar mix, moisture content and scratch coat preparation, the installer will feel the mortar start to grab within a few seconds of the setting movement process. At this point, no further movement of that ACMV should be made as bonding will be broken. If the ACMV is inadvertently moved after initial set has begun, it should be removed, mortar scraped off the back of the ACMV and scratch coat, and then reinstalled following the application process.

Tight fitted ACMV should be applied from the corners toward the middle of a wall, and from the bottom toward the top of the wall.

Cold Weather Application

Applications should be protected from temperatures below 40 degrees F (4 degrees C). The use of anti-freeze admixtures to lower the freezing point of the mortar is not recommended. Accelerating admixtures shall comply with C 1384; accelerating admixtures containing calcium chloride are not recommended. ACMV pieces containing visible frozen moisture shall not be installed.

The installation area should be sheltered and heated to keep the temperature above 40 degrees F (4 degrees C).

Hot Weather Application

If the environmental conditions during installation exceed 90 degrees F (32 degrees C) additional water may be needed on the scratch coated surface and the backs of the ACMV being applied. Providing shade and/or frequent misting of the wall may be required. Consult with mortar manufacturer to determine if mortar mix hot weather mix options are available. Local building code hot weather methods should be followed.

Cleaning the Adhered Concrete Masonry Veneer

Refer to ACMV manufacturer recommendations on cleaning and maintenance. Do not use harsh chemicals for cleaning, such as muriatic acid, or abusive tools, such as wire brushes to clean the surface.

Sealing Adhered Concrete Masonry Veneer

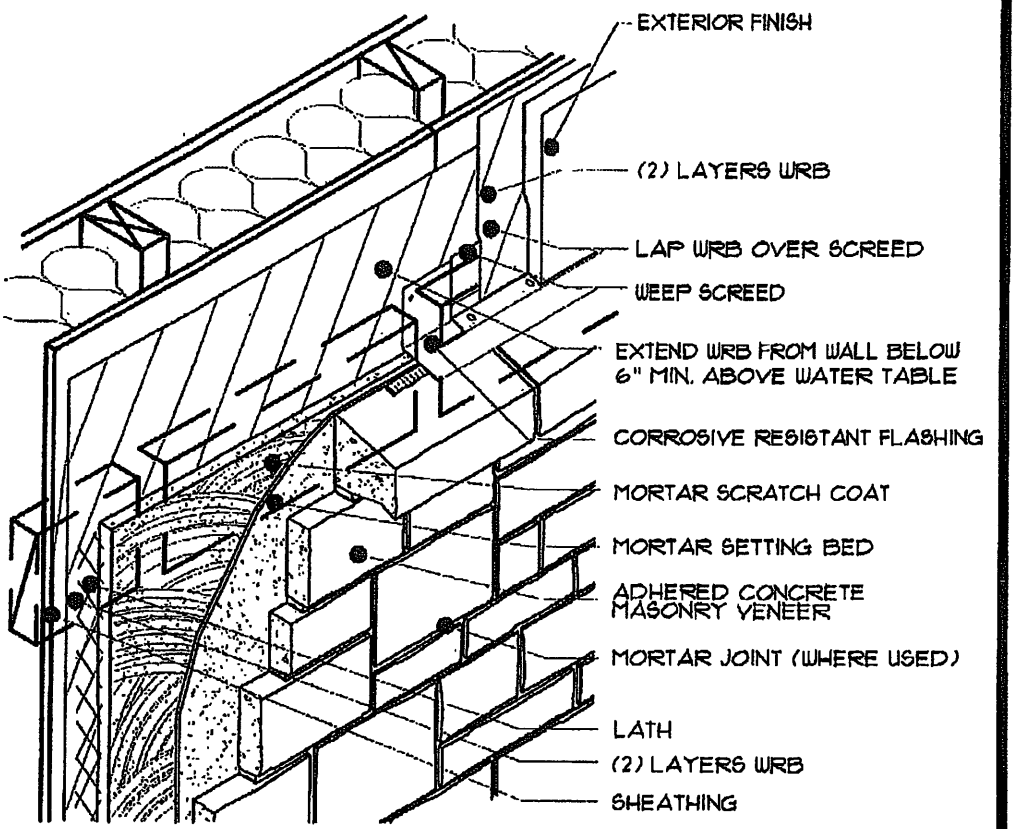
Refer to the ACMV manufacturer for recommendations regarding the use of sealants or topically applied water or graffiti-resistant coatings.

Caution

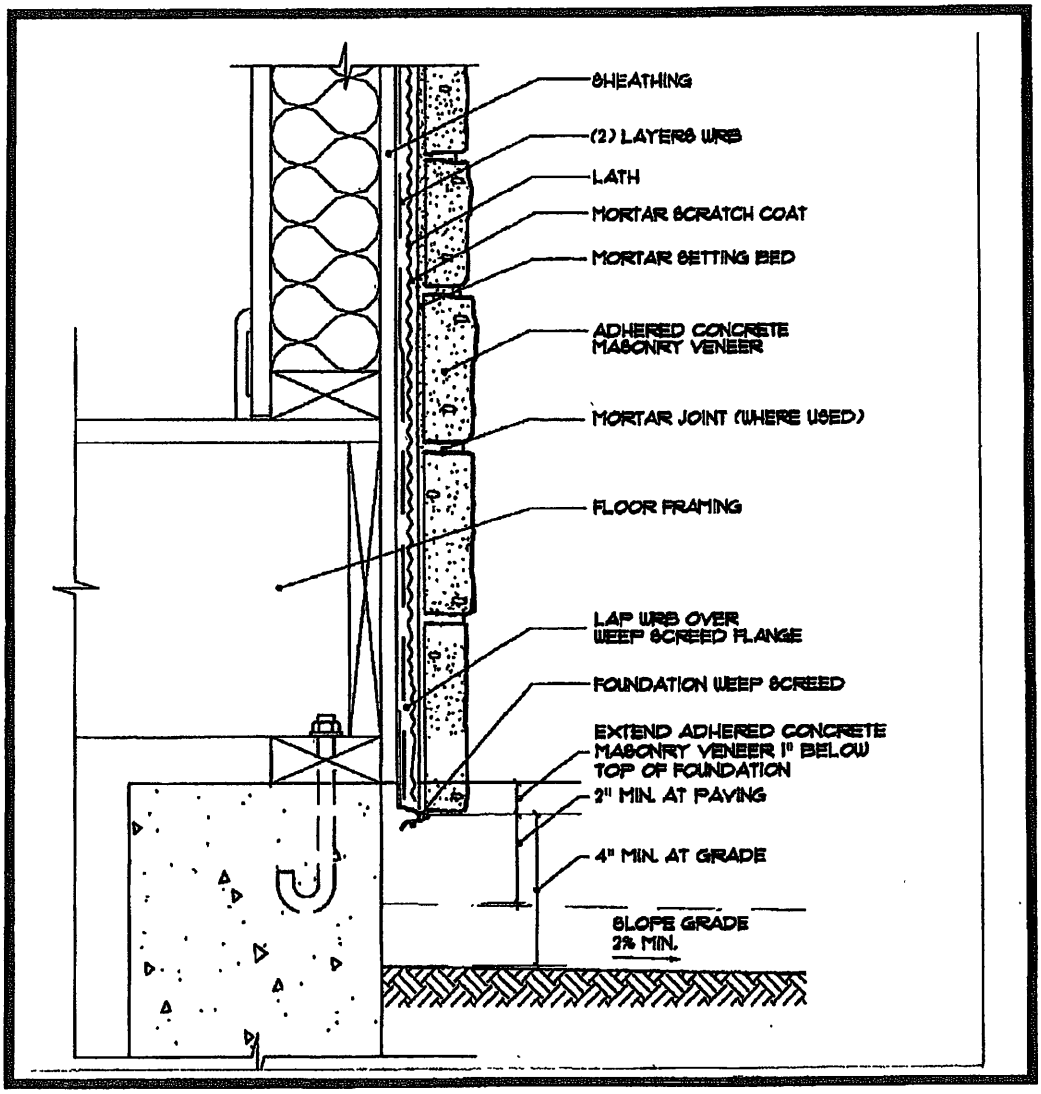
The following precautions should be taken to ensure a successful and durable ACMV installation.

- Do not subject ACMV to direct water contact. For example, avoid allowing sprinklers to directly spray onto the surface. Also, downspouts or drainage pipes should be placed so that water is not constantly saturating the ACMV units.
- Do not subject ACMV to contact with de-icing materials, salt, or other harsh chemicals. Prolonged exposure to these conditions may discolor the ACMV or result in surface damage.

Wall Assembly

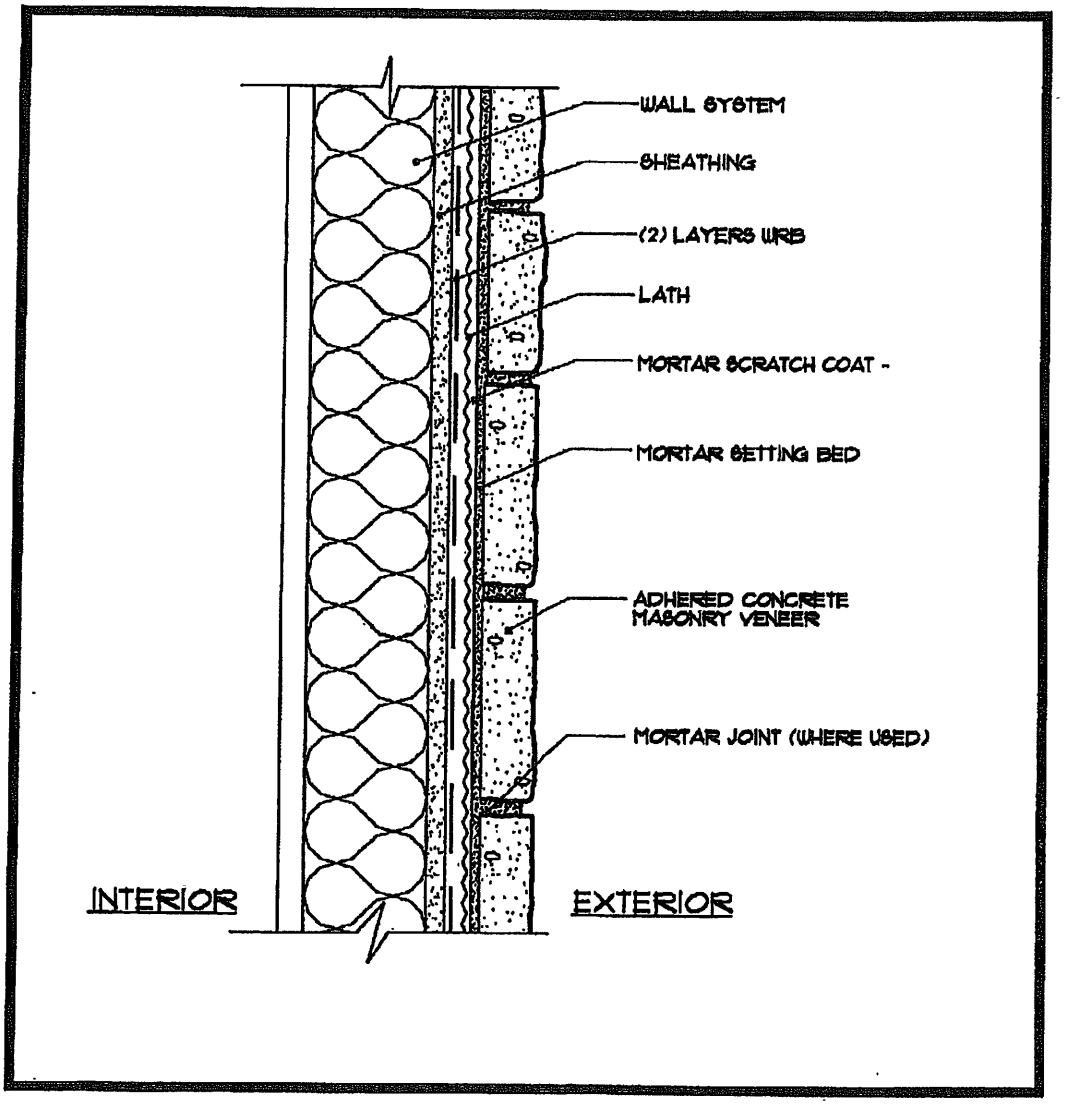


Foundation Wall Base



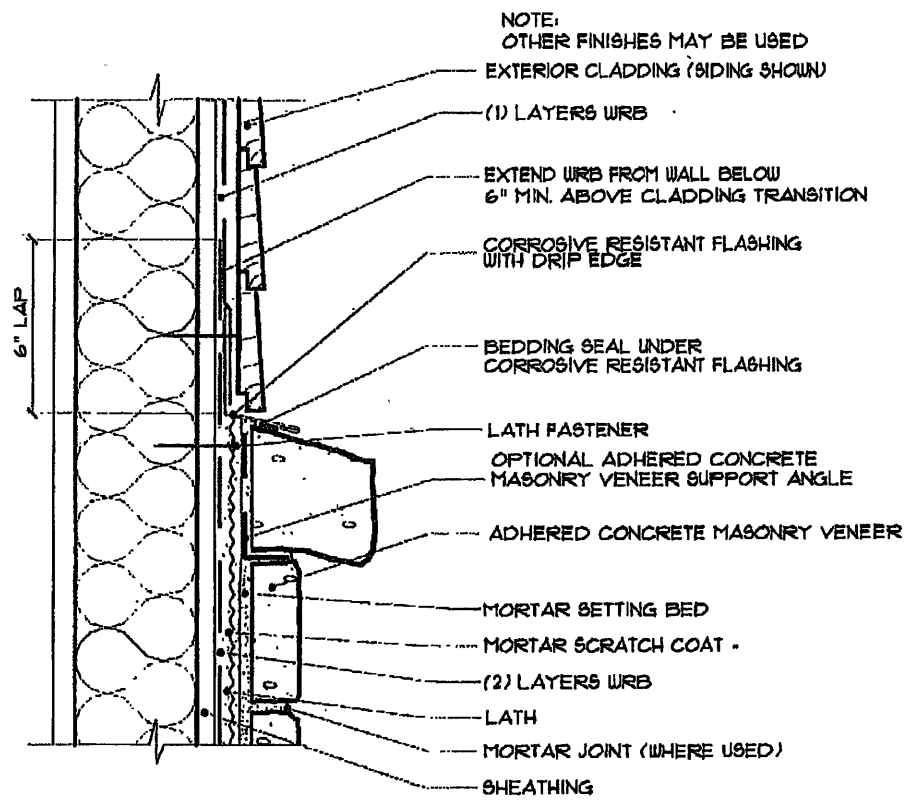
A minimum of a four inch gap is required at the base of the wall for proper drainage and to avoid water intrusion into the assembly.

Typical Wall Section



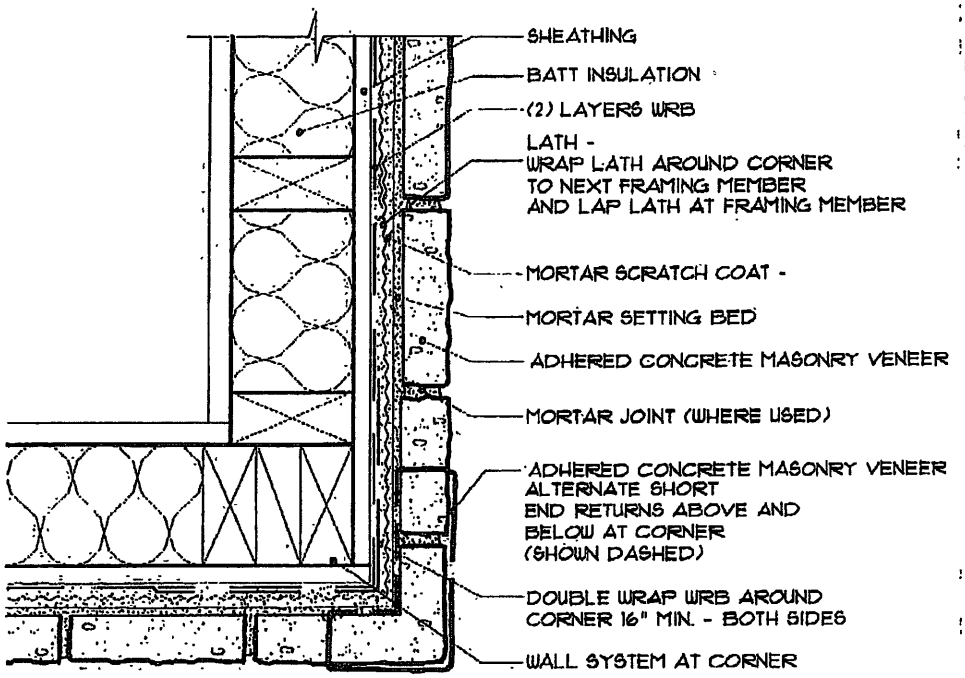
Note layering of sheathing, water resistive barrier, lath, scratch coat, and adhered concrete masonry veneer.

Cladding Transition



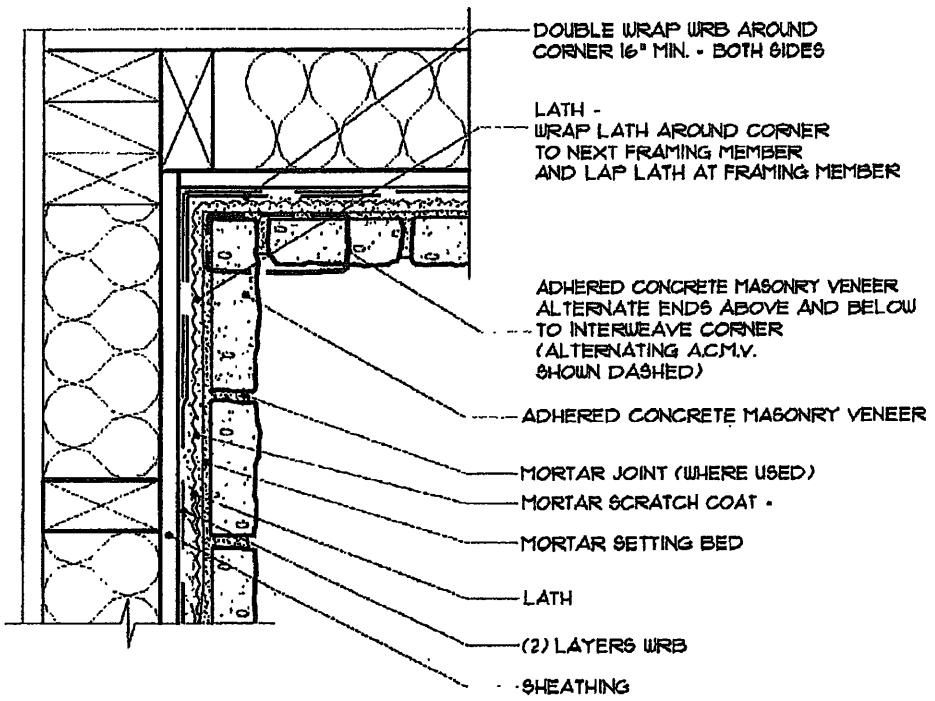
The flashing should be installed prior to the adhered concrete masonry veneer. Water resistive barrier laps over the back leg of flashing for positive drainage. Optional support anchor shown. Verify installation requirements with adhered concrete masonry veneer manufacturer.

Outside Corner



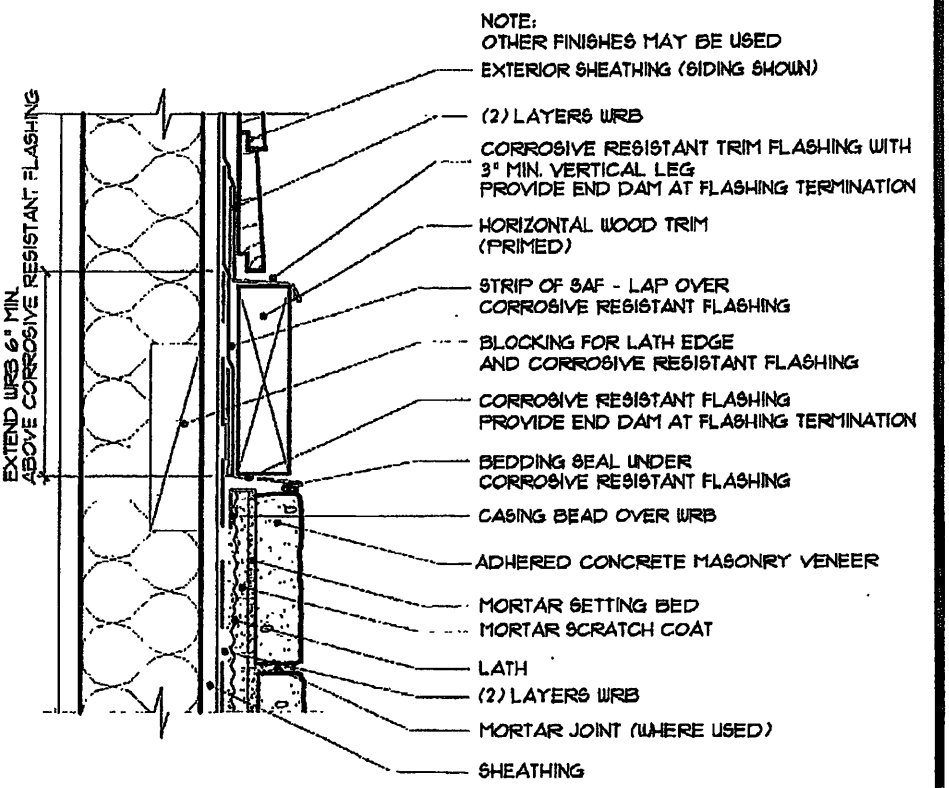
Randomly alternate short end returns above and below at the corner. Lap lath around the corner to the next framing member.

Inside Corner



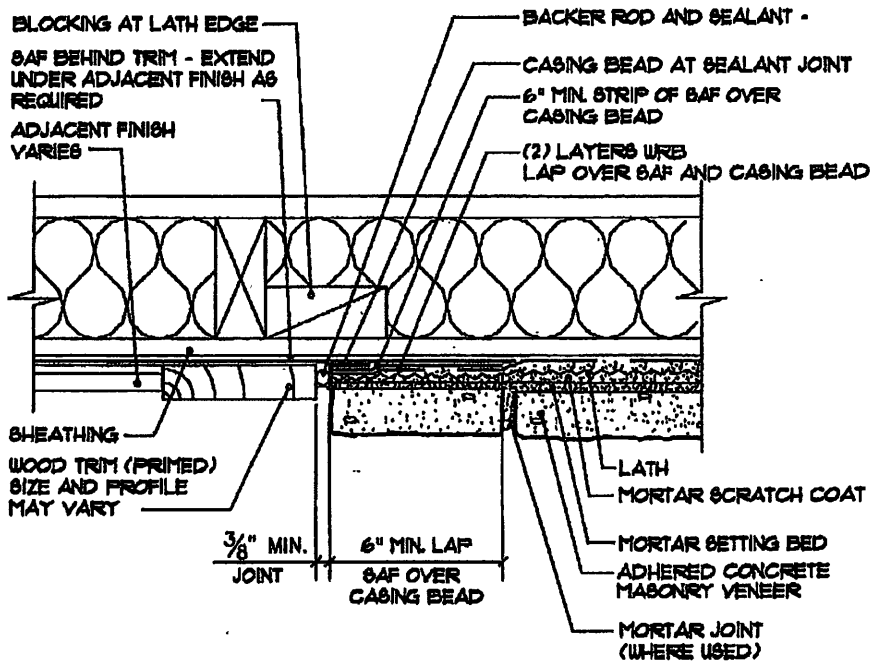
Randomly alternate ends above and below to interweave the corner. Double wrap water resistive barrier around both sides of the corner. Lap lath to the framing at least 16 inches to the next framing member.

Horizontal Transition



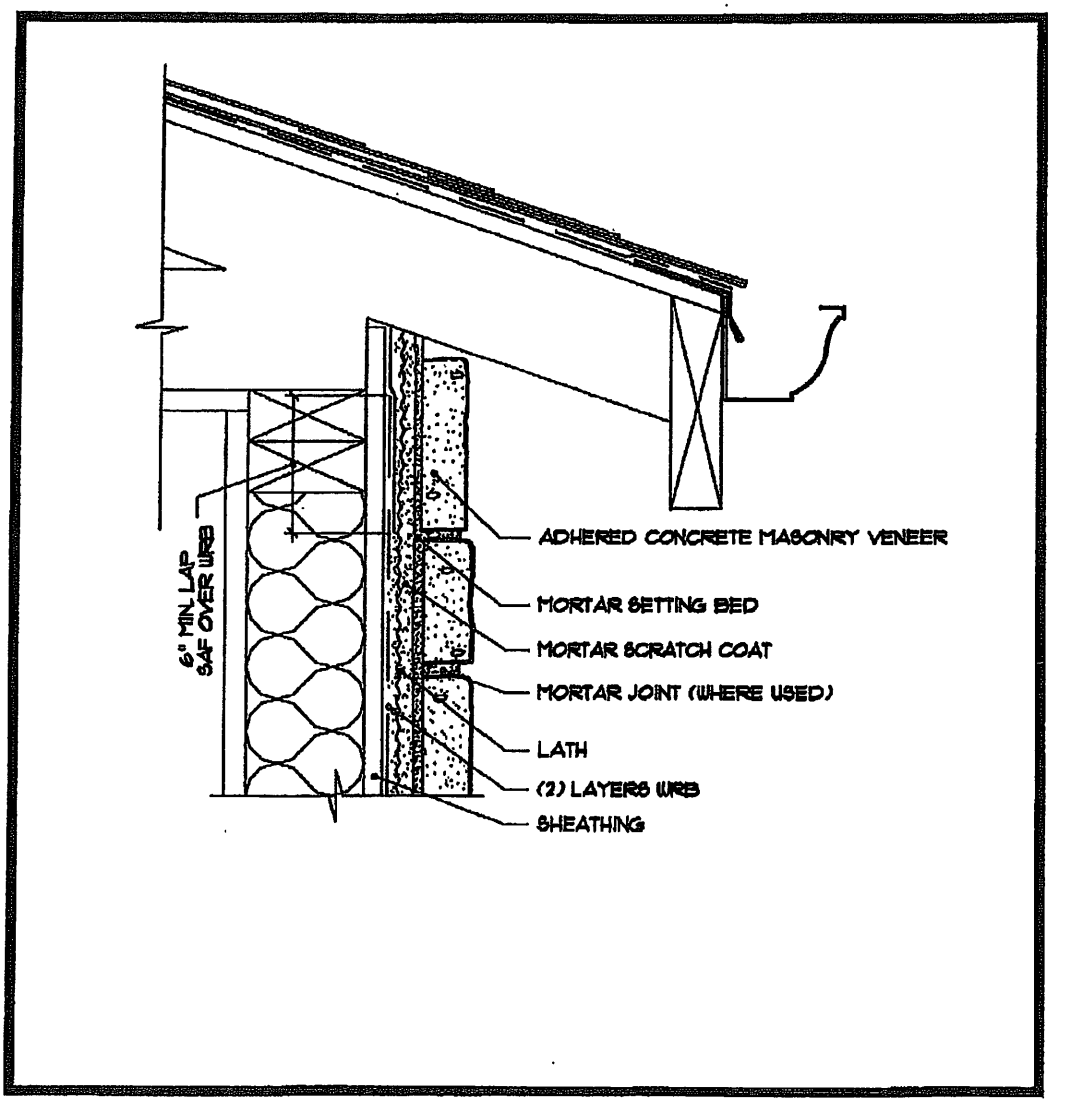
Note that self adhering flashing is lapped shingle-fashion with corrosive resistant sheet metal. A bedding seal is used under the corrosive resistant sheet metal next to the adhered concrete masonry veneer.

Vertical Transition



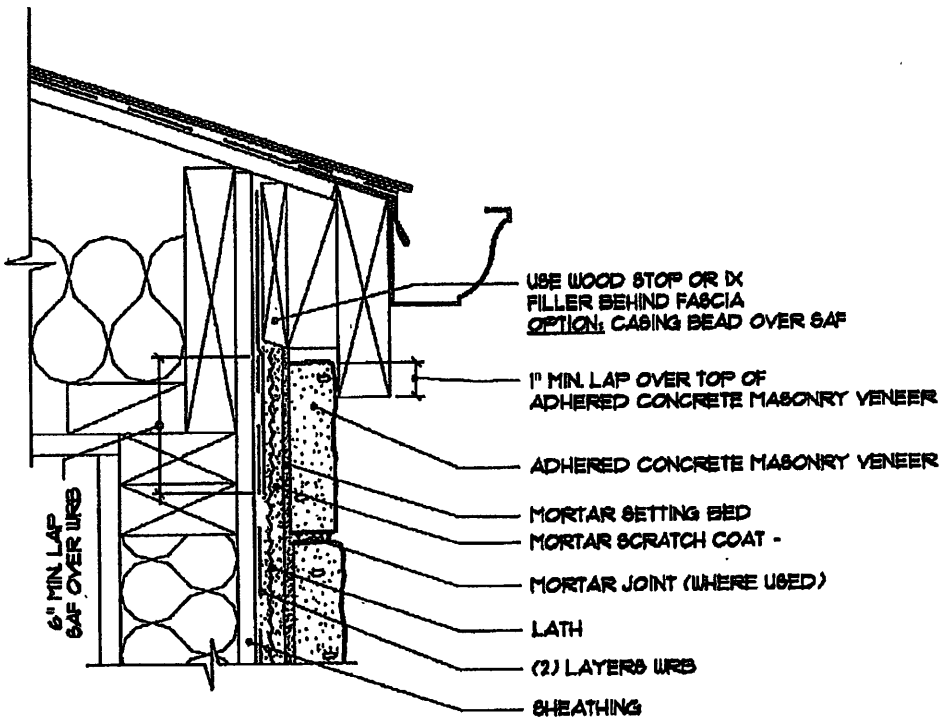
Self adhering flashing extends under the adjacent finishes. A 3/8" minimum gap should be used between finishes.

Open Eave - Overhang



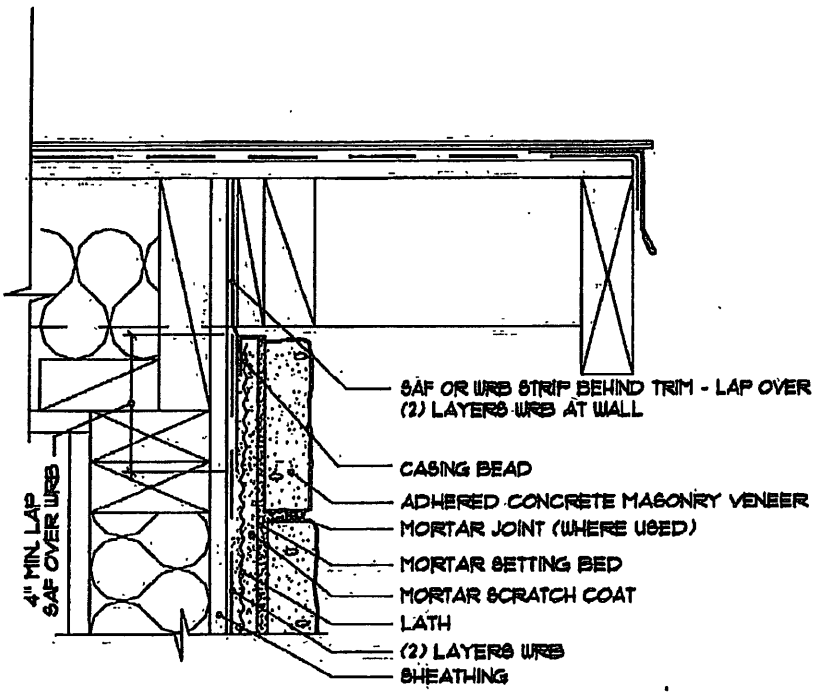
Water resistive barrier should be in place prior to soffit installation followed by adhered concrete masonry veneer.

Open Eave - Flush



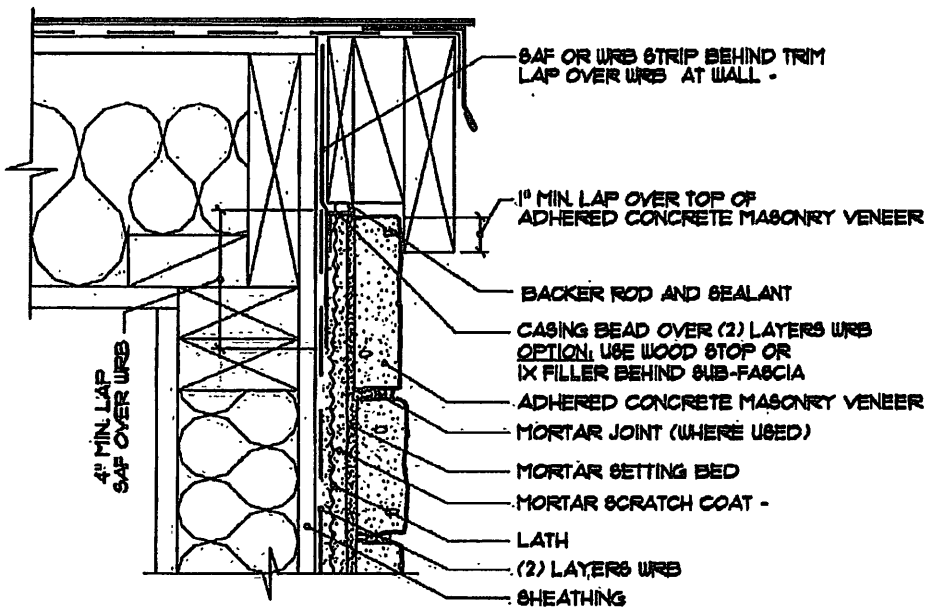
Water resistive barrier should be in place prior to soffit installation followed by adhered concrete masonry veneer.

Rake - Overhang



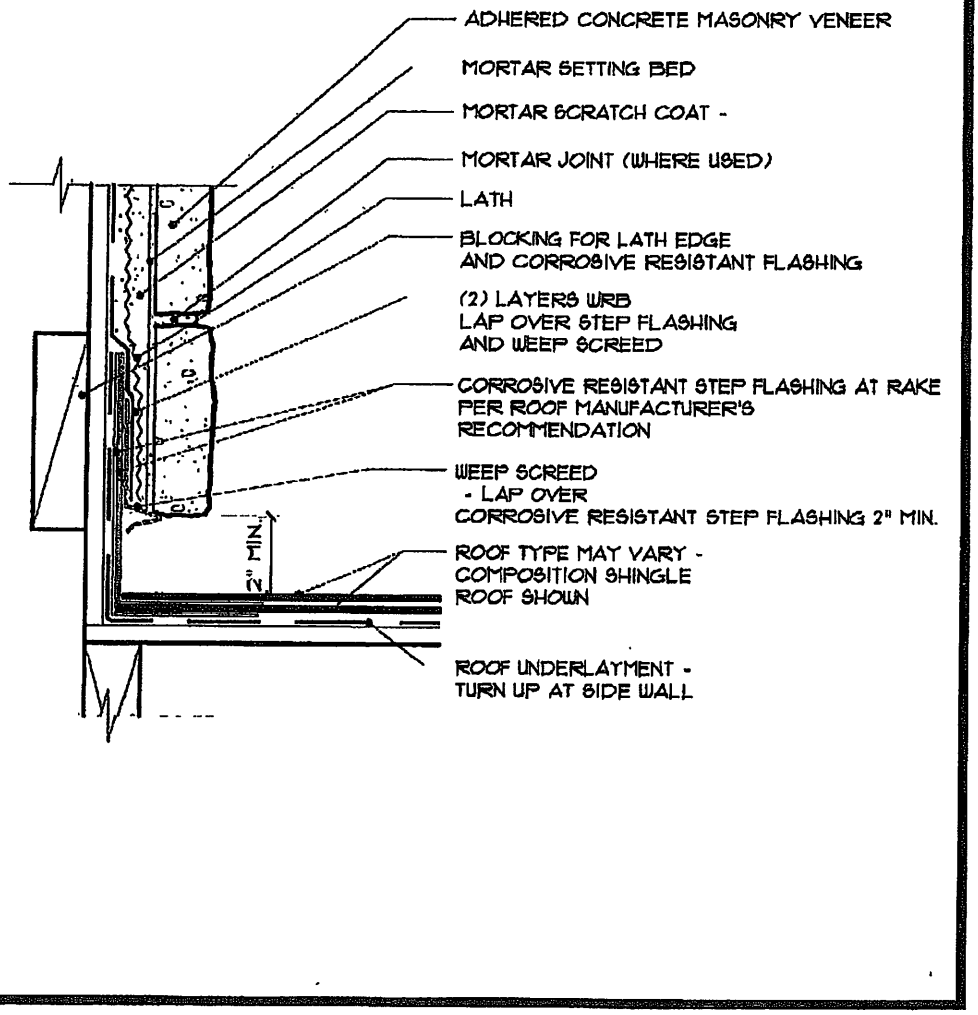
The intent of these details is to limit exposure to wind driven rain.

Rake - Flush



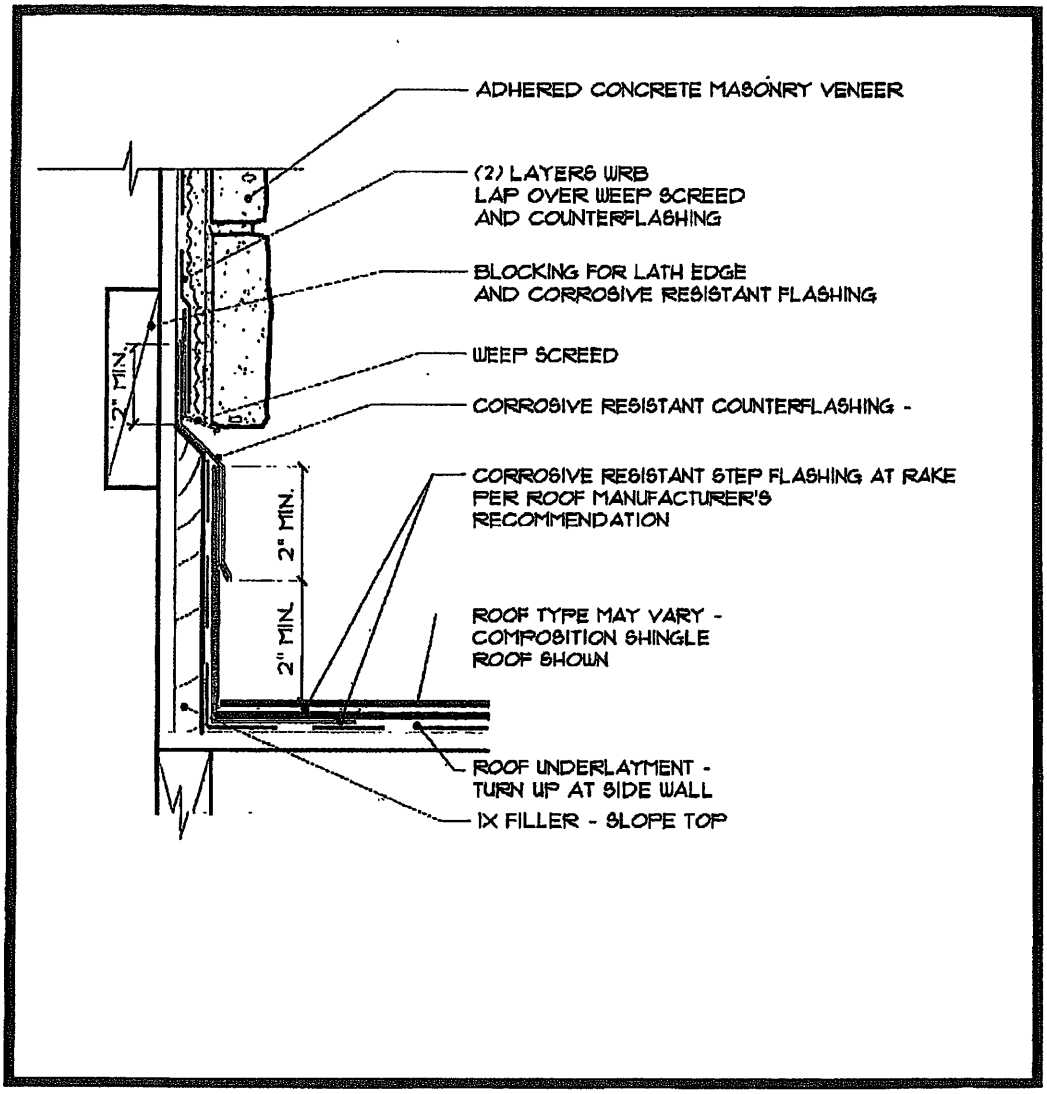
Note the use of backer rod and sealant.

Side Wall - Composition Shingles



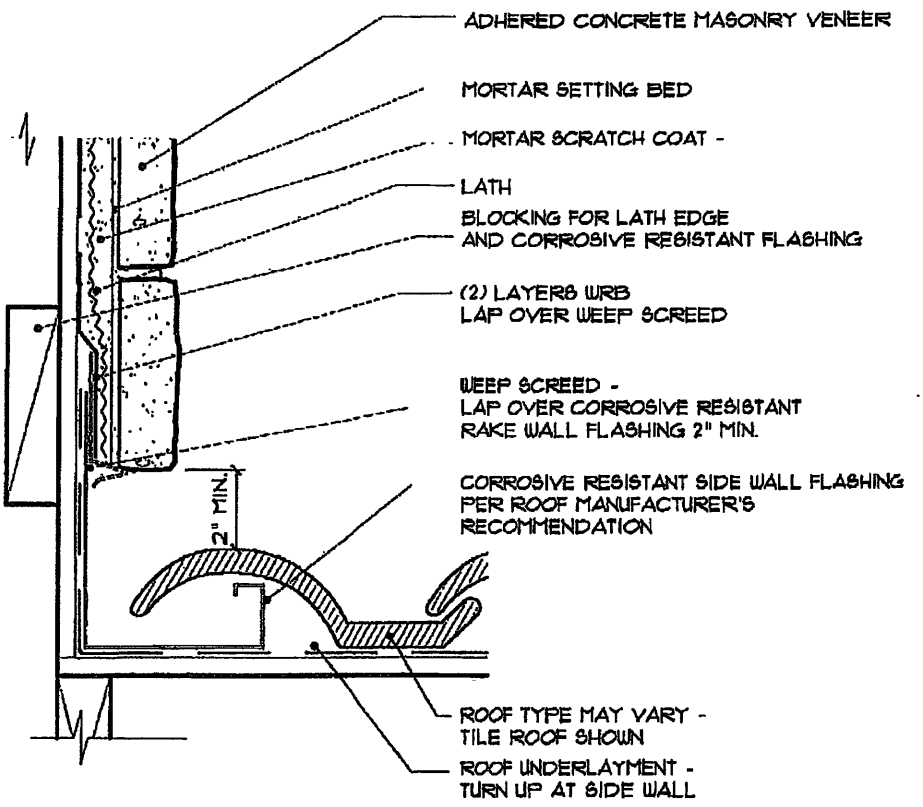
Water resistive barrier laps over step flashing and weep screed.

Side Wall - Composition Shingles Curbing



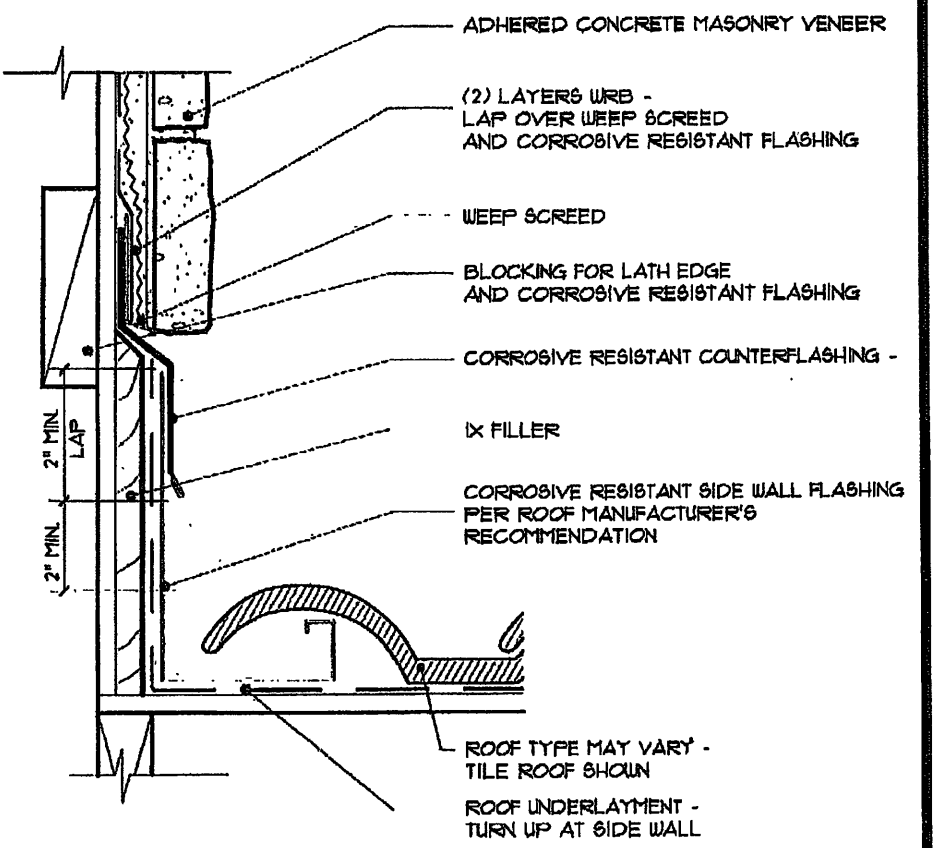
This detail includes base trim. Note the counterflashing between trim and adhered concrete masonry veneer.

Side Wall - Tile Shingles



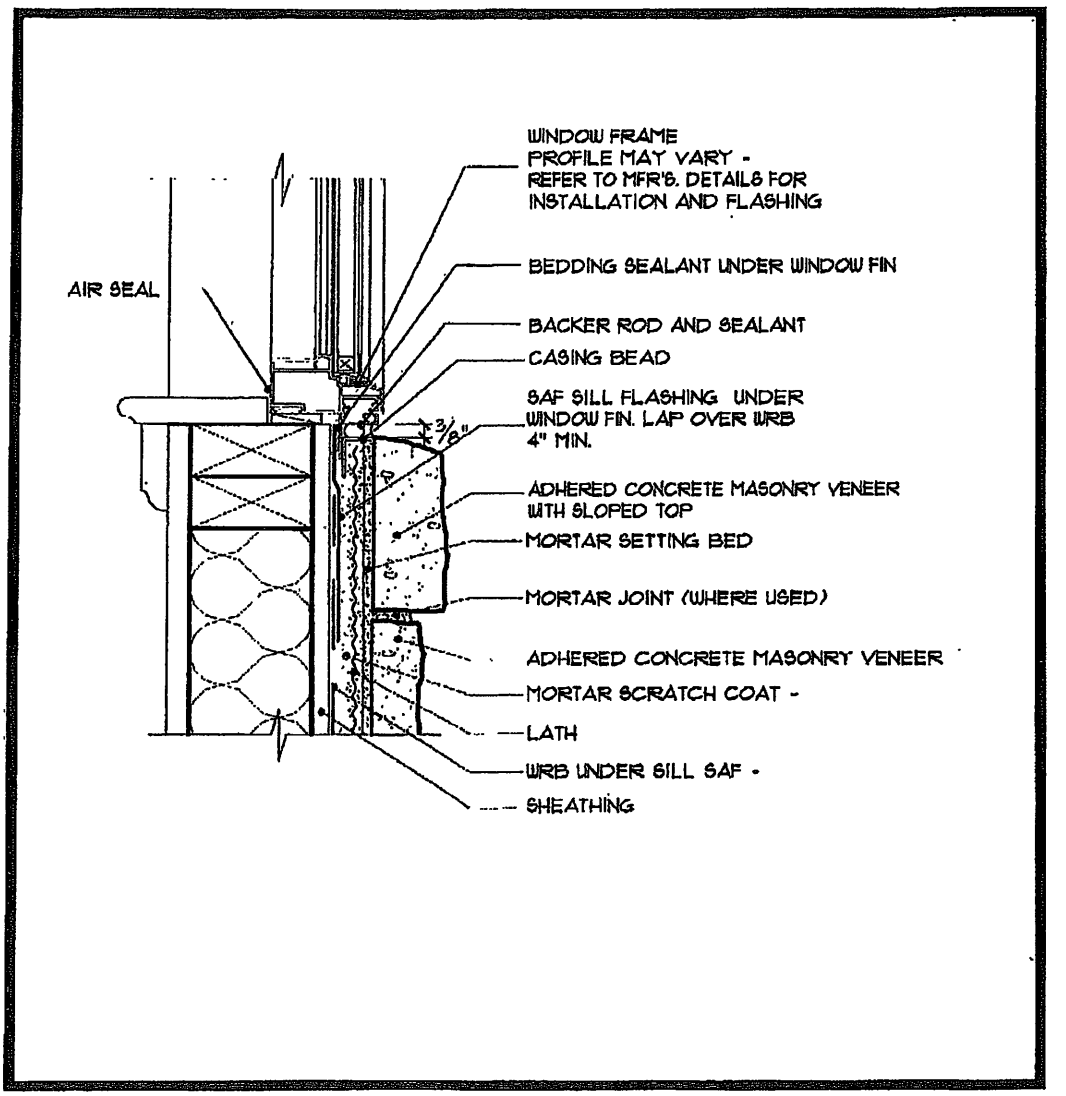
Water resistive barrier laps over step flashing and weep screed.

Side Wall - Tile Shingles Curbing



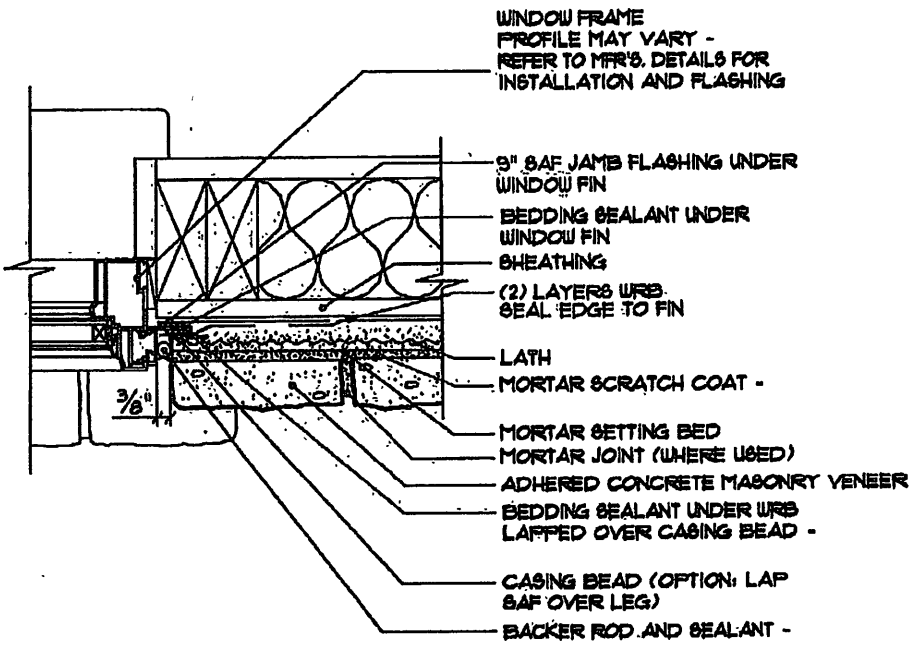
This detail includes curbing. Note the counterflashing between trim and adhered concrete masonry veneer.

Window Sill



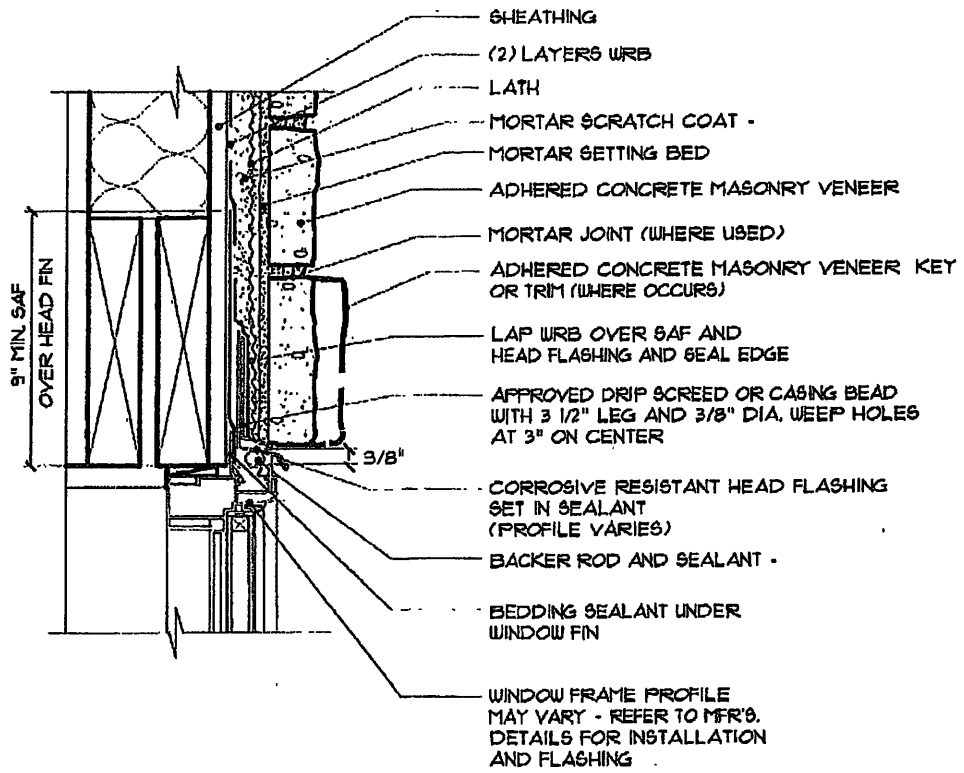
Rough openings must be properly flashed prior to window installation. Tuck water resistive barrier under pan flashing at sill. Sill flashing should drain between layers of WRB or to exterior of adhered concrete masonry veneer.

Window Jamb



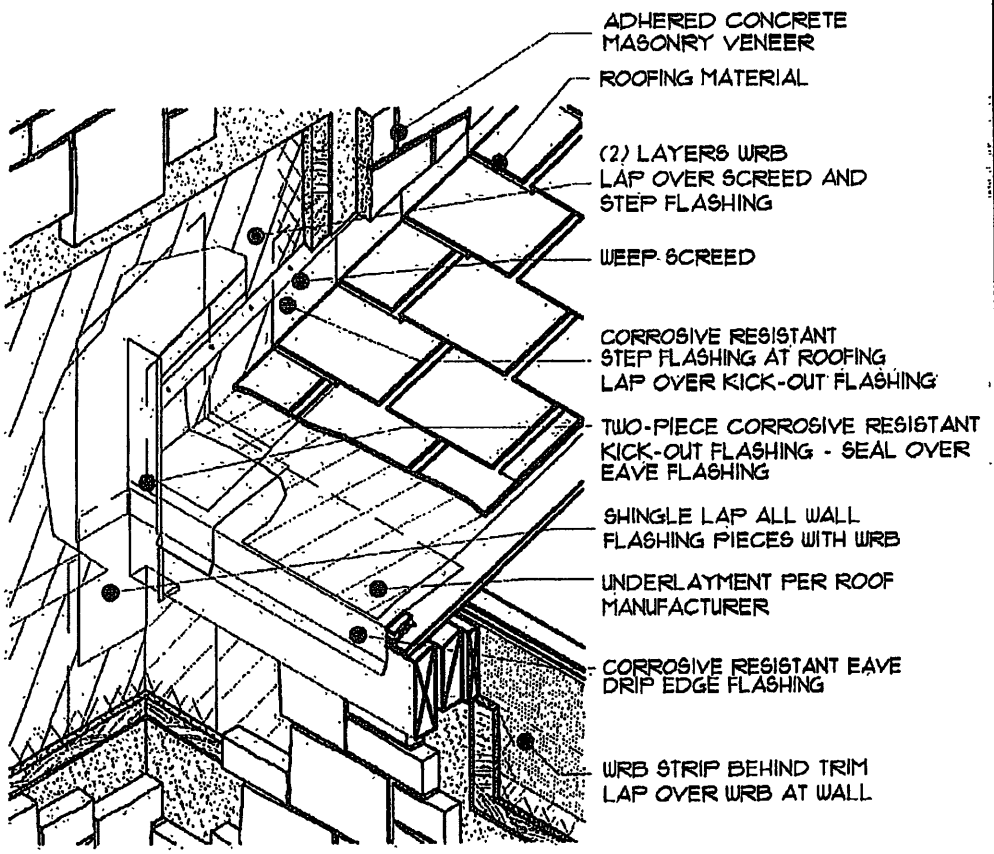
Rough openings must be properly flashed prior to window installation. Tuck water resistive barrier under paper at sill. Flashing should drain layers between of WRB. Extend layers of flashing to extreme of adhered concrete masonry veneer.

Window Head



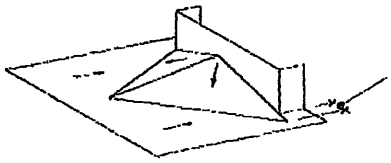
Apply adhesive membrane at window head to cover drip cap and membrane at jambs.

Kickout Flashing



Kickout flashing should be sized properly to accommodate thickness of ACMV.

Cricket



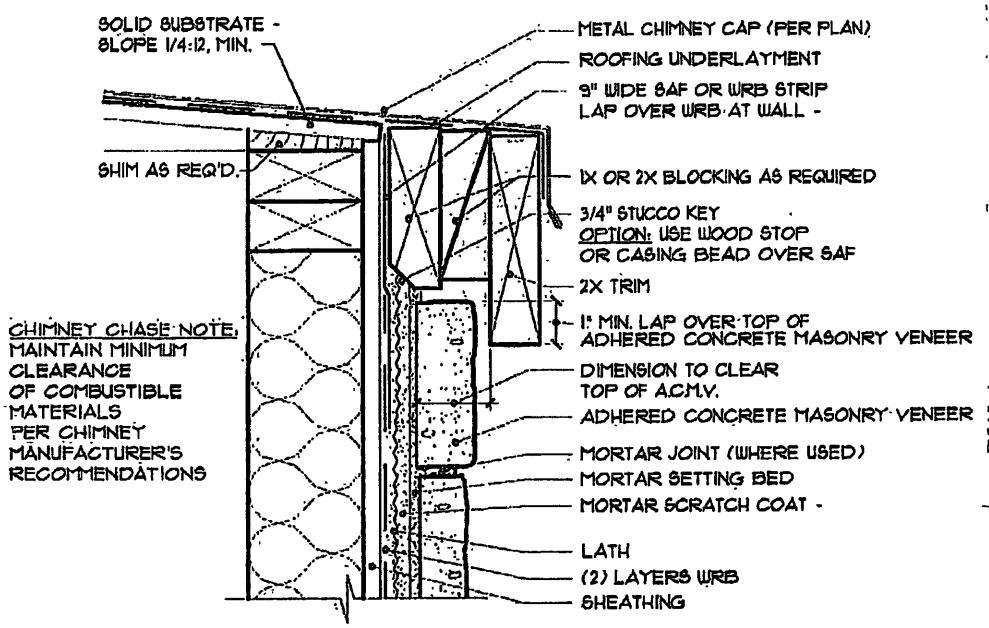
EXTEND CRICKET MIN. 2" BEYOND CHASE

TYPICAL CORROSIVE RESISTANT CRICKET PER ROOF MANUFACTURER'S RECOMMENDATIONS

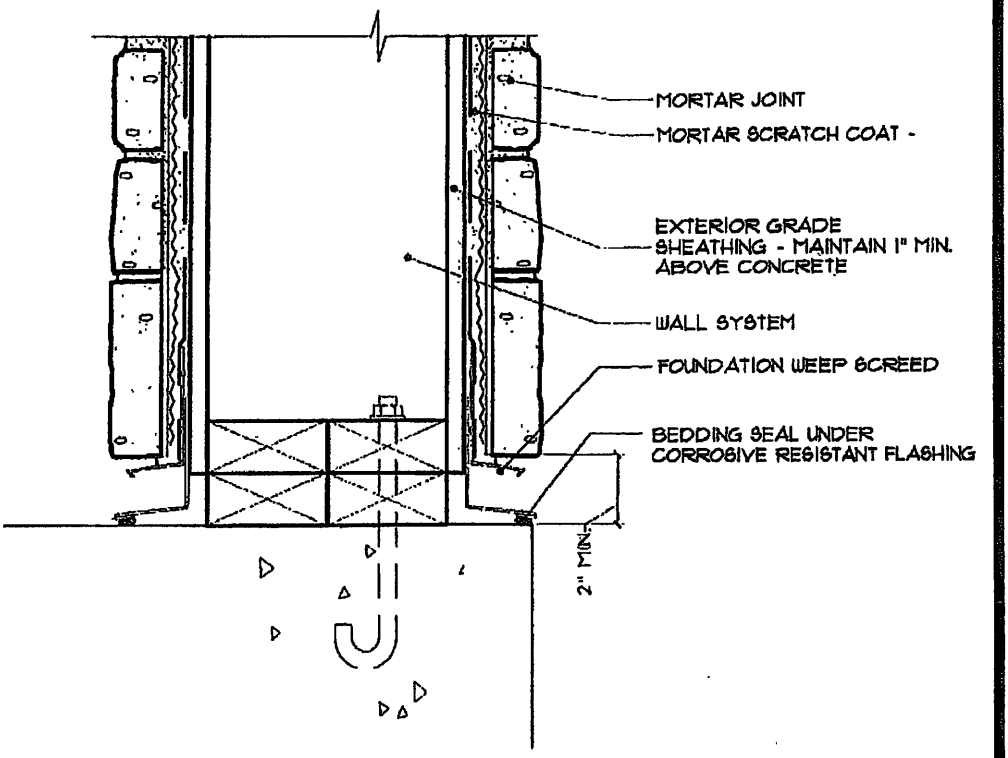
(2) LAYERS WRB

WEEP SCREED

Chimney Chase

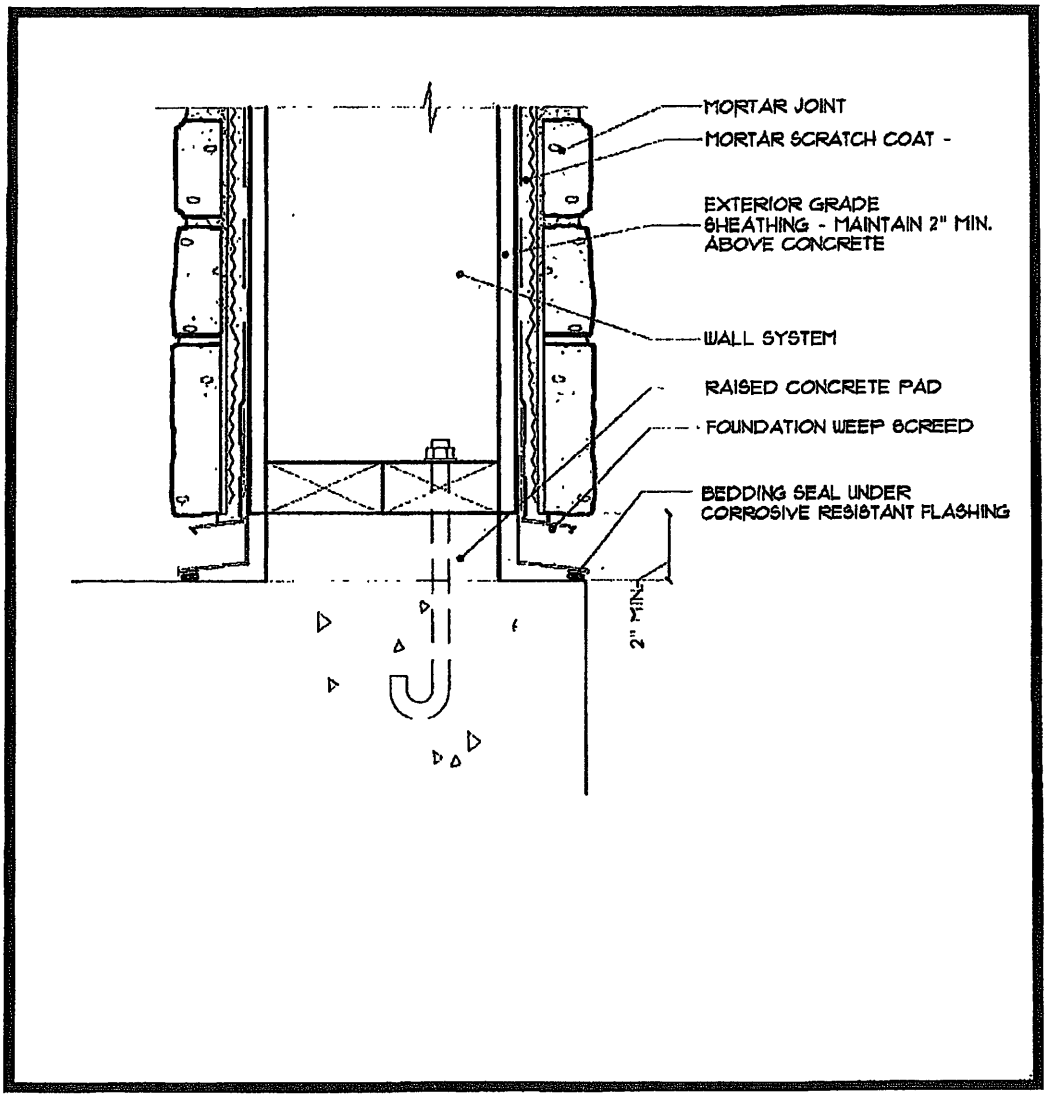


Column Base



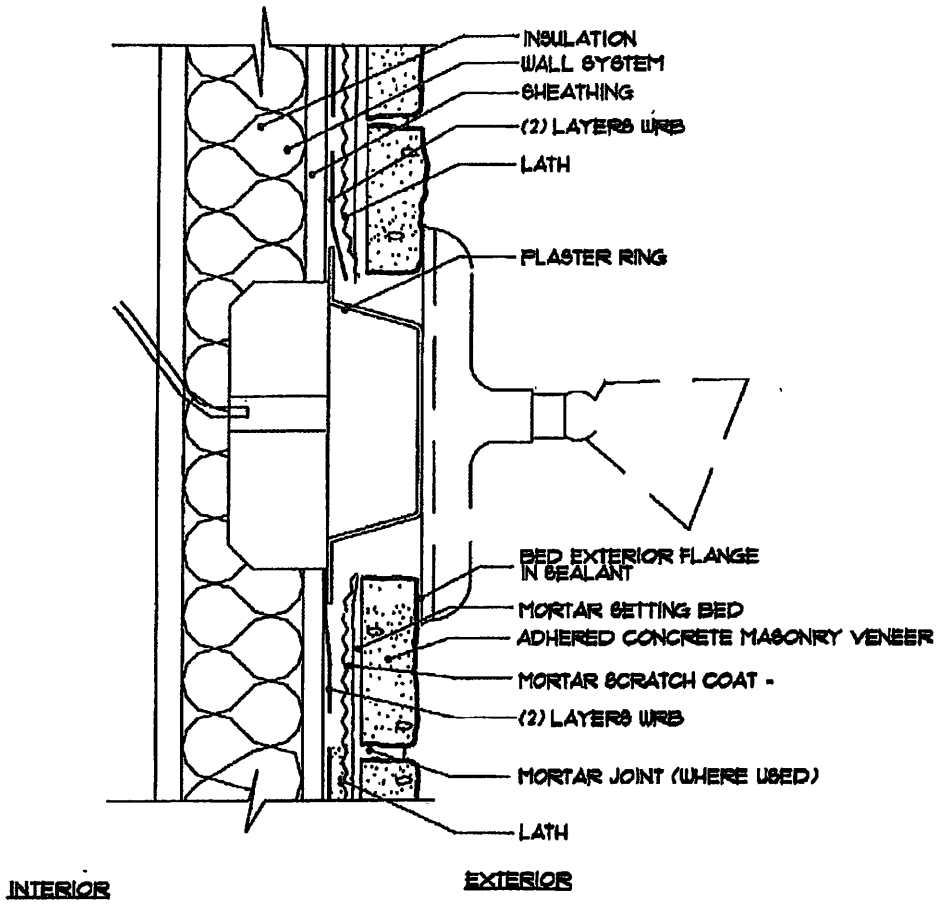
A minimum two inch clearance should be maintained at all sides of the base. All column materials to be exterior grade. Do not extend flashing past edge of ACMV for safety reasons.

Raised Column Base



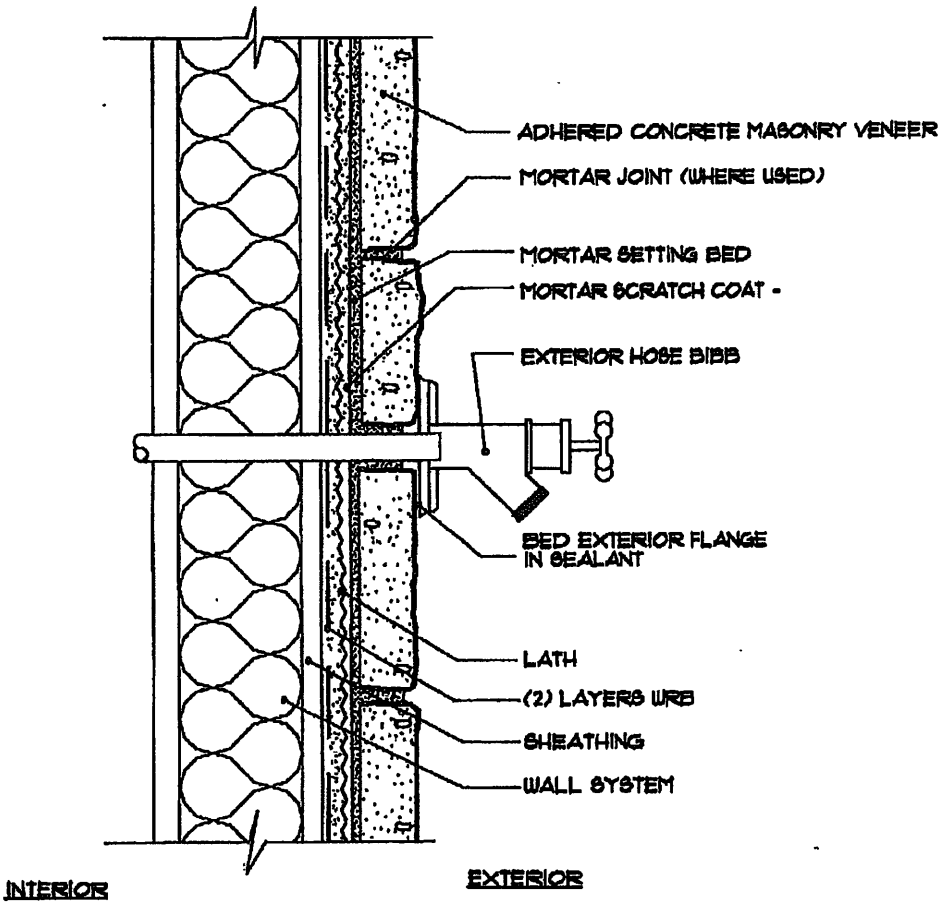
Adhered concrete masonry veneer may overlap the raised concrete pad, but a clearance of two inches should be maintained at all sides of the base. Do not extend flashing past edge of ACMV.

Fixture Penetration



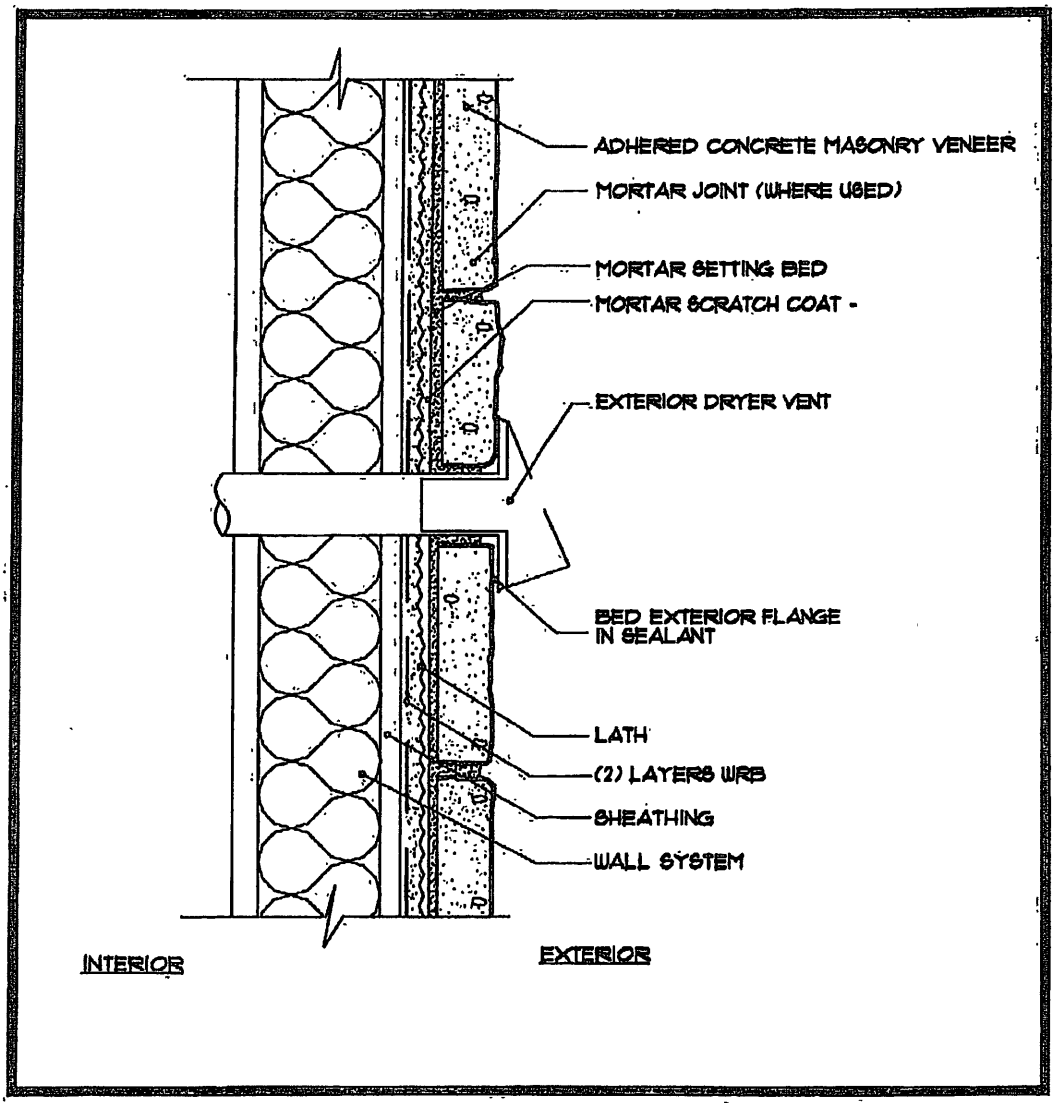
Plaster rings should be affixed over the service box to bring the face of the box flush with the adhered concrete masonry veneer. Be sure to bed the exterior flange in sealant. Water resistive barrier should be installed snugly around the plaster ring flange.

Pipe Penetration



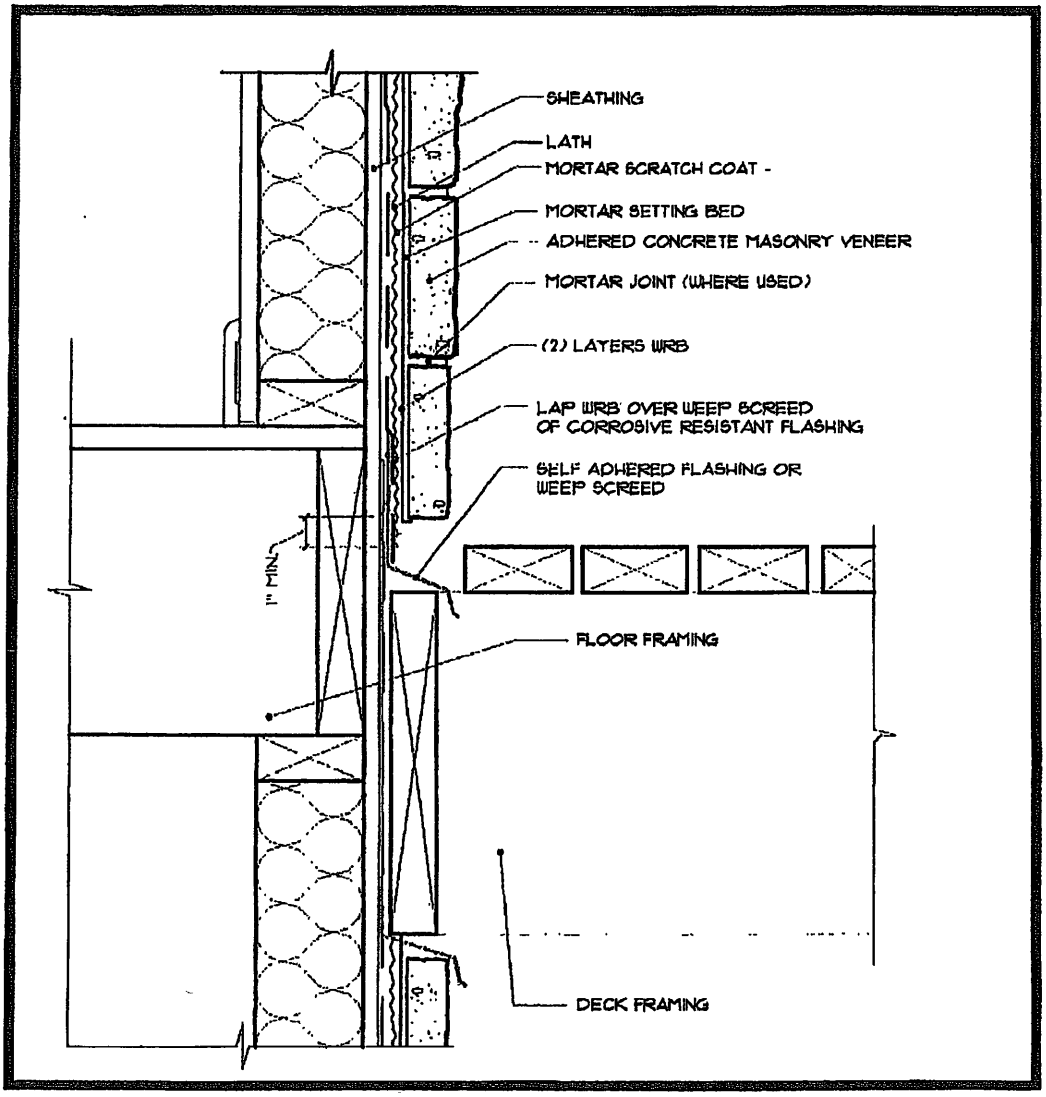
Be sure to bed all covers, flanges, and escutcheons in sealant before fastening them to the wall.

Dryer Vent Penetration



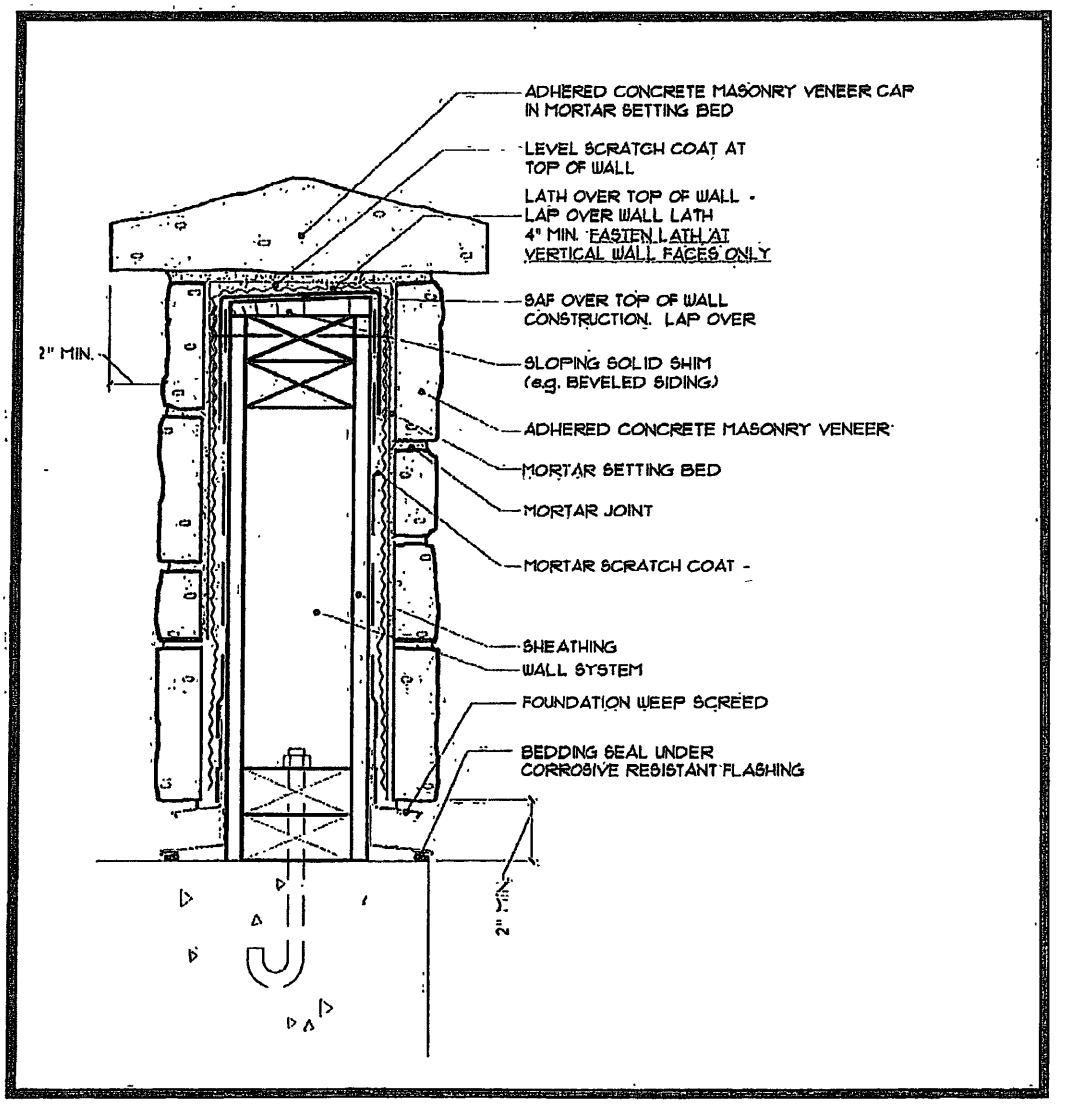
Be sure to bed all covers, flanges, and escutcheons in sealant before fastening them to the wall.

Deck Termination



Be sure to lap water resistive barrier over weep screed and floor framing to manage water intrusion. Provide gap between adhered concrete masonry veneer and decking for drainage.

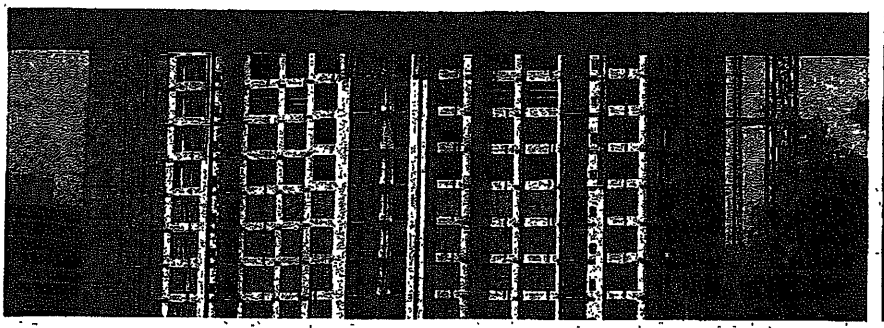
Wall Cap

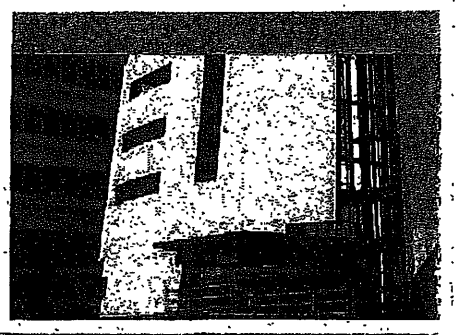


Lath should lap over the top of the wall but be fastened only to vertical wall faces. Self adhering flashing should lap top of the wall. A sloping solid shim should top the wall under the SAF and lath.

03044

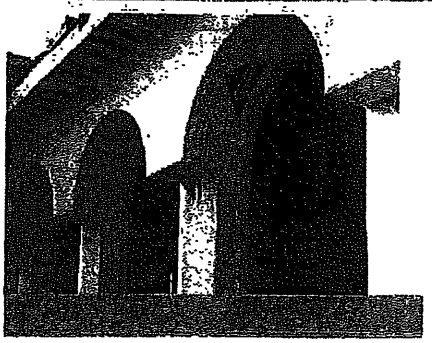
Georgia-Pacific
Gypsum

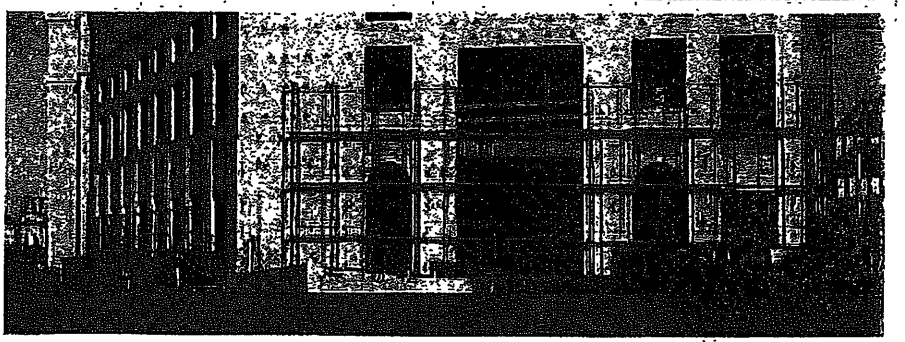




DensGlass® Sheathing

Preferred substrate under brick, stone, stucco, siding and Exterior Insulation and Finishing Systems (EIFS).

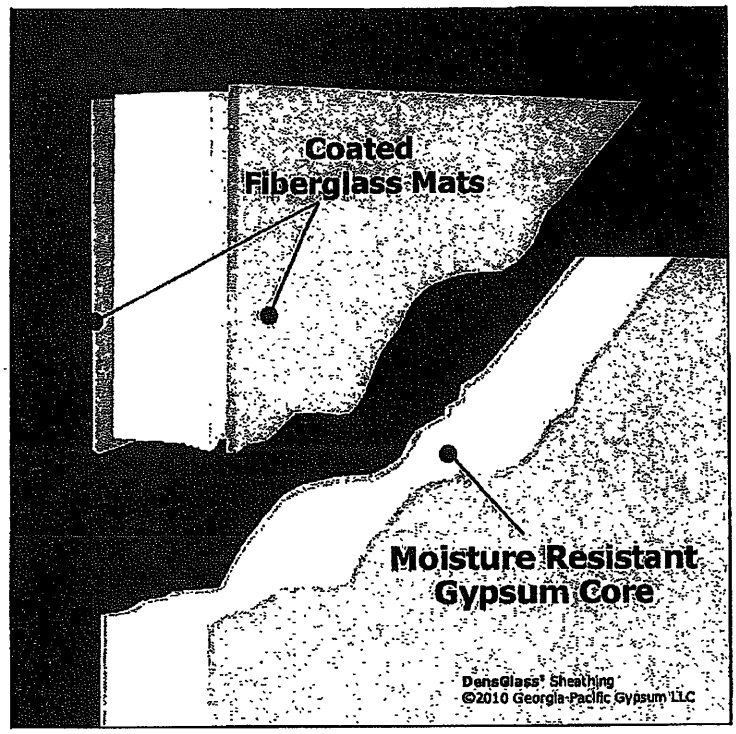




MOISTURE- AND MOLD-RESISTANT HIGH-PERFORMANCE SOLUTIONS

03045

Product Overview



DensGlass® Sheathing has fiberglass mats for superior mold and moisture resistance compared to paper-faced sheathings.

- *Fiberglass mats eliminate a potential food source for mold and may reduce remediation and scheduling delays associated with paper-faced drywall.*
- *Replaces traditional paper-faced sheathing.*
- *Backed with a 12-month limited warranty against in-place weather exposure damage (delamination, deterioration and decay).**

**For complete warranty details, visit www.gpgypsum.com*

When tested, as manufactured, in accordance with ASTM D 3273, DensGlass Sheathing scored a 10, the highest level of performance for mold resistance under the ASTM D 3273 test method.

The score of 10, in the ASTM D 3273 test, indicates no mold growth in a 4-week controlled laboratory test. The mold resistance of any building product when used in actual job site conditions may not produce the same results as were achieved in the controlled, laboratory setting. No material can be considered mold proof. When properly used with good design, handling and construction practices, Dens™ Brand gypsum products provide increased mold resistance compared to standard paper-faced wallboard.

Available Sizes/Dimensions

DensGlass Sheathing is available in 1/2" (12.7 mm) thickness and DensGlass® Fireguard® Sheathing is available in 5/8" (15.9 mm) thickness. DensGlass Sheathing is manufactured in a 4' (1219 mm) width and 8' (2438 mm), 9' (2743 mm) and 10' (3048 mm) lengths. Other lengths are available upon request.

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DensGlass® Sheathing is the preferred substrate under brick, stone, stucco, siding and Exterior Insulation and Finishing Systems (EIFS) because of its exemplary track record. DensGlass Sheathing should be specified for any project where flexibility and easy sheathing installation are paramount without the headaches and expense of delamination, deterioration, sagging and warping Look for the distinctive GOLD color to ensure you're using genuine DensGlass Sheathing

Mold Resistance

Independent tests confirm that DensGlass Sheathing, with its patented fiberglass mat design, resists the growth of mold when tested, as manufactured, per ASTM D 3273.

Strength

Fiberglass mats penetrate into the panel to make an integrated unit that offers superb strength; outstanding resistance to delamination, deterioration, warping and job site damage; and an excellent bonding surface for EIFS. The flexural strength of DensGlass Sheathing is approximately the same in both directions. This means DensGlass Sheathing can be installed either vertically or horizontally without sacrificing wall strength between studs. DensGlass panels also protect and help stabilize structural framing.

Stability

DensGlass Sheathing is extremely resistant to rippling, buckling and sagging, even under humid conditions — which makes it particularly suitable for soffits. In actual tests, DensGlass panels exceeded ASTM C 1396 and ASTM C 79 standards for humidified deflection by a factor of five times over the standard for paper-faced gypsum sheathing.

Fire Resistance

DensGlass Sheathing is noncombustible as described and tested in accordance with ASTM E 136. Tests of 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing conducted in accordance with ASTM E 119/CAN ULC S-101 qualify the product for a variety of UL listings and other designs in the GA-600 Fire Resistance Design Manual.

Superior Weather Protection

DensGlass Sheathing integrates a water-resistant, treated core with a fiberglass mat face and back to provide superb protection from the elements. Panels will not delaminate or deteriorate due to normal weather conditions — even during construction delays that last as long as 12 months after installation.

A water-resistive barrier is not required over DensGlass Sheathing to provide for the protection of the gypsum sheathing itself. Consult with the local building code, design professional, owner or cladding manufacturer for water-resistive barrier requirements. DensGlass Sheathing is the ideal substrate for a wide variety of air and water-resistive barriers including building wraps, liquid applied coatings and self-adhering membranes. See page 9 for details.

Easy to Handle

DensGlass Sheathing is lightweight and easy to handle. It can be cut and fastened with standard drywall tools and fasteners. The product is much easier to work with than wood substrate, cement board or fiber cement sheathing, which tend to be heavy and bulky.

Outstanding Warranty

DensGlass Sheathing is covered by a 12-month limited warranty for weather exposure, a five-year limited warranty against manufacturing defects and a 12-year limited warranty when used as a substrate for architecturally specified EIFS. For a copy of the limited warranty, call 1-800-225-6119. Or visit our Web site at www.gpgypsum.com.

Standards and Code Compliance

DensGlass Sheathing is manufactured to meet ASTM C 1177. Application standards where applicable are in accordance with Gypsum Association Publication GA-253 for gypsum sheathing or ASTM C 1280.

Evaluated by:

- ICC-ES Legacy Report NER 574
- CCMC-12064-R
- ICC-ES Legacy Report ER 4305
- N.Y. City MEA 244-88-M
- Florida Product Approval Code FL 2524-R3

The data relating to fire- and sound-tested assemblies is based on the characteristics, properties and performance of materials and systems obtained under controlled test conditions as set forth under the appropriate ASTM standard, such as E 119 (fire), E 90 (sound) or E 72 (structural).

Georgia-Pacific Gypsum Products and LEED®

Many of our products may contribute to LEED® credits. To find out more, please reference the Sustainable Materials Data Sheets (SMDS) on our website (www.gpgypsum.com) for recycled content, regional materials, low emitting materials and other potential categories for LEED credit contributions.

Physical Properties

Product Comparison	5/8" (15.9 mm) DensGlass® Fireguard® [4]	5/8" (15.9 mm) Gypsum Sheathing Type X (Paper-faced)	1/2" (12.7 mm) DensGlass® Sheathing	1/2" (12.7 mm) Regular Gypsum Sheathing (Paper-faced)
Width, Nominal	4' (1219 mm)	4' (1219 mm)	4' (1219 mm)	4' (1219 mm)
Length, Standard	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)
Weight/lbs/SF (kg/m²)	2.5 (12)	2.2 (11)	1.9 (9)	1.9 (9)
Bending Radius	8" (2438 mm)[9]	n/a	6' (1829 mm)[9]	n/a
Composition	Fiberglass mats gypsum core	Paper facings gypsum core	Fiberglass mats gypsum core	Paper facings gypsum core
Racking Strength, lbs./ft. (dry) (N/m) (Ultimate – not design value)	>654[5] (>9544)	654[1] (9544)	>540[5] (>7878)	540[1] (7878)
Flexural Strength,[4] parallel, lbf. (N) (4' weak direction)	100 (445)	50[2] (222)	80[7] (356)	40[2] (178)
Compressive Strength	min. 500 psi (3445 kPa)	min. 400 psi (2750 kPa)	min. 500 psi (3445 kPa)	min. 350 psi (2400 kPa)
Humidified Deflection,[4,6] inches	1/8" (3 mm)	5/8" (15.9 mm)	2/8" (6 mm)	10/8" (32 mm)
Permeance (perms)[5] (ng/Pa·s·m²)	17 (970)	25 (1400)	23 (1300)	27 (1600)
"R" Value[6] °F·ft²·hr/BTU (K·m²/w)	.67 (0.118)	.56 (0.099)	.56 (0.099)	.45 (0.079)
Combustibility[10]	Noncombustible	Combustible	Noncombustible	Combustible
Linear Expansion with Change Moisture in/in/%RH(mm/mm %RH)	6.25×10^{-6}	7.5×10^{-6}	6.25×10^{-6}	7.5×10^{-6}
Flame Spread, E84 CAN ULC-S102	10	15	10	15
Coefficient of Thermal Expansion in/in/°F (mm/mm/°C)	8.5×10^{-6} (15.3×10^{-6})	10×10^{-6} (18×10^{-6})	8.5×10^{-6} (15.3×10^{-6})	10×10^{-6} (18×10^{-6})
Resists Growth of Mold (tested, as manufactured, per ASTM D 3273)	Yes	No	Yes	No
Handling Characteristic	Scores with utility knife and snaps easily	Scores with utility knife and snaps easily	Scores with utility knife and snaps easily	Scores with utility knife and snaps easily
Fasteners	Standard	Standard	Standard	Standard

1. Gypsum Association – GA-253
2. Minimum requirements for ASTM C 1396
3. Maximum requirements for ASTM C 1396
4. Tested in accordance with ASTM C 473
5. Tested in accordance with ASTM E 96 (dry cup method)
6. Tested in accordance with ASTM C 518 (heat flow meter)
7. Minimum requirements for ASTM C 1177
8. Double fasteners on ends as needed
9. Tested in accordance with ASTM E 72
10. As defined and tested in accordance with ASTM E 136

Installation Recommendations

- DensGlass® Sheathing must be installed in accordance with the instructions in this brochure, Gypsum Association document GA-253 or ASTM C 1280 DensGlass Sheathing can be attached parallel or perpendicular to wood or metal framing. Use appropriate board orientation for specific fire assemblies and shear wall applications within this document, other reference documents or as required by designing authority. The framing width shall not be less than 1-1/2" (38 mm) wide for wood framing and 1-1/4" (32 mm) for steel framing. Framing members shall not vary more than 1/8" (3 mm) from the plane of the faces of adjacent framing.
- Fasteners should be driven flush with the panel surface (not countersunk) and into the framing system. Locate fasteners at least 3/8" (9 mm) from the ends and edges of the sheathing. Nails or screws, as listed in the fastener chart, may be used to attach DensGlass Sheathing to framing. When a pneumatic fastening system into metal is specified to attach DensGlass Sheathing, consult with manufacturer for application specifications and shear resistance data. DensGlass Sheathing is not to be used as a base for nailing or other fastening
- Install DensGlass Sheathing with end joints staggered on horizontal applications. Ends and edges of the sheathing should fit tightly. DensGlass Sheathing panels shall not be less than 8" (203 mm) from the finish grade in fully weather- and water-protected siding systems, and not less than 12" (305 mm) from the ground for properly drained and ventilated crawl spaces. Consult with the design authority for control joint recommendations.

Wall Applications

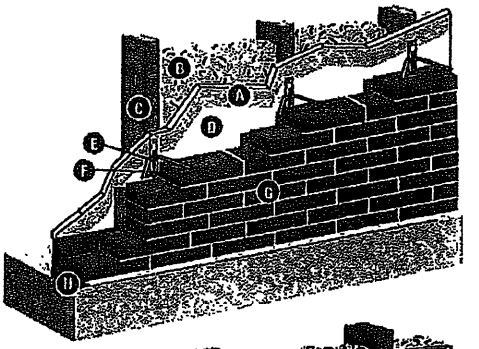
Installing Cladding over DensGlass Exterior Sheathing

Most conventional exterior sidings and wall coverings — including wood, vinyl, composition, metal, stone, brick, wood shingles, shakes and plywood panels — may be applied over DensGlass Sheathing. Consult your local building codes for water resistive barriers (WRB) requirements.

A. DensGlass Sheathing
B. Insulation
C. Framing
D. Water-Resistive Barrier
E. Masonry Tie
F. 2" (50mm) Max. Air Space
G. Brick Masonry or Stone Veneer
H. Flashing and Weeps
I. Wood Shingles or Shakes
J. Plywood Siding
K. Vinyl Siding
L. Fiber Cement Siding
M. Metal Siding

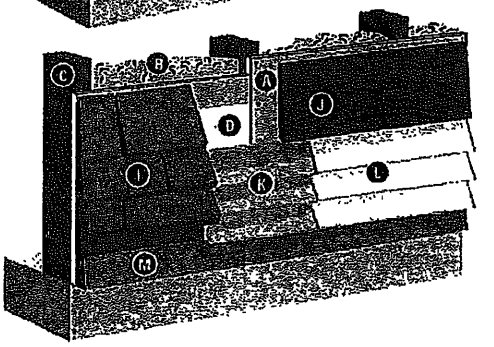
Brick Cavity Wall

Masonry or stone veneer can be applied over DensGlass Sheathing just as it would be over any other type of sheathing. Attach the masonry ties securely through the panels and into the steel or wood framing. Space the ties as required by masonry courses. Apply water-resistive barrier as required by building code or design authority.



Shingles, Shakes, Vinyl, Metal, Wood, Fiber Cement Siding

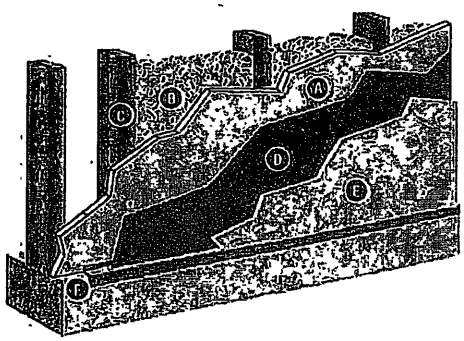
DensGlass Sheathing can be used in applications such as under wood shakes or shingles, plywood panel siding or other horizontal siding applications. All siding must be attached through the DensGlass Sheathing and into the steel or wood framing. Apply water-resistive barrier as required by building code or design authority.



Illustrations not intended for design or specification purposes.

Wall Applications continued

A. DensGlass® Sheathing
B. Insulation
C. Framing
D. Paper-Backed Metal Lath
E. Conventional Stucco
F. Minimum 1/4" (6 mm) Gap



Conventional Stucco

Stucco systems may be applied over DensGlass Sheathing using paper-backed metal lath. Paper-backed metal lath must be mechanically attached through the DensGlass Sheathing into the steel or wood framing. Install stucco system in accordance with the manufacturer's instructions, the Portland Cement Association guidelines and local building code requirements.

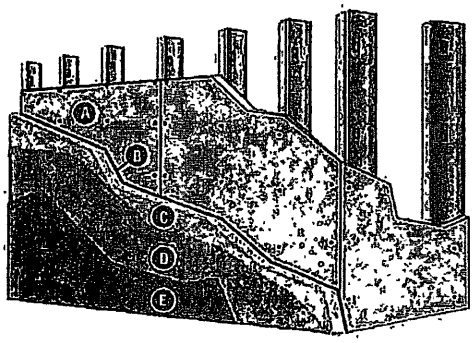
Exterior Insulation and Finish Systems (EIFS)

DensGlass Sheathing is an ideal substrate for adhesive or mechanical application of expanded polystyrene (EPS) or extruded polystyrene insulation in EIFS applications and is recommended for all climate zones.

DensGlass Sheathing is designated as the preferred gypsum substrate for EIFS by EIMA, the EIFS industry members association, in the EIFS Durability Specifications Guideline. DensGlass panels are treated with an exclusive GOLD color primer coating. This coating, proprietary to Georgia-Pacific Gypsum and developed especially for DensGlass Sheathing, has several important advantages for EIFS applications:

- Eliminates the need for sealer/primer with adhesively applied EIFS.
- Strengthens the bond between panel and surfacing product.
- Makes the panel more resistant to surface water. The result: labor cost and callbacks go down while customer satisfaction on each project goes up.
- 12-year limited warranty when used in an architecturally specified EIFS application.
- Maximum framing spacing 16" (406 mm) o.c. for 1/2" (12.7 mm) and 24" (610 mm) o.c. for 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing.

A. DensGlass Sheathing.
B. Adhesive or Mechanically Attached
C. Polystyrene Insulation
D. Reinforcing Mesh Embedded in Base Coat
E. Finish Coat



High Velocity Hurricane Zone (HVHZ)

The ability to withstand the destructive winds and the impact of various objects during a hurricane in a coastal area is key to the survival of any exterior cladding system. DensGlass Sheathing from Georgia-Pacific Gypsum helps BASF, Sto Corp, Dryvit, Parex Lahabra, Inc., Fiberweb, Inc. and Wellbilt International's systems pass the strict Miami-Dade County and Florida Building Code requirements for High Velocity Hurricane Zones (HVHZ). The systems were tested independently to determine the performance against specific criteria for impact resistance, air and water infiltration resistance and wind load resistance. For more information, please visit www.gpgypsum.com or contact the system manufacturer.

Fastening and Framing

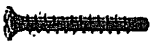
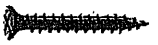
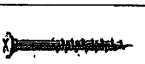
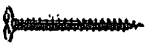
Thickness	Framing Spacing	Panel Orientation	Fastener Spacing – Wood Framing	Fastener Spacing – Metal Framing
1/2" (12.7 mm)	24" (610 mm) o.c. max[1,3]	Parallel[2] or Perpendicular	8" (203 mm) o.c. field[2] & perimeter	8" (203 mm) o.c. along framing
5/8" (15.9 mm)	24" (610 mm) o.c. max[3]	Parallel[2] or Perpendicular	8" (203 mm) o.c. field[2] & perimeter	8" (203 mm) o.c. along framing

1. Only for mechanically attached claddings. When specified behind EIFS, maximum framing spacing for 1/2" (12.7 mm) DensGlass® Sheathing is 16" (406 mm) o.c.

2. Fastener spacing around the perimeter of the wall and along intermediate vertical framing members. To meet the racking shear strength listed in the physical properties table, fastener spacing is 4" (102 mm) o.c. around the perimeter of each panel and 8" (203 mm) o.c. along vertical framing members.

3. For racking strength resistance apply panel edges parallel with framing spaced a maximum of 16" (406 mm) o.c. for both 1/2" (12.7 mm) and 5/8" (15.9 mm) DensGlass Sheathing.

4. Fire-rated assemblies may require additional fasteners, see specific assembly details.

Fastener*	Length – 1/2" Thick	Length – 5/8" Thick	Description	Application
	1" (25 mm)	1-1/4" (32 mm)	Bugle head fine thread, rust-resistant drill point drywall screw	DensGlass Sheathing to heavy-gauge steel
	1" (25 mm)	1-1/4" (32 mm)	Bugle head fine thread, rust-resistant sharp point drywall screw	DensGlass Sheathing to light-gauge metal framing furring
	1-1/4" (32 mm)	1-5/8" (41 mm)	Bugle head, rust-resistant, coarse thread sharp-point screw	DensGlass Sheathing to wood framing
	1-1/4" (32 mm)	1-1/4" (32 mm) metal 1-5/8" (41 mm) wood	Wafer head, rust-resistant screws, drill or sharp point	DensGlass Sheathing to heavy-gauge or light-gauge, metal or wood, respectively
	1-1/2" (38 mm)	1-3/4" (45 mm)	11-gauge, galvanized nail	DensGlass Sheathing to wood framing or equivalent

**For screws, meet or exceed ASTM C 1002 or C954. Contact fastener manufacturer for correct amount of corrosion resistance*

Negative Uniform Lateral Loads (Wind Load)

5/8" (15.9 mm) DensGlass® Fireguard® Sheathing Horizontally-Applied

Stud Spacing, in./O.C. (mm)	Screws, in./O.C. (mm)	Ultimate load, PSF* (kPa)
16 (406)	8 (203)	127 (6.08)
16 (406)	6 (152)	142 (6.80)
16 (406)	4 (102)	192 (9.19)
12 (305)	8 (203)	157 (7.51)
12 (305)	6 (152)	204 (9.77)
12 (305)	4 (102)	270 (12.93)
8 (203)	8 (203)	208 (9.96)
8 (203)	6 (152)	354 (16.95)
8 (203)	4 (102)	410 (19.63)

NOTE: Apply DensGlass Sheathing to appropriately engineered framing system. Tested applied to 6" (152 mm) x 1-5/8" (41 mm) 18-gauge (43 mils) steel studs using #6 1-1/4" (32 mm) bugle head screws. Other stud sizes may be suitable.

Source: Tested in accordance with ASTM E 330 by Hurricane Test Laboratory. For a copy of report #G488-1001-07, contact Georgia-Pacific Gypsum Technical Hotline at 1-800-225-6119.

**Maximum load capacity (not design load) of the 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied horizontally. Apply appropriate safety factor from the design method used to calculate design load. For example, a safety factor of 3 applied to an ultimate load of 127psf (6.08 kPa) results in a design load of 42 psf (2.01 kPa).*

1/2" (12.7 mm) and 5/8" (15.9 mm) DensGlass Fireguard Sheathing Vertically or Horizontally Applied

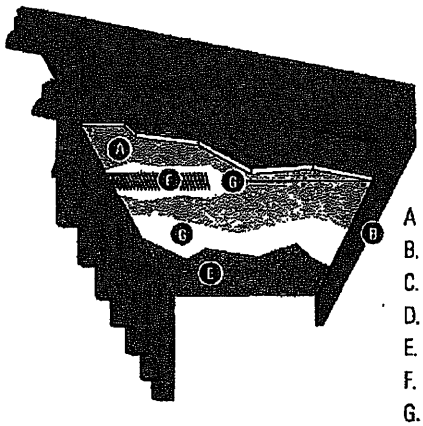
Thickness, Inches (mm)	Board Orientation	Stud Spacing, in. o.c. (mm)	Ultimate Load, Psf (kPa)
1/2" (12.7)	Vertical	16 (406)	65 (3.11)
1/2" (12.7)	Horizontal	16 (406)	70 (3.35)
5/8" (15.9)	Vertical	24 (610)	68 (3.26)
5/8" (15.9)	Horizontal	24 (610)	85 (4.07)
5/8" (15.9)	Vertical	16 (406)	92 (4.40)

Source: TPI Report #99-047; wind load per ASTM E330 (bugle head screws 8" (203 mm) o.c.)

Soffit Applications, Fastening, Framing and Finishing

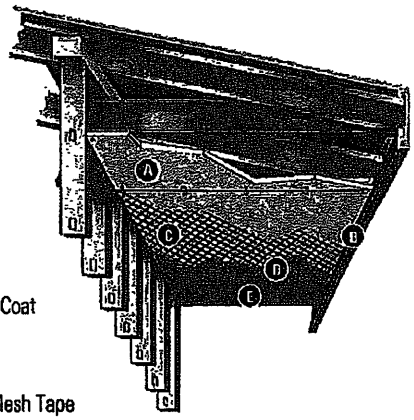
Method #1

Painted Ceilings and Soffits
Finished Joints



Method #2

Exterior Ceilings and Soffits



A. DensGlass® Sheathing
B. Drip Edge
C. Reinforcing Mesh/Base Coat
D. Base Coat
E. Finish Coat
F. 2" (51 mm) Fiberglass Mesh Tape
G. ToughRock® Setting Compound*

**Sandable setting compounds are not recommended.*

Thickness	Framing Spacing	Orientation	Screw Spacing
1/2" (12.7 mm)	16" (406 mm) o.c. max	Parallel or Perpendicular	8" (203 mm) o.c. along framing
1/2" (12.7 mm)	24" (610 mm) o.c. max	Perpendicular 24" o.c. framing	8" (203 mm) o.c. along framing
5/8" (15.9 mm)	24" (610 mm) o.c. max	Parallel or Perpendicular	8" (203 mm) o.c. along framing

Method #1

Embed 2" (51 mm) wide fiberglass mesh tape in ToughRock® 90 Setting Type joint compound, or equivalent, over all joints. Once dry, apply a skim coat of ToughRock 90 setting compound, or equivalent, over the panels to achieve a uniform, smooth finish over the entire area. Prime with exterior-grade primer and finish with two coats of exterior-grade paint.

Method #2

Apply a synthetic-type Direct Applied Finish System in accordance with the coating manufacturer's recommendation.

Special Conditions:

1. Control joints are recommended a maximum of 30 feet (9144 mm) or closer as specified by the design authority.
2. The roof must be dried in or protection from the elements must be provided prior to installing DensGlass Sheathing in horizontal applications to prevent moisture from ponding or settling on top of the sheathing panel or within the finished soffit.
3. Sandable setting compounds are not acceptable for use over DensGlass Sheathing in exterior soffit applications.
4. Georgia-Pacific Gypsum's ToughRock 90 setting compound is not available in all markets. It is permissible to use setting-type joint compounds from other manufacturers that are equivalent to ToughRock 90 setting compound.

Soffit Board Comparison

Product Comparison	5/8" (12.7 mm) DensGlass®	1/2" (12.7 mm) Gypsum Soffit Board (Paper-faced)	5/8" (15.9 mm) DensGlass Sheathing	5/8" (15.9 mm) Gypsum Soffit Board (Paper-faced)
Humidified Deflection[1] (Sag)	2/8" (6 mm)	7/8" (22 mm)	1/8" (3 mm)	4/8" (13 mm)
Water Absorption[1]	<10%	40%	<10%	40%
Surface Water Absorption[1]	.83 grams	2.5 grams	.83 grams	2.5 grams
Surface	Fiberglass mat	Paper-faced	Fiberglass mat	Paper-faced

1. Specified values for DensGlass Sheathing are found in ASTM C 1177, ASTMC 1396 and ASTM C 931 for gypsum soffit board, tested in accordance with ASTM C 473.

Air- and Water-Resistive Barriers

The need for moisture control, greater energy savings, comfort and improved environment is driving the use of air- and water-resistive barriers. Manufacturers, building codes and standards organizations are improving the ways moisture is controlled in buildings. DensGlass® Sheathing has been widely accepted for years as the preferred substrate with these systems and provides superior performance over other sheathings. The ultimate in wall performance and peace of mind is starting with the best substrate – DensGlass Sheathing.

DensGlass Sheathing is a superior substrate for a wide variety of air and water-resistive systems which include:

- #15 asphalt felt, ASTM D 226, type 1 or equivalent
- Synthetic wraps such as Tyvek®, Typar® MetroWrap®, ASTM E 1677 or equivalent
- Liquid- or fluid-applied air or vapor barriers such as Tremco ExoAir® 120, Grace Perm-A-Barrier® VP, Henry Air-Bloc™ 32 or Carlisle Barriseal®
- Water barrier systems such as Sto Guard® as manufactured by Sto Corp., Dryvit's Backstop® NT, Prosoco R-GUARD™ or equivalent
- Asphalt-based coatings
- Self-adhering membranes such as Carlisle CCW, Grace Perm-A-Barrier®, Henry Air-Bloc Vapor Barriers, Protecto Wrap
- Water-resistive barrier and drainage membranes such as DELTA-DRY®

Follow manufacturer's installation recommendations for use with DensGlass panels, local building code requirements and design authority's specifications.

Note: It is not required to provide a water-resistive barrier over DensGlass Sheathing for the protection of the gypsum sheathing itself during the 12-month weather exposure limited warranty. Consult with local building code, design professional, owner or cladding manufacturer for water-resistive barrier requirements and compatibility with the wall cladding.

Protection of Penetrations

All penetrations should be protected to prevent air and water infiltration. Follow building code, door/window manufacturer, or design authority's recommendations for flashing around openings, abutments to dissimilar materials and wall terminations.

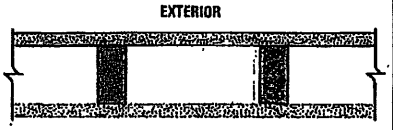
In areas that do not prescribe to current code requirements but still require long-term joint protection, either of the following two methods may be specified in lieu of an air- and water-resistive barrier system: **Method 1)** Apply minimum 3/8" (9 mm) bead of sealant to joints and trowel to provide a layer approximately 2" (51 mm) wide by 1/16" (2 mm) thick spanning the joint. Use backer rod for openings larger than 1/8" (3 mm). **Method 2)** Apply glass mesh joint tape to all joints, overlapping at intersections by the width of the tape. Apply approximately 3/8" (9 mm) bead of caulk along the joint. Embed the caulk into the entire surface of the tape with a trowel. Use backer rod for openings larger than 1/8" (3 mm). Follow manufacturer's installation recommendations for use with DensGlass Sheathing, and design authority specifications.

A variety of caulk and polymer-based "fill" materials may be specified, including GE, Dow Corning, Tremco, Sto, Dryvit, BASF and Proseco. Please contact the caulk manufacturer for its recommended caulks over DensGlass Sheathing.

Fire-Rated Assemblies (Wood-Framed)[1] continued

Design assemblies for illustrative purposes only. Consult appropriate fire resistance directory for assembly information. See Fire Safety Caution on back panel.

1-Hour Fire Rating



Test Reference: UL U305, U337, WHI 495-0702, ULC W301, GA WP 5515

Wall Thickness: 4-7/8" (124 mm)

Weight per Sq. Ft.: 7.5 (37 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing applied parallel (U337, W301, U305) or at right angles (U305) to 2 x 4 wood studs 16" (406 mm) o.c. with 1-3/4" (45 mm) galvanized roofing nails 7" (178 mm) o.c. for all framing members. Exterior surface covered with weather exposed cladding or finish system.

Interior: 5/8" (15.9 mm) DensArmor Plus® Fireguard® interior panels or 5/8" (15.9 mm) ToughRock® Fireguard® gypsum board applied parallel or at right angles to studs with 1-7/8" (48 mm) 6d coated nails 7" (178 mm) o.c. Stagger joints each side. **(Load-bearing)**

1-Hour Fire Rating

Test Reference: UL U309, cUL U309

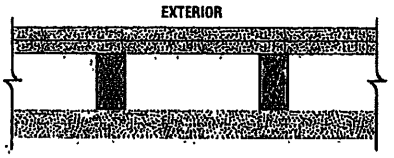
Wall Thickness: 4-7/8" (124 mm)

Weight per Sq. Ft.: 7.5 (37 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied parallel or at right angles to 2 x 4 wood studs spaced 24" (610 mm) o.c. with 1-7/8" (48 mm) galvanized roofing nails 7" (178 mm) o.c.

Interior 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board to framing with 1-7/8" (48 mm) 6d coated nails 7" (178 mm) o.c. **(Load-bearing)**

2-Hour Fire Rating



Test Reference: UL U301, cUL U301

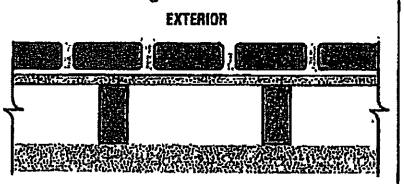
Wall Thickness: 6-1/8" (156 mm)

Weight per Sq. Ft.: 12.5 (61 kg/m²)

Exterior: Two layers 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied parallel or at right angles to 2 x 4 wood studs 16" (406 mm) o.c. Base layer attached with 1-7/8" (48 mm) galvanized roofing nails 16" (406 mm) o.c. Face layer attached with 2-3/8" (60 mm) galvanized roofing nails 8" (203 mm) o.c. Stagger joints between layers and on base layer of both sides.

Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied horizontally or vertically to framing. Base layer attached with 1-7/8" (48 mm) 6d cement coated nails 6" (152 mm) o.c. Face layer attached with 2-3/8" (60 mm) 6d cement coated nails 8" (203 mm) o.c. Stagger joints between layers and on base layer of both sides. **(Load-bearing)**

2-Hour Fire Rating



Test Reference: UL U302, cUL U302, GA WP 8410

Wall Thickness: 10-1/8" (257 mm)

Exterior: One layer 1/2" (12.7 mm) DensGlass Sheathing applied parallel or at right angles to studs with 1-3/4" (45 mm) galvanized roofing nails 6" (152 mm) o.c. Face layer is 2" x 4" x 8" (51 mm x 102 mm x 203 mm) clay brick with 1" (25 mm) air space between brick and exterior sheathing. 20-gauge (30 mils) galvanized wire ties attached to each stud with 8d coated nails as described above, located at every sixth course of bricks. **(Load-bearing)**

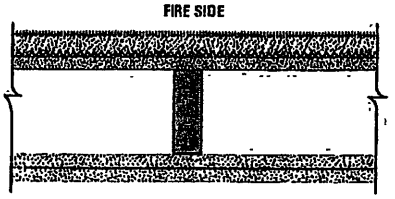
Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied parallel or at right angles to 2 x 4 wood studs 16" (406 mm) o.c. Base layer attached with 1-7/8" (48 mm) 6d coated nails 8" (203 mm) o.c. Face layer attached with 2-3/8" (60 mm) coated nails 8" (203 mm) o.c.

[1] *Load restricted for Canadian applications—see UL Guide BXUV7.*

Fire-Rated Assemblies (Wood-Framed)[1] continued

2-Hour Fire Rating

FIRE SIDE



Test Reference. UC 12-21-67, GA WP 8420

Wall Thickness: 8-5/8" (219 mm)

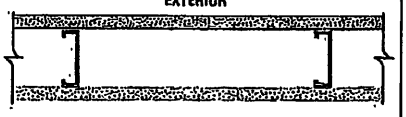
Exterior: Base layer 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing retardant treated 2 x 6 wood studs 16" (406 mm) o.c. with 6d coated nails, 1-7/8" (48 mm) long, 0.0915" (2 mm) shank, 1/4" (6 mm) heads, 12" (305 mm) o.c. and covered with a single layer fire resistant protective weather retarder paper stapled along each edge at 16" (406 mm) o.c. Galvanized self-furring wire mesh applied over sheathing with 8d galvanized roofing nails, 2-3/8" (60 mm) long, 0.113" (3 mm) shank, 9/32" (7 mm) heads, 6" (152 mm) o.c. Cement-stucco applied over wire mesh in two 1/2" (12.7 mm) thick coats with bonding agent applied between coats.

Interior: Base layer 5/8" (15 9 mm) DensArmor Plus® Fireguard® or 5/8" (15 9 mm) ToughRock® Fireguard® applied parallel to studs with 6d coated nails, 1-7/8" (48 mm) long, 0.0915" (2 mm) shank, 1/4" (6 mm) heads, 12" (305 mm) o.c. Face layer 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard applied at right angles to studs with 8d coated nails, 2-3/8" (60 mm) long, 0.113" (3 mm) shank, 9/32" (7 mm) heads, 8" (203 mm) o.c. at edges and 12" (305 mm) o.c. at intermediate studs. **(Load-bearing)**

Fire-Rated Assemblies (Steel-Framed)

1-Hour Fire Rating

EXTERIOR



Test Reference: UL U465, ULC W415, cUL U465, GA WP 1081

Wall Thickness: 4-7/8" (124 mm)

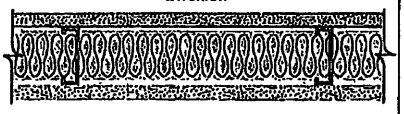
Weight per Sq. Ft.: 6 psf (29 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to min. 3-5/8" (92 mm) corrosion resistant 25-gauge (18 mils) steel studs 24" (610 mm) o.c. with 1" (25 mm) corrosion resistant bugle head screws 8" (203 mm) o.c. at board edges and 8" (203 mm) at intermediate studs.

Interior: 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing with 1" (25 mm) Type S bugle head screws 8" (203 mm) o.c. at board edges and 12" (305 mm) at intermediate studs.

1-Hour Fire Rating

EXTERIOR



Test Reference: UL U425,[1] cUL U425

Wall Thickness: 4-3/4" (121 mm)

Weight per Sq. Ft.: 6 psf (29 kg/m²)

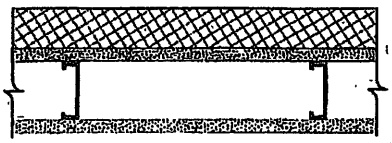
Exterior: 5/8" (15.9 mm) DensGlass® Sheathing applied vertically to min. 3-1/2" (89 mm) corrosion resistant 20-gauge (30 mils) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S corrosion resistant bugle head screws 8" (203 mm) o.c.

Interior: 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing with 1" (25 mm) Type S bugle head screws 12"(305 mm) o.c. Insulation to completely fill stud cavity. **(Load-bearing: 100% of design load)**

[1]Load restricted for Canadian applications—see UL Guide BXUV7.

Fire-Rated Assemblies (Steel-Framed) continued

1-Hour Fire Rating



Test Reference: SWRI 01-4409-003, GA WP 8122

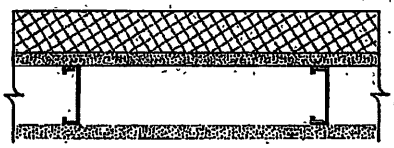
Partition Thickness: 6" – 7" (152 – 178 mm) Varies based on insulation thickness

Weight per Sq. Ft.: 7.0 (34 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing applied parallel to 3-5/8" (92 mm) 18-gauge (43 mils) steel studs 16" (406 mm) o.c. with #6 x 1-1/4" (32 mm) self-drilling, corrosion-resistant, bugle head, drywall screws 8" (203 mm) o.c. at edges and ends and 8" (203 mm) o.c. at intermediate studs. Proprietary polymer modified exterior insulation and finish system applied over sheathing. 2" (51 mm) maximum foam-plastic thickness..

Interior: 5/8" (15.9 mm) ToughRock® Fireguard® or 5/8" (15.9 mm) DensArmor Plus® Fireguard® gypsum board applied parallel to studs with #6 x 1-1/4" (32 mm) self-drilling, bugle head drywall screws 8" (203 mm) o.c. at edges and ends and 12" (305 mm) o.c. at intermediate studs.

1-Hour Fire Rating



Test Reference: SWRI 01-4409-001, GA WP 8123

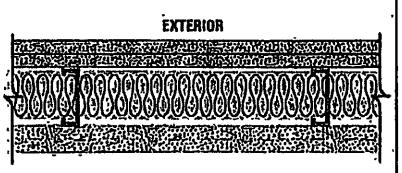
Partition Thickness: 6" – 9" (152 – 229 mm) Varies based on insulation thickness

Weight per Sq. Ft.: 7.0 (34 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied parallel to 3-5/8" (92 mm) 18-gauge (43 mils) steel studs 24" (610 mm) o.c. with #6 x 1-1/4" (32 mm) self-drilling, corrosion-resistant, bugle head, drywall screws 8" (203 mm) o.c. at edges and ends and 8" (203 mm) o.c. at intermediate studs. Polymer-based exterior insulation and finish system applied over sheathing. 4" (102 mm) maximum foam-on-plastic thickness.

Interior: One layer 5/8" (15.9 mm) ToughRock Fireguard or 5/8" (15.9 mm) DensArmor Plus Fireguard gypsum board applied parallel to studs with #6 x 1-1/4" (32 mm) self-drilling, bugle head drywall screws 8" (203 mm) o.c. at edges and ends and 12" (305 mm) o.c. at intermediate studs.

2-Hour Fire Rating



Test Reference: UL U425[1], cUL U425

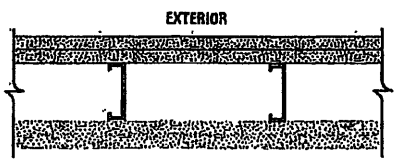
Wall Thickness. 6" (152 mm)

Weight per Sq. Ft.: 11.0 psf (54 kg/m²)

Exterior: Two layers 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to min. 3-1/2" (89 mm) corrosion resistant 20-gauge (30 mils) steel studs 24" (610 mm) o.c. Base layer attached with 1" (25 mm) Type S-12 corrosion resistant bugle head screws 8" (203 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S-12 corrosion resistant bugle head screws spaced 8" (203 mm) o.c. Joints staggered.

Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing. Base layer attached with 1" (25 mm) Type S-12 bugle head screws 12" (305 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S-12 bugle head screws spaced 12" (305 mm) o.c. Joints staggered. Insulation to completely fill stud cavity. **(Load-bearing: 80% of design load)**

2-Hour Fire Rating



Test Reference: UL U411, cUL U411

Wall Thickness: 5" (127 mm)

Weight per Sq. Ft.: 11.0 (54 kg/m²)

Exterior: Two layers 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to min. 2-1/2" (64 mm) corrosion resistant 25-gauge (18 mils) steel studs 24" (610 mm) o.c. Base layer attached with 1" (25 mm) Type S corrosion resistant bugle head screws 16" (406 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S corrosion resistant bugle head screws spaced 8" (203 mm) o.c. Joints staggered.

Interior. Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing. Base layer attached with 1" (25 mm) Type S bugle head screws 16" (406 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S bugle head screws spaced 16" (406 mm) o.c. in the field and along vertical edges and 12" (305 mm) o.c. to the floor and ceiling runners. Joints staggered. Batt or blanket insulation optional.

[1]Load restricted for Canadian applications—see UL Guide BXUV7.

Architectural Specifications

Part 1 – General

1.0 Description

Work in this section includes, but is not limited to: wall, ceiling and soffit sheathing.

Related work specified elsewhere:

Brick masonry	Finish carpentry	Joint sealers
Stone	Exterior Insulation and Finish Systems (EIFS)	Light-gauge metal framing
Cold-formed metal framing	Siding	Painting
Rough carpentry		

1.1 Submittals

Product Data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.

1.2 Quality Assurance

Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.3 Delivery, Storage and Handling

Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible. Product also may be wrapped in temporary factory-applied plastic packaging (plastic wrap) that **must** be removed upon receipt. Reference GA801 for storage information. **Failure to remove the plastic shipping covers and plastic wrap may result in entrapment of condensation or moisture, which may cause application problems.**

Storage and handling: Store flat on a level surface and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

Part 2 – Products

2.0 Sheathing Board

Acceptable Products: 1/2" (12.7 mm) DensGlass® Sheathing; 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing

Size: DensGlass Sheathing: 1/2" (12.7mm) thick by 4' (1219 mm) by 8' (2438 mm), 9' (2743 mm) or 10' (3048 mm) (1.9 lb. per square foot) (9.3 kg/m²); DensGlass Fireguard Sheathing: 5/8" (15.9mm) thick x 4' (1219 mm) x 8' (2438 mm), 9' (2743 mm) or 10' (3048 mm) (2.5 lb. per square foot) (12 kg/m²).

Composition: Gypsum sheathing manufactured in accordance with ASTM C 1177 with fiberglass mats both sides and long edges, water-resistant treated core.

Fire resistance: Noncombustible as described and tested in accordance with ASTM E 136 and CAN/ULC-S114.

1/2" or 5/8" (12.7 mm or 15.9 mm) DensGlass Sheathing: Flame spread 10, when tested in accordance with ASTM E 84 and CAN/ULC S-102. 5/8" (15.9 mm) DensGlass Fireguard Sheathing is rated Type X as defined in ASTM C 1177 and can be used as a replacement to any other generic assembly utilizing a 5/8" (15.9 mm) Type X gypsum board (see GA-600 for numeric assemblies). DensGlass Fireguard Sheathing is UL classified, Type DGG, in UL designs G501, G520, G531, L501, L508, L532, L556, L591, N501, N502, N505, N602, P225, P227, P230, P235, P254, P259, P266, P302, P516, P517, P701, P710, P711, P713, P714, P717, P718, P719, P720, P722, P725, P728, P729, P730, P731, P732, P733, P734, P735, P738, P739, P740, P741, P742, P801, P811, P815, P819, P824, P825, P826, P827, P828, S728, S736, U017, U032, U040, U204, U207, U301, U302, U305, U309, U326, U329, U330, U332, U337, U338, U339, U341, U342, U351, U354, U355, U356, U357, U358, U360, U364, U369, U379, U411, U418, U420, U425, U434, U436, U439, U442, U449, U450, U460, U465, U467, U473, U475, U487, U494, U495, U502, U504, U505, U506, U510, U512, U531, U603, U617, U623, U626, U633, U640, U646, U647, U648, U649, U651, U652, U926, V415, V417, V419, V420, V421, V430, V432, V434, V435, V450, V473, V486, V487, V490, X508, X516, X517, X525, X526, X527, X528, X535, X602, X604 and ULC classified, Type DGG in ULC designs: EW10, EW17, U301, U302, W301, W404, W415, W442 and W465. DensGlass Fireguard Sheathing can be used in UL assemblies where the gypsum board is listed as *Gypsum Board (Classified or Unclassified)* for thicknesses up to 5/8" (15.9 mm).

2.1 Air- and Water-Resistive Barrier

If required by local building code, #15, nonperforated, asphalt saturated felt complying with ASTM D 226, Type 1, synthetic building wraps complying with ASTM E 1677, or other water-resistive barrier system meeting local building code requirements.

2.2 Accessories

Joint tape: 2" (51 mm) wide fiberglass mesh tape, see 3.2.A.

Joint compound: ToughRock® setting-type joint compound, see 3.2.A.

Nails, wood framing: 11-gauge galvanized roofing nails, 1-1/2" (38 mm) min. length for 1/2" (12.7 mm) DensGlass® Sheathing and 1-3/4" (45 mm) length for 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing.

Screws, metal framing: Bugle or wafer head, self-tapping, rust-resistant, fine thread for heavy-steel gauge. Bugle or wafer head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

Screws, wood framing: Rust-resistant, bugle or wafer head, coarse thread, 1-1/4" (32 mm) length sharp point for wood.

Part 3 – Execution

3.0 Preparation

Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than 1/8" (3 mm) from the placement of faces of adjacent members.

3.1 Sheathing

Provide DensGlass Sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.

Install DensGlass Sheathing with GOLD side out.

Use maximum lengths possible to minimize number of joints.

Attach DensGlass Sheathing to wood framing with nails spaced 4" (102 mm) o.c. at perimeter for racking shear resistance; 8" (203 mm) o.c. at perimeter where there are framing supports and where racking shear resistance is not required; and 8" (203 mm) o.c. along intermediate framing in field for both conditions. Unless specified otherwise, attach DensGlass Sheathing to metal framing with screws spaced 8" (203 mm) o.c. at perimeter where there are framing supports; and 8" (203 mm) o.c. along intermediate framing in field. A greater number of fasteners may be specified to obtain specific values.

Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink. Locate fasteners minimum 3/8" (10 mm) from edges and ends of sheathing panels, tight against and flush with surface of sheathing.

Water-Resistive Barrier: If a water-resistive barrier is required by the local building code, design professional, owner or cladding manufacturer over DensGlass Sheathing, one of the following procedures may be used. Consult building code or design authority for proper application selection. Follow manufacturer's installation recommendations.

A. Entire exterior face of gypsum sheathing covered with an asphalt impregnated felt or synthetic fiber wrap such as Tyvek® Commercial Wrap, or equal.

B. Liquid applied barriers such as Sto Guard® as manufactured by Sto Corp., Dryvit's Backstop® NT, Prosoco R-GUARD™, or equal.

C. Self adhering membranes.

3.2 Painted Ceilings and Soffits

Soffits must be dried in and protected from the elements during and after installation.

A. Apply fiberglass mesh joint tape over joints and embed in setting-type joint compound specified. Skim coat surface with setting-type joint compound for smooth finish. Prime and paint with exterior grade, high quality paint.

B. Apply EIFS with or without insulation; install as recommended by manufacturer.

Limitations

DensGlass® Sheathing is resistant to normal weather conditions, but it is not intended for immersion in water. Cascading roof/floor water should be directed away from the sheathing until appropriate drainage is installed.

Avoid any condition that will create moisture in the air and condensation on the exterior walls during periods when the exterior temperature is lower than the interior. The use of forced air heaters creates volumes of water vapor which, when not properly vented, can condense on building materials. The use of these heaters and any resulting damage is not the responsibility of Georgia-Pacific Gypsum. Consult heater manufacturer for proper use and ventilation. Vapor barrier may also restrict ventilation.

When DensGlass Sheathing panels are used in slanted wall applications, that portion of the wall must be temporarily protected from the elements by the use of a water-resistant barrier prior to application of the cladding. Do not allow water to pond or settle on sheathing. Also, exposed wall ends such as those that may be found in parapets must be covered to prevent water from infiltrating the cavity.

Georgia-Pacific Gypsum does not warrant and is not responsible or liable for the performance of the cladding or exterior systems applied over DensGlass Sheathing. The suitability and compatibility of any system is the responsibility of the system manufacturer or design authority.

Do not laminate DensGlass Sheathing to masonry surfaces; use furring strips or framing.

DensGlass Sheathing is not intended for roof applications. For roof applications, consult our DensDeck® Roof Board brochure.

DensGlass Sheathing is not intended for interior or exterior tile applications. For interior tile applications, consult our DensShield® Tile Backer brochure.

DensGlass Sheathing should not be used in lieu of plywood where required.

Do not apply DensGlass Sheathing below grade.

For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed. Openings and penetrations must be properly flashed and sealed. Failure to do so will void the warranty.

Do not use DensGlass Sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.

COMMONLY USED METRIC CONVERSIONS

Gypsum Board Thickness
- 1/4 in. – 6 mm
- 1/2 in. – 12.7 mm
- 5/8 in. – 15.9 mm
- 1 in. – 25.4 mm

Gypsum Board Width
- 2 ft. – 610 mm
- 4 ft. – 1219 mm
- 32 in. – 813 mm

Gypsum Board Length
- 4 ft. – 1219 mm
- 5 ft. – 1524 mm
- 8 ft. – 2438 mm
- 9 ft. – 2743 mm
- 10 ft. – 3048 mm
- 12 ft. – 3658 mm

Framing Spacing
- 16 in. – 406 mm
- 24 in. – 610 mm

Fastener Spacing
- 2 in. – 51 mm
- 2.5 in. – 64 mm
- 7 in. – 178 mm
- 8 in. – 203 mm
- 12 in. – 305 mm
- 16 in. – 406 mm
- 24 in. – 610 mm

Temperature
- 40°F – 5°C
- 50°F – 10°C
- 125°F – 52°C

The Dens® Brand of High-Performance Gypsum Products from Georgia-Pacific

DensGlass® Sheathing	The original and universal standard of exterior gypsum sheathing offers superior weather resistance, with a 12-month weather exposure limited warranty. Look for the familiar GOLD color.
DensShield® Tile Backer	Acrylic-coated tile backer stops moisture at the surface. Lightweight and strong, built for speed on the job site. IBC/IRC Code Compliant. GREENGUARD listed for microbial resistance.
DensDeck® Roof Boards	Fiberglass mat roof board used as the ideal thermal barrier and cover board to improve resistance to wind uplift, hail, foot traffic, fire, moisture and mold in a broad range of commercial roofing applications. Look for green DensDeck Prime and DensDeck DuraGuard, too.
DensGlass® Shaftliner	Specially-designed panels for moisture-prone vertical or horizontal shafts, interior stairwells and area separation wall assemblies. 12-month weather exposure limited warranty. GREENGUARD listed for microbial resistance.
DensArmor Plus® High-Performance Interior Panel	High-performance interior panel accelerates scheduling because it can be installed before the building is dried-in. 12-month weather exposure limited warranty. GREENGUARD Indoor Air Quality Certified,® GREENGUARD Children & Schools℠ Certified and CHPS™ listed for low emissions. GREENGUARD listed for microbial resistance.
DensArmor Plus® Abuse-Resistant Interior Panel	Same benefits as DensArmor Plus® High-Performance Interior Panel with added resistance to scuffs, abrasions and surface indentations. Ideal for healthcare facilities and schools. GREENGUARD Indoor Air Quality Certified,® GREENGUARD Children & Schools℠ Certified and CHPS™ listed for low emissions. GREENGUARD listed for microbial resistance.
DensArmor Plus® Impact-Resistant Interior Panel	Even greater durability with an embedded impact-resistant mesh for the ultimate resistance in high traffic areas. Ideal for healthcare facilities, schools and correctional institutions. GREENGUARD Indoor Air Quality Certified,® GREENGUARD Children & Schools℠ Certified and CHPS™ listed for low emissions. GREENGUARD listed for microbial resistance.

Georgia-Pacific
Gypsum

U.S.A. Georgia-Pacific Gypsum LLC
CANADA Georgia-Pacific Canada, ULC

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FIRE SAFETY CAUTION – Passing a fire test in a controlled laboratory setting and/or certifying or labeling a product as having a one-hour, two-hour, or any other fire resistance or protection rating and, therefore, as acceptable for use in certain fire rated assemblies/systems, does not mean that either a particular assembly/system incorporating the product, or any given piece of the product itself, will necessarily provide one-hour fire resistance, two-hour fire resistance, or any other specified fire resistance or protection in an actual fire. In the event of an actual fire, you should immediately take any and all actions necessary for your safety and the safety of others without regard for any fire rating of any product or assembly/system.

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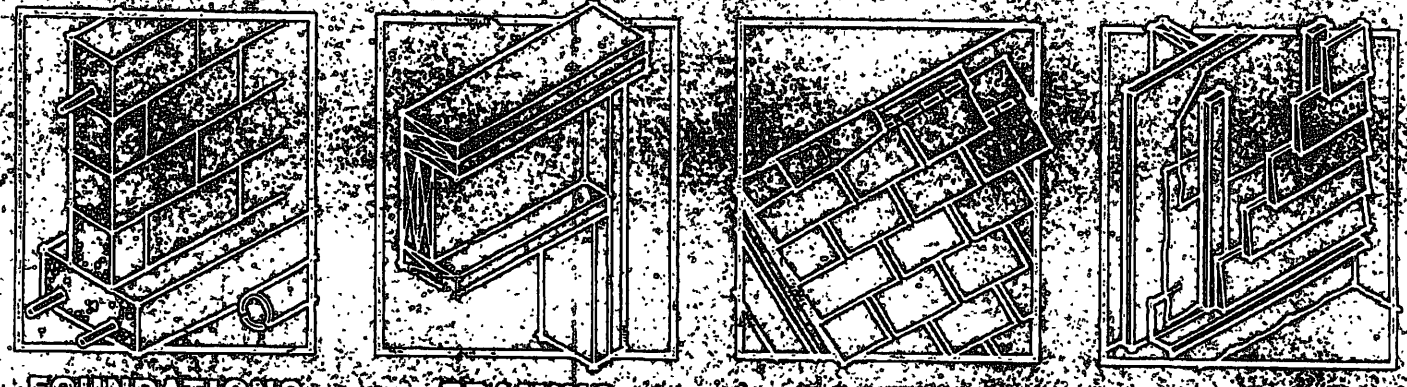
Volume 1

JLC FIELD GUIDE

TO RESIDENTIAL CONSTRUCTION

A Manual of Best Practice



FOUNDATIONS FRAMING ROOFING EXTERIORS

A JOURNAL OF LIGHT CONSTRUCTION BOOK

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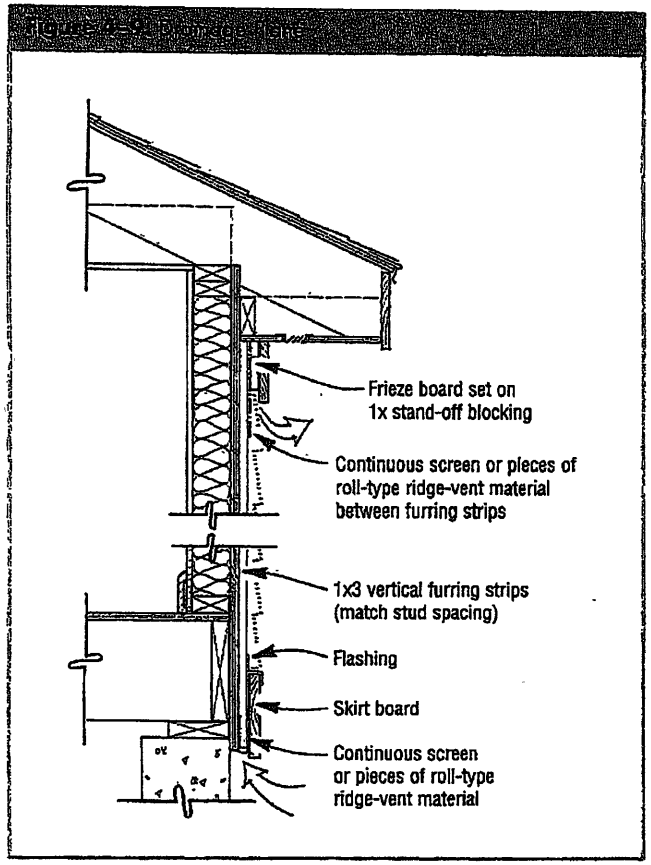


Siding that is pressed up tight against sheathing (even with felt or plastic housewrap) will retain moisture, causing the siding and finish to fail prematurely and water to move into walls. All siding should be installed over battens that create an air space behind the siding so water can drain down and out.

For more information: "Water-Managed Wall Systems," JLC 2/95

03064 "Making Walls Watertight," JLC 12/95

ALL SIDINGS WILL LEAK. MOST WATER THAT LEAKS BEHIND THE siding is driven by rain or wicks into small cracks. Caulks and sealants are not an answer to stopping water penetration. Instead, all siding materials should be applied over a drainage plane (also called a rain screen) to allow water to fall down and out. This drainage plane is created by first applying sheathing wrap and flashings — lapped to shed water — and then by creating an air space and weep holes so water can drain away from the building (Figure 4-9).

SHEATHING WRAP MATERIALS

Sheathing wraps that work well include asphalt-saturated felt and plastic housewraps.

Type D kraft paper (a lighter black paper than asphalt felt), sisal kraft paper (asphalt sandwiched between two layers of kraft paper), and cross-laminated plastic housewraps all perform poorly in rainy and snowy climates. However, two layers of Type D paper work well beneath stucco in most climates (see "Stucco Drainage Plane," page 346).

All sheathing wrap must be integrated with flashing materials. It's not enough to wrap a house, and then to simply X-cut the openings and fold the flaps inside. Follow the guidelines in Figure 4-10 when installing any sheathing wrap.

Asphalt-Saturated Felt

Commonly available in two weights, asphalt felt, or "black paper," is made from recycled corrugated papers mixed with sawdust and an asphalt resin. When it actually was made from cotton felt, 15-lb. felt weighed 15 pounds per square, and 30-lb. felt weighed 30 pounds per square. These days, asphalt felt weighs considerably less (between 6 and 12 pounds per square) and is now simply designated No. 15 and No. 30.

When choosing No. 15 felt, look for material rated ASTM D4869 or ASTM D229. The better material is rated by the more stringent ASTM D229 standard, which ensures a weight of at least 11.5 lbs. per square.

The biggest drawback to using asphalt felt as a sheathing wrap is that it's difficult to apply well on walls. Generally, wrinkles are not a problem, but tears — particularly at inside corners — should be avoided. Also, try to prevent sags between the relatively narrow (36-in.) courses.

Plastic Housewrap

Drainage Planes

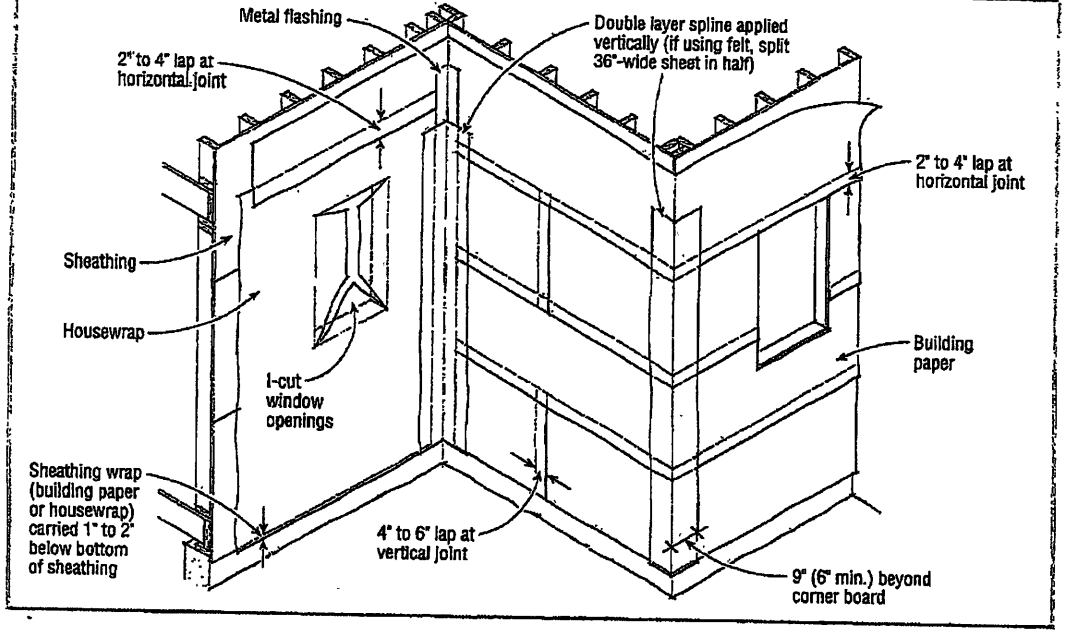
Sheathing Wrap

In cold temperatures, plastic housewraps stay more flexible than paper and felt wraps. Also, plastic housewraps resist tearing, so they are easier to apply.

Plastic housewraps typically are made of polyolefin fabric — either polyethylene or polypropylene. The primary difference in housewraps is whether or not they are perforated:

- Perforated products are made from a vapor-tight plastic, and then needle-punched to allow the wrap to "breathe"

Figure 1 — Lap Sheathing Wrap Below



All sheathing wraps must be applied from the bottom to the top, so upper courses lap over lower courses and shed water away from the house. Always carry the sheet around corners, then reinforce the barrier at the corner by applying a second layer, or spline. This spline should extend at least 6 in. beyond the joint between the siding and corner boards.

(allow vapor to pass through). Unfortunately, these holes also allow liquid water to seep through, particularly when the siding is pressed tight against it. The housewrap will slow the seepage but will not block it entirely.

- Non-perforated housewraps are made from a plastic fiber that allows vapor to pass between the fibers. These generally perform much better than perforated products at resisting liquid water, which should be considered their primary task. Relatively few houses suffer from water vapor penetrating from outside, but many suffer from rain and snow infiltration.

Leaching

Housewraps are susceptible to damage from extractives that can leach from wood siding materials, particularly cedar and redwood. This can be prevented in two ways:

- Install siding on battens to create an air gap, which reduces contact between the sheathing wrap and siding (Figure 4-9, page 296).
- Back-prime all wood siding materials. This reduces leaching and blocks moisture from moving through the siding and blistering the finish (see "Finishes," pages 373-380).

INSTALLING SHEATHING WRAP

For more information: "Choosing a Sheathing Wrap," JLC xxxx

"Wrapping the House," JLC 3/00

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The primary purpose of housewrap is to stop water, not air. Air-sealing and vapor control are secondary. See Figure 4-10, previous page, for details about how to lap sheathing wrap to shed water.

- Use sheathing wrap or felt paper on all houses, no matter what kind of siding is used.
- The wrap should be continuous; avoid a patchwork of small pieces. Review flashing details (pages 302-306), as some flashings (such as those around electrical fixtures, mechanical penetrations, etc.) should be installed concurrent with sheathing wrap.
- Lap upper courses of housewrap over lower courses 4 in. and lap vertical seams 12 in. Code requires a horizontal lap of only 2 in. and a vertical lap of 6 in., but water may still back up beyond these minimal overlaps.
- Do not X-cut sheathing wrap at openings. Instead, I-cut the sheathing wrap, running the knife along the rough opening at the head and sill, and then slitting vertically in the center of the opening (see Figure 4-10, previous page).
- If the walls are wrapped while they are lying on the deck before standing them up, be sure to add a course of sheathing wrap to cover the rim joist. Remember, this course must lap under the sheathing wrap above it.
- Always wrap gable ends. This part of a house sees a lot of exposure to wind-driven water, but often is neglected when contractors assume that the sheathing wrap is meant to stop air.
- Add a second layer of sheathing wrap along inside and outside house corners, lapping at least 9 in. (an even multiple of 36-in.-wide asphalt felt) on each wall.
- Control splashback by sloping the grade around the house and keeping siding at least 8 in. above grade. At decks and stoops where splashback may be a problem, use a wide peel-and-stick flashing membrane (see "Flexible Flashing Materials," opposite page). Make sure this membrane laps under the sheathing wrap above it.
- All flashing (for windows, doors, deck ledgers, electrical fixtures, vents, pipes, and cantilevered beams) must lap

under the sheathing wrap above it. Do not rely on tape to seal the flashing.

To Tape or Not

Manufacturers of plastic housewrap recommend taping all seams to block air leakage through walls. However, typical plywood and OSB sheathing are impermeable to air, so there is no need to tape all the seams.

Some tape is useful for stopping water leaks by repairing rips (particularly tears around staples) and for securing the wrap to flashing before the siding is in place. For best results, use a polypropylene tape intended for sheathing wrap or a flexible, peel-and-stick flashing. A high-quality polyurethane rubber caulk may also be used to seal plastic housewrap (see "Caulks and Sealants," page 371).

Do not patch over housewrap and rely on the stickiness of tape to seal the patch. Always lap housewrap and flashings under the piece of sheathing wrap above.

FLEXIBLE FLASHING MATERIALS

Flexible flashing — a self-adhering bituminous tape — should be used to flash all the following: exterior door sills; deck ledgers; inside and outside corners of wall sheathing; stucco shelves and parapets; below-grade concrete cracks; and wall areas subject to splashback.

Flexible flashings come in several varieties, including "peel-and-stick" products, as well as non-stick products.

RUBBERIZED-ASPHALT FLASHINGS

Self-adhesive, rubberized asphalt flashings are made from the same materials as the eaves membranes used to prevent ice dam leaks. Typically available in rolls from 4- to 12-in. wide (but sometimes available up to 36 in. wide), these flexible flashings can be applied directly to the sheathing, as long as the surface is warm and relatively clean.

Flexible Flashing

Thickness varies from 25- to 60-mils. The thinner the material, the easier it can be folded and tucked beneath siding, but also the easier it will tear and degrade in sunlight.

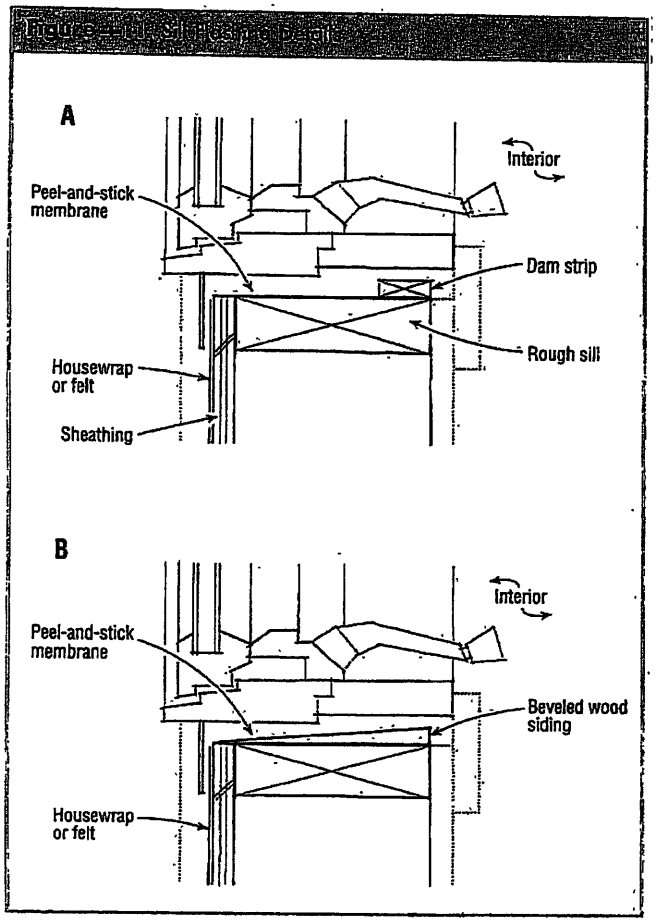
Climate Cautions

- **In warm temperatures,** when rubberized asphalt is the stickiest, it is nearly impossible to reposition it once the flashing has touched the surface. Make sure to dry-fit before pulling the release paper. It is also very difficult to handle alone when it is this sticky.
- **In hot temperatures,** rubberized asphalt tends to ooze, making it messy to handle. In sunbelt areas (or wherever surface temperatures might exceed 180°F), avoid using with metal flashings; the flashings will cook and the asphalt soon dries out, usually after creating a dripping mess.
- **In cold weather,** self-adhering flashings often don't stick well. Check the manufacturer's minimum application temperature. Some stick in temperatures below 25°F, but most require surface temperatures of 40°F or greater.

Compatibility

The solvents in rubberized asphalt will stain rolled vinyl flashing — the flexible coiled trim stock — but generally will not hurt the more rigid vinyls used for window fins and siding.

Do not use rubberized asphalt and butyl tapes together. On concrete, masonry, or OSB, rubberized-asphalt flashings may not stick well unless a primer is applied. On these surfaces, a butyl flashing works better.



Apply a narrow dam strip or bevel cant strip to the rough sill before flashing with sheathing wrap or a flexible flashing membrane.

For more information: "Choosing Flexible Flashing," JLC 6/02

"Controlling Moisture in Mixed Climates," JLC 6/98

"Avoiding Moisture Problems in Cooling Climates," JLC 03068

Poly vs. foil. Rubberized-asphalt flashings typically come with a polyethylene or foil covering to protect them from sunlight. Poly-covered products need to be covered from sunlight within 30 to 60 days; foil-covered tapes have no exact exposure limitations but eventually will dry out and become brittle in full sunlight. Once the flashing has become brittle, any shift in surface movement will pull at the bond until either the bond fails or the membrane cracks.

Exposed applications. In permanently exposed applications, use an EPDM flashing tape instead of an inexpensive flexible flashing material. The drawback with EPDM tape is that it's expensive, as well as quite thick (about 70-mil), making it awkward to fold into small areas.

BUTYL RUBBER FLASHINGS

Butyl costs about twice as much as rubberized asphalt, but concedes great results: The adhesive lasts longer and sticks over a wider range of temperatures. Butyl grabs better onto rough surfaces, such as concrete and OSB, yet the bond develops slowly, allowing for easy repositioning. Also, butyl is less likely to ooze in high temperatures or to stain a finished surface.

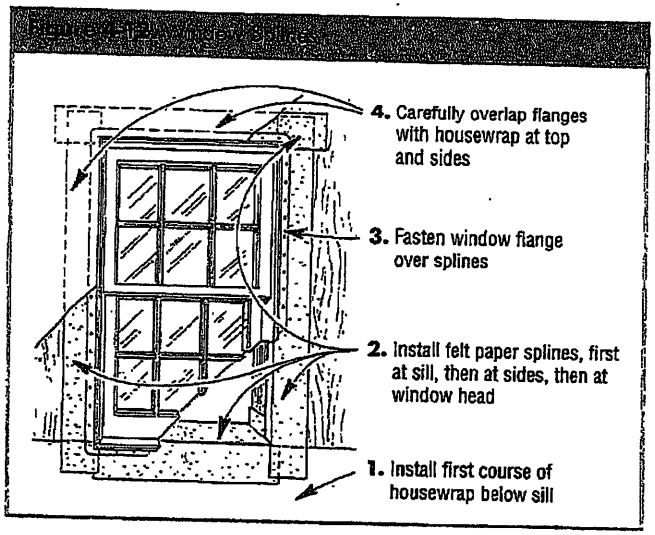
Like rubberized asphalt products, butyl flashings are available with either a polyethylene or foil surface. Poly-covered flashings should be covered within 30 days to protect from UV light. Foil does a good job at reflecting the UV light, but it still heats up in exposed sunlight. It will hold out longer, but when left exposed, foil-faced flashing eventually will degrade.

Compatibility. Do not use butyl flashing near any

asphalt-based products. The butyl and the asphalt products will both dry out faster and loose their adhesion.

NONSTICK FLASHINGS

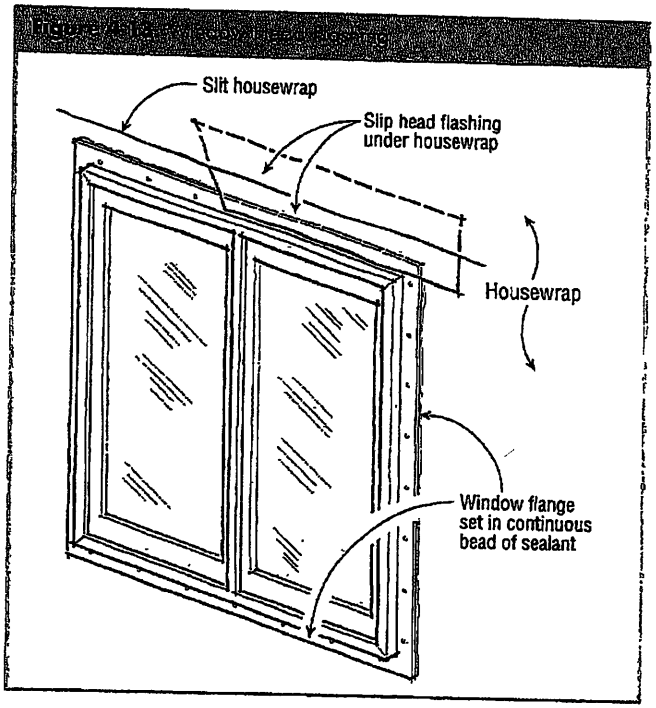
Not all flexible flashings are self-adhering. Some must be secured with staples or roofing nails. While generally thinner and the quickest to deteriorate in sunlight, these are often the best choice for applying beneath siding and trim in consistently cold temperatures, or when the surface is rough or dirty — factors that can diminish the bond of peel-and-stick flashings. Cover nonstick flashing as soon as possible to protect it from sunlight.



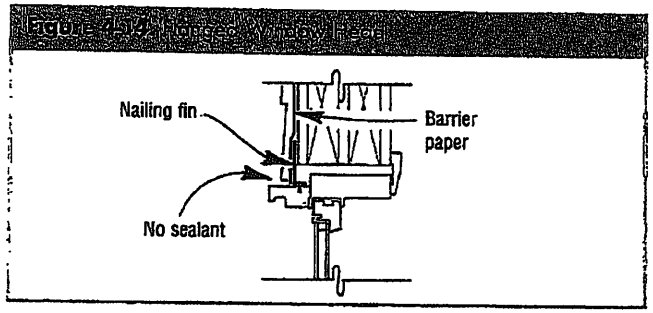
Flash windows and doors with window splines cut from felt paper or flexible flashing. Make sure the sheathing wrap laps over the splines at the top and sides. At the sill, however, the bottom end of the spline and the sill flashing should overlap the sheathing wrap.

DRAINAGE PLANE

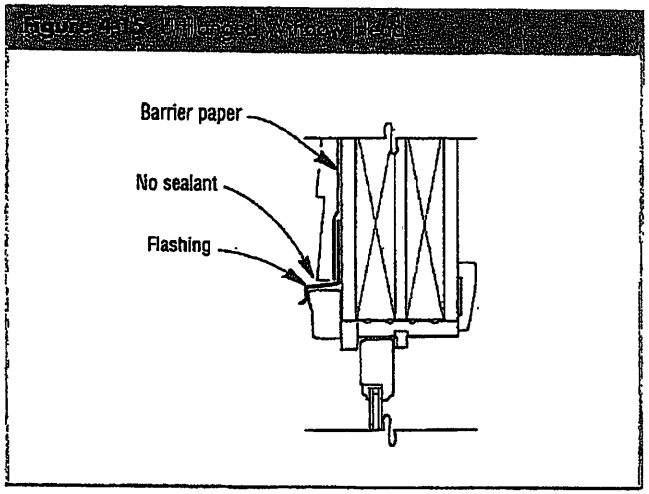
Water will always get behind siding. Wind blows in through gaps, and when the sun beats down on wet siding, it drives



If the window flange is not tucked under the sheathing when the window is installed, slit the housewrap and then slip in a piece of flexible flashing and drape it over the flange.



With flanged windows, make sure the sheathing wrap laps over the top fin. Leave a 1/4-in. gap between the siding and the flange, but don't caulk this gap. Water draining from above must have a place to exit.



With unflanged windows, install metal Z-flashing under the sheathing wrap and over the window head trim.

For more information on "Water-Managed Wall Systems," JLC 2/01

"Making Walls Watertight," JLC 12/95

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moisture inward. No siding material is impervious to water, and if the siding is pressed tight against plastic housewrap or applied over foam sheathing, the front of the siding tends to dry while the back stays wet. This stresses all types of siding: It cups boards, curls shingles, accelerates stucco cracks, and weakens mortar bonds in brick veneer. With all siding, an air space behind the siding (1/4- to 3/8-in. is enough) will allow water to drain and the backside of the siding to dry.

Well-Drained Wall Systems

Different sidings call for different drainage details. Typical details for well-draining walls are shown for different types of siding:

Board siding, Figure 4-37, page 322;

Shake and shingle siding, Figure 4-41, page 326;

Vinyl siding, Figure 4-51, page 333;

Stucco, Figure 4-66, page 346.

In each case, an air space must be created behind the siding and an exit provided for water to drain out.

FLASHING DETAILS

- Never rely on the stickiness of peel-and-stick flashings for sealing; the bond is unlikely to last over the life-span of the house.
- Always lap flashings under the sheathing wrap above.

FLASHING WINDOWS

Do not X-cut sheathing wrap at openings. Instead, I-cut the sheathing wrap, running the knife horizontally along the rough opening at the head and sill, then slitting vertically in the center of the opening (Figure 4-10, page 297). This way,

the window flange can be slipped under the sheathing wrap when installing the window.

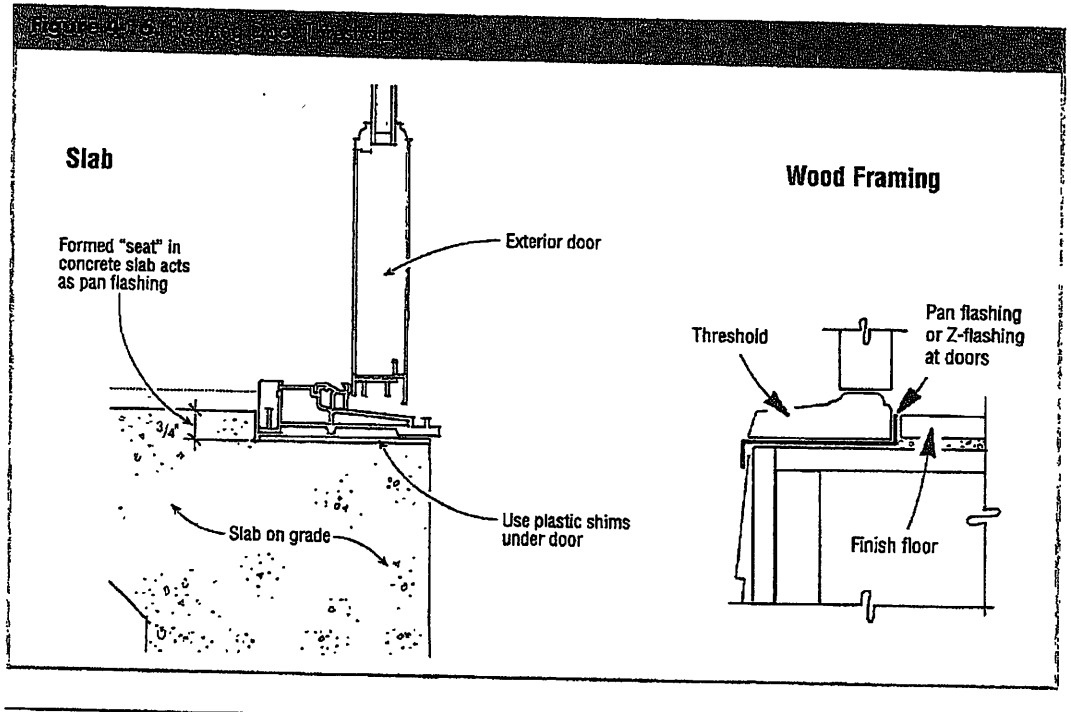
Sill details: Install a beveled cant strip or narrow dam strip to the rough opening sill, then wrap the sill with sheathing wrap or a flexible flashing membrane (Figure 4-11, page 300). Make sure this membrane drapes over the sheathing wrap below.

All sheathing wrap must be integrated with flashing materials. It's not enough to wrap a house, and then to simply X-cut the openings and fold the flaps inside. Follow the guidelines in Figure 4-10 (page 297) when installing any sheathing wrap.

Flashing Windows and Doors

Window and Door Splines

Water will leak through the gap where the siding butts the casing. Even if this joint is caulked, the sealant won't last as long as the paint job, and water will eventually work itself inside. Windows and doors should be flashed with felt paper or flexible flashing splines (Figure 4-12, page 301).



Mulled entry doors and sliders are most prone to leaks at the threshold. Provide a formed seat in the slab (far left) or a metal pan flashing to keep water off the floor.

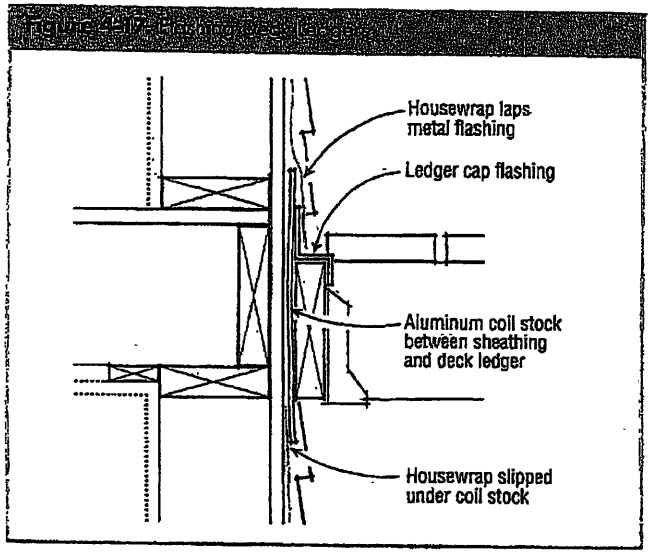
The splines should be installed after the sill flashing, and the sheathing wrap should go on afterwards or be slit so it laps over the splines.

Flanged window heads do not need additional flashing. The nailing fin will do a good job sealing the head if it can be tucked beneath the sheathing wrap when the window is installed (**Figure 4-14, page 302**). Leave a 1/4-in. gap between the siding and the window along the head, but do not caulk this gap: Otherwise, water that runs behind the siding from above won't have a place to drain.

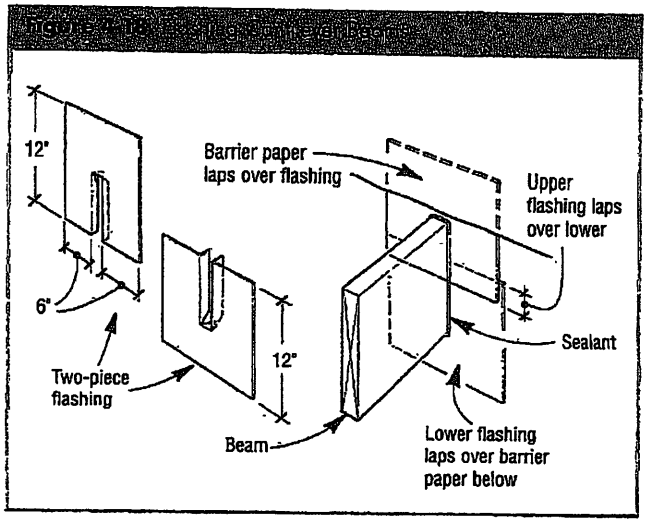
If the flange cannot be tucked under the sheathing wrap when the window is installed, slit the wrap and add a head flashing, as shown in **Figure 4-13, page 301.**

Unflanged windows will need an additional metal Z-flashing above the head casing or brick mold, as shown in **Figure 4-15, page 302.** Make sure this Z-flashing laps underneath the sheathing wrap.

Mulled windows and window walls must have a continuous head flashing; the manufacturer's mullion cover will not prevent water from running between the window units from above.



To properly flash a ledger, run the flashing behind the ledger to a drip-edge.



Protect cantilevered balcony and deck beams with a two-part flashing sealed with urethane. The top flashing piece must lap over the bottom one.

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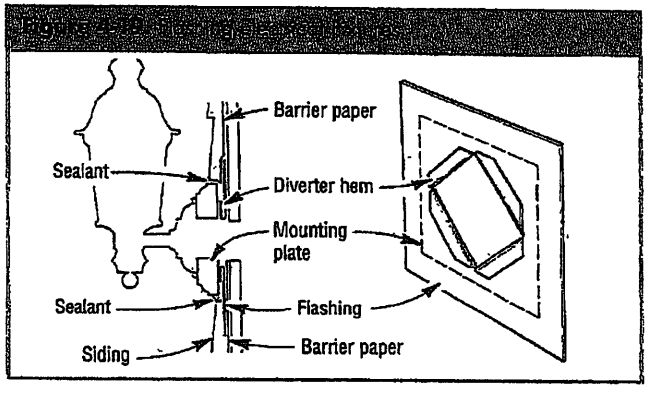
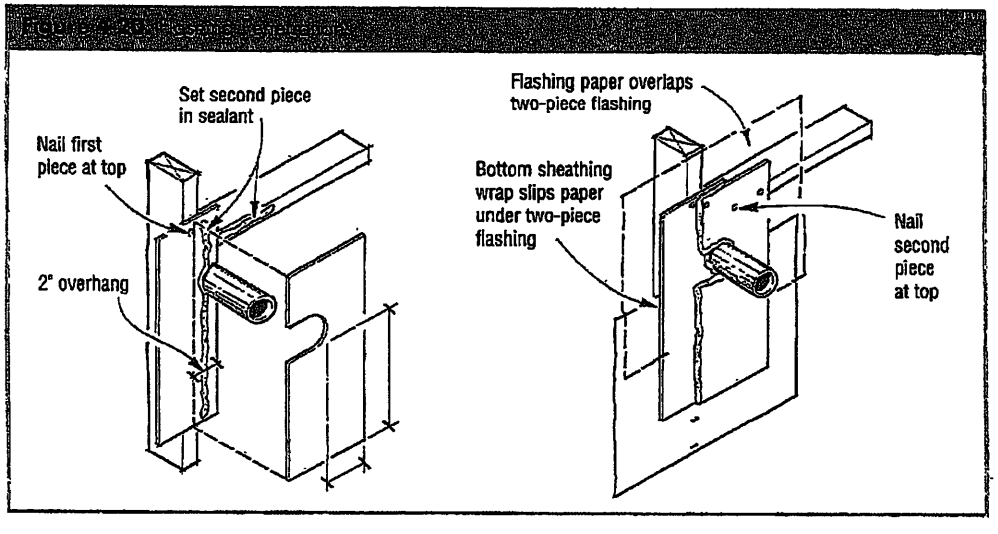
Round-top windows should be flashed with a peel-and-stick flexible flashing. Slit the sheathing wrap and slip it underneath, letting it drape over the window top. Then cut the flashing to conform to the nailing fin. Rely on proper lapping of the flashing, not on caulk.

FLASHING DOORS

Water that gets past siding and trim around doors can run along the floor, ruining finish flooring. This is a particular problem where splashback from dripping eaves and overhangs soaks the door. Over wood floors, door thresholds should be flashed with a metal pan or Z-flashing. Slabs should be formed with a "seat" to hold the threshold (Figure 4-16, page 303).



Exterior electrical boxes and fixtures can be sealed with a hemmed metal plate. Slit the sheathing wrap above the fixture and slip the plate beneath.



To seal around wall penetrations, use a two-piece metal plate bedded in urethane sealant. Sheathing wrap above the metal plate should lap over the plate while sheathing wrap below it should be slipped beneath.

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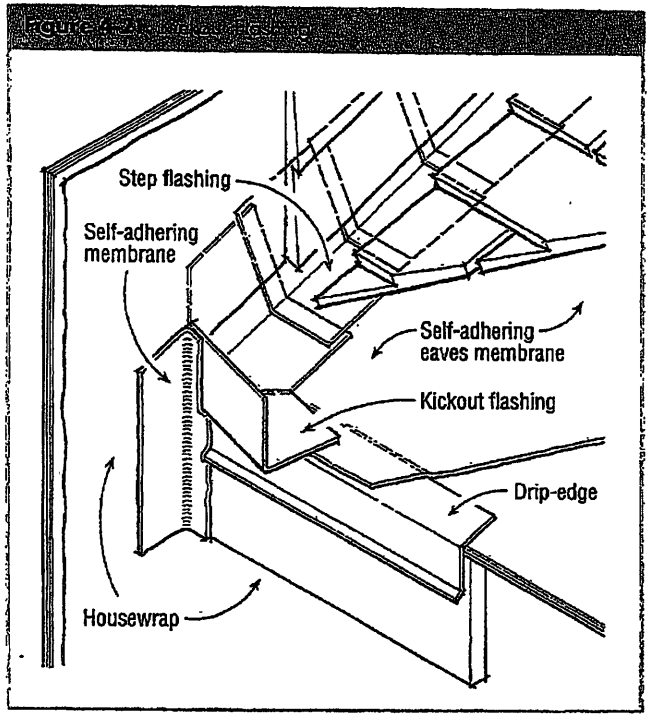
FLASHING LEDGERS AND BEAMS

Ledger flashing needs to be more than a Z-flashing running along the top edge of the ledger board. Use metal coil stock behind the ledger, as shown in Figure 4-17. Make sure the coil stock slips under the sheathing wrap above the ledger, and drapes over the sheathing wrap below the ledger.

Alternatively, build a deck completely free-standing from the wall, or insert spacers between the ledger board and the wall, so it stands out and allows water to drain freely.

Cantilevered deck or balcony joists that project through the wall framing are trouble spots. Flash with a two-piece flashing membrane, as shown in Figure 4-18.



To prevent water from dumping behind the siding at the end of a roof intersection, bend a small "kickout" from metal flashing to divert water running down the roof away from the siding.

Flashing Wall Penetrations

Electrical fixtures. Install electrical boxes and lighting fixtures on a hemmed metal flashing plate, as shown in Figure 4-19. Do not tape the plate over the sheathing wrap; slit the sheathing wrap and tuck it beneath.

Mechanical penetrations. Gas line, conduit, water spigots, and other small penetrations should be flashed with a two-piece metal flashing plate (Figure 4-20). Seal the two plates with a "low modulus" urethane caulk (see "Caulks and Sealants," page 371).

Sidewall Flashing

Because of the volume of water that can pour down a sloped roof, one of the most critical flashing details occurs where a roof intersects a sidewall. The roof should be flashed with a step flashing (see Figure 3-76, page 277). Where the roof terminates, install a kick-out to deflect water away from the siding (Figure 4-21).

Though not always possible in the schedule, it's best to install a full 36-in. piece of rubberized asphalt flashing on the wall before the subfascia and trim boards are nailed in place, and then come back to install the kickout.

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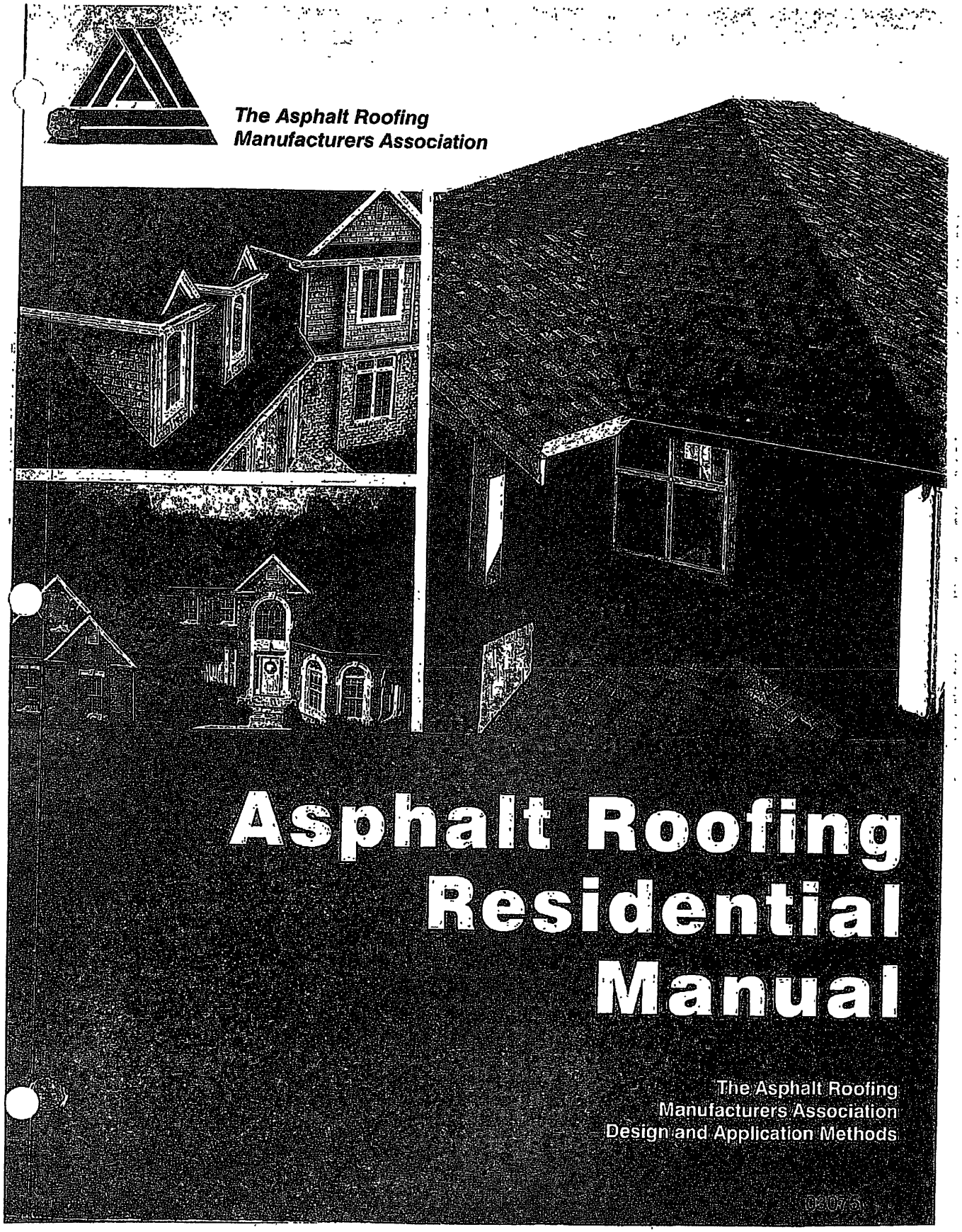
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CHAPTER 3
DESIGN CONSIDERATIONS

VENTILATION AND MOISTURE CONTROL

Proper ventilation of attic areas is an essential factor in gaining the maximum service life out of the building materials used in the roof assembly, in addition to improving heating and cooling costs. Overlooking this consideration may result in:

- Premature failure of the roofing including blistering.
- Buckling of the roofing due to deck movement.
- Rotting of wood members.
- Moisture accumulation in insulation.
- Ice dam formations in cold climates.
- Mold growth due to moisture accumulation.
- Deck distortion.

BUILDING CODE COMPLIANCE

Local building code requirements should be followed for ventilation. Ventilation requirements will be found in the building code or energy code enforced by your local building code compliance office. The ventilation requirements stated in this manual are the minimum required by shingle manufacturers. Consult your shingle manufacturer for their specific ventilation requirement in order to conform to the terms of the shingles' product warranty.

VENTILATION EFFECTS ON HEATING AND COOLING COSTS

In Northern climates, during the winter months, moisture control is a major concern. Increased insulation and tighter construction techniques help seal the side walls more effectively against air migration. At the same time, large volumes of occupancy-generated water vapor are pushed upwards toward the attic space and the much drier outside air. This can result in the blistering of shingles when proper ventilation is not followed. Vapor retarders will reduce the flow, but not stop it.

Condensation results when water vapor comes in contact with a cold surface such as the underside of a roof deck. Condensed water vapor can soak insulation and affect its performance. It can also cause mold to grow, wood roof decks and structural members to rot, plaster to crack, and paint to peel. Proper attic ventilation can remove water vapor from the attic space before condensation can occur and cause trouble.

Ice dams are formed by the cyclical thawing of snow over the warmed portions of the roof and subsequent refreezing at the cold eave. Proper ventilation can reduce the overall temperature of the roof deck, minimizing the thawing of snow and ice on the surface of the roof.

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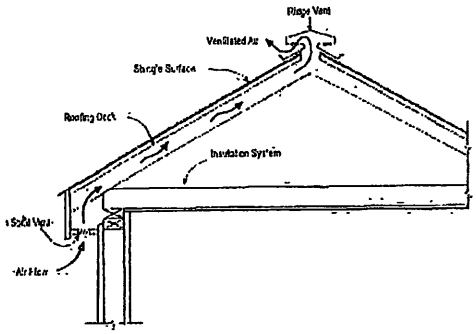

Fig 3-1 Proper Ventilation
With proper ventilation, air will circulate freely under the roof deck and carry away water vapor before it can condense. One of the best methods is a combination of continuous eaves and ridge vents that together provide uniform natural draft ventilation from the bottom to the top of the attic space. Louver and vent openings should not be covered during the winter. Eaves or soffit vents should not be blocked by insulation. Structures with bath and kitchen vents that are vented directly to the attic space should have these rerouted through the roof deck to discharge outside of the structure to remove excess water vapor.

During the summer months and in hot and humid climates, radiant heat from the sun can cause high roof deck temperatures. Gradually, the entire attic space is heated, and, in turn, the entire dwelling feels the effect of a hot roof. This heat buildup can be short-circuited by ventilating the underside of the roof deck. Research has reinforced the idea that prolonged exposure to high heat levels will accelerate aging and shorten the service life of asphalt roofing products and wood deck products. Having a properly ventilated flow-through air space between the roof deck and a radiant barrier or layers of insulation will offer relief from heat and moisture buildups.

The minimum specifications underlined in building codes of one square foot net free ventilating area for every 150 ft.^{2} of attic floor space is a good starting point for providing proper ventilation. It should be pointed out, though, that those specifications were written well before the concern for energy conservation and the subsequent trend towards tighter house construction and may not be sufficient for every structure. The manufacturers of asphalt shingles, ventilating systems and vapor retarders should be consulted for proper use of their products.

VENTILATION HINTS AND PRACTICES

[Note]
Do not vent exhaust air directly into roof cavity or attic.

1. Minimum net free ventilation area, that is, the area permitting unrestricted airflow, of 1 ft.^{2} for each 150 ft.^{2} of attic floor space is recommended. When vents are located at eaves or soffits and near the roof's peak or along the ridge for maximum net airflow, the net free vent area may be reduced (minimum 1 ft.^{2} for each 300 ft.^{2}). For a balanced system, ventilation should be equal at the undereave and at or near the ridgeline. In cases where a balanced system cannot be achieved, always provide more than 50% of the total required ventilation at the undereave and the remainder at the upper portion of the roof. Wire screening can reduce ventilation by half so allow for this during design.

2. Vent exhaust air from kitchens and bathrooms to the outdoors with vent pipes that run through the roof cavity or attic to roof exhaust vents.

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3. Provide for free airflow between framing and/or under roof sheathing at eaves to insure that ceiling or roof insulation does not block ventilation paths. For vaulted or cathedral roof construction provide a free ventilation path from the eave vent to the ridge vent, between all rafters, below the shingle roof decking and above the insulation. See ARMA Technical Bulletin – "Application of Asphalt Shingles over Insulation or Insulated decks."

SLOPE

Asphalt shingles are intended to be applied to a minimum of 2" per foot. Of all the factors to consider in choosing an asphalt roofing product, one of the most critical is the slope of the roof. It affects the surface drainage of water. These roofs are intended to be water shedding, not a waterproof barrier. Therefore, free drainage dictates the limits within which shingles or roll roofing may be used. Consideration of roof drainage can make the difference between a weather-tight roof and one that leaks.

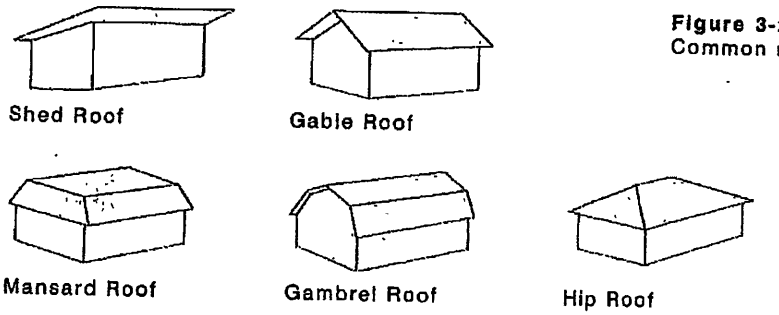

Figure 3-2
Common roof styles

The slope of a roof is determined in part by its style. A number of common styles are illustrated in Figure 3-2.

In general, most asphalt shingles may be used on roof slopes from 4" per foot to 21" per foot using standard application methods. For roofs having a slope greater than 21" per foot, special steep slope application procedures must be followed (see page 82). Most asphalt shingles may be used on slopes from 2" per foot to 3.9" per foot if special low slope application procedures are followed (see page 81).

The minimum slope on which roll roofing may be used depends on the application method and the type of roll roofing. Roll roofing may generally be used on roof slopes down to 2" per foot using the exposed nail method and down to 1" per foot using the concealed nail method.

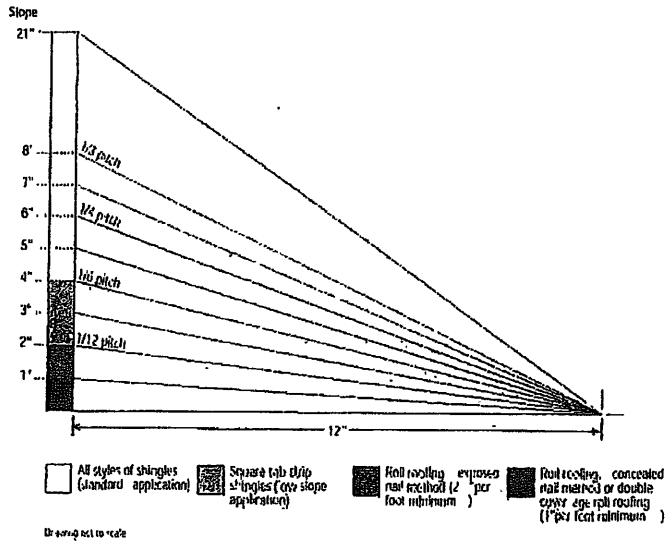

Figure 3-3
Minimum pitch and slope requirements for various asphalt roofing products

Double coverage roll roofing, which typically provides a top lap of 19", may be used on slopes down to 1" per foot. In general, roll roofing should not be used on slopes less than 1" per foot unless specified by the manufacturer.

Slope limitations for asphalt roofing materials are summarized in Figure 3-3.

DECK MATERIALS

[Note]
The type, grade, thickness and installation of structural materials used for roof decks should conform to the requirements of building codes.

The deck should be built in accordance with local building codes with structural sheathing panels rated by building code accredited third-party approval agencies. All wood products must be properly conditioned to be at moisture equilibrium. Failure to use properly conditioned deck materials can result in deck movement, which will distort or damage the overlying roofing materials. Distortion or damage of asphalt roofing materials resulting from deck movement is not a manufacturing defect of the roofing product. To avoid or reduce the appearance of buckles or distortions caused by old lumber roof decks, it is recommended that old and distorted lumber be replaced.

Check with individual roofing manufacturers for their specific requirements for type and thickness of roof decking. Additionally, be sure that the selected roof decking materials comply with local building codes.

DIRECT APPLICATION OF ASPHALT SHINGLES OVER INSULATION OR RADIANT BARRIER DECKS

With today's high cost of energy and the emphasis placed on energy conservation, some homeowners, when reroofing, are applying insulation on the exterior side of the existing roof and then applying asphalt shingles directly over insulation.

Asphalt roofing manufacturers recommend against this practice for the following reasons:

1. Shingles may be damaged or punctured when nailed to a non-rigid surface.
2. The nail-holding power of shingles applied directly over insulation may not be adequate, leaving shingles prone to wind damage.
3. Due to the insulation and radiant barriers preventing heat dissipation underneath the shingles, heat buildup may accelerate the weathering and reduce the life of the roof.
4. Fire and wind ratings on asphalt shingles may be affected. Individual systems should be checked with the manufacturer for the appropriate rating.
5. Proper ventilation underneath the roof deck is impossible to accomplish when applying shingles directly over insulation or radiant barriers. See ARMA Technical Bulletin – "Application of Asphalt Shingles over Insulation or Insulated decks."

For insulated decks and radiant barriers, it is recommended that a flow-through ventilated air space be provided between the top of the insulation and the nailable deck to assist in vapor and heat dissipation.

Structural Insulated Panels (SIP) are being used for roof decks and they may or may not be approved for use under shingles even if they have an approved nailable surface. Consult the roofing material manufacturer for approval over SIP products. Some SIP manufacturers are making panels with ventilation cavities.

For more details, see ARMA Technical Bulletin, "Application of Asphalt Shingles Over Insulation or Insulated Decks."

DECK PREPARATION

A number of roofing problems may result from failures within the underlying roof structure. Therefore, it is important that the materials supporting the roofing are properly installed.

The underlying structure should provide a rigid deck surface. It should not sag, shift or deflect under the weight of roofing materials, the workers installing the materials or the snow or rain loads the roof may have to support. An unstable structure could lead to movement and may affect the structural integrity and water shedding ability of the roofing and flashing.

Warping as well as other problems may result even with well seasoned lumber if the attic space under the roof deck or the spaces between the rafters and beams in a cathedral ceiling or mansard roof are not properly ventilated. Poor ventilation can result in an accumulation of moisture that eventually condenses on the underside of the roof deck.

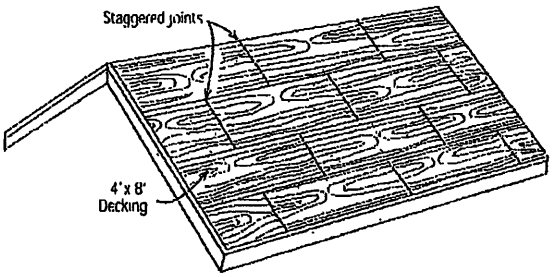

Figure 3-4
Typical Roof Deck

Inspect the lumber before installation. Do not use any board that is badly warped, has loose knots or has excessively resinous areas. Wood resin may chemically affect asphalt roofing materials.

Always check for a flat and dry nailing surface before installing deck panels. Follow the deck manufacturer's attachment instructions carefully when installing each panel. For more information, contact APA - The Engineered Wood Association at P.O. Box 11700, Tacoma, WA 98411, (253) 565-6600 or www.apawood.org.

If the sheathing is already in place, check it for deteriorated or rotted areas, which should be replaced. For excessively resinous areas and loose knots, cover any large areas with sheet metal patches. Underlayment may be used for small areas before the roofing is applied.

DRIP EDGES

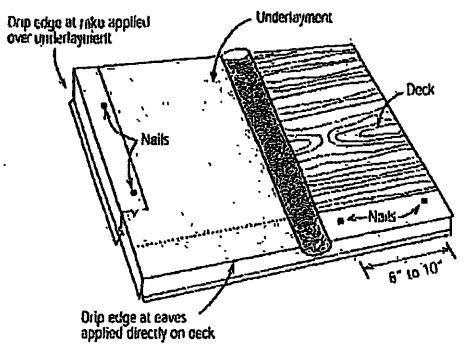

Figure 3-5
Application of drip edge at rake and eaves

Drip edge provides efficient water shedding at the rakes and eaves and protects the underlying wood from rotting. Drip edge should be made of a corrosion-resistant material that extends approximately 3" back from the roof edge and bends downward over the fascia.

Apply the drip edge underneath the underlayment along the eaves and over the underlayment on the rakes. Figure 3-5 details the placement and fastening of drip edge in combination with the underlayment. The use of a drip edge is strongly recommended and may be required by local building codes. If no drip edge or a wood strip is used as a drip edge, then all rake and eave overhangs should be ⅜" to 1".

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D Flashing Drip Edge

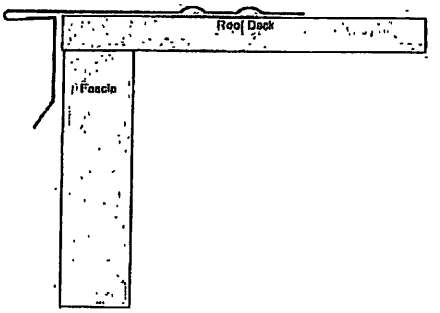

Figure 3-6a
Recommended drip edge:

On rake edge:

1. All underlayment goes under the drip edge.
2. Starter course shingle and remaining field shingles can be trimmed flush with drip edge.

On eaves:

1. All underlayment goes on top of drip edge.
2. Starter shingles and field shingles should be aligned flush with the drip edge or with an overhang up to ¾".

90 degree with Drip Edge

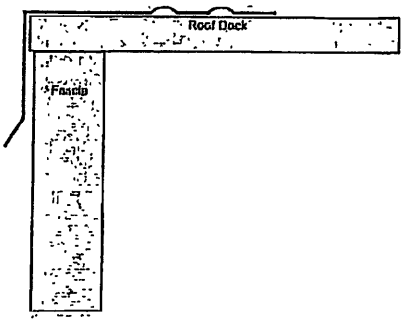

Fig 3-6b
Acceptable drip edge:

On rake edge:

1. All regular underlayments go under the drip edge.
2. Self-adhered shingle underlayment may go on top or under the drip edge (See the manufacturer's application instructions).
3. Starter course shingles and remaining field shingles should overhang the drip edge ¼" to ¾".

On eaves:

1. All underlayment goes on top of drip edge. [See above]
2. Shingles should be aligned to overhang the drip edge ¼" to ¾".

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ROOFING NAILS

It is recommended by ARMA that properly driven and applied roofing nails are utilized as the preferred nailing system for asphalt shingles. Nails are also required in the International Building Code.

Nails

Nails should have a minimum nominal shank diameter of 12 gauge, 0.105", and a minimum head diameter of ⅜". Nails will have smooth shanks (except for "gripper marks" sometimes located just below the head) although nails with shank deformations such as "barbs" may be used.

Corrosion Resistance

Galvanizing by various processes is the typical means of achieving corrosion resistance. Aluminum roofing nails do not require additional coatings for corrosion resistance. Steel nails must be corrosion resistant.

Nail Length

Nails should be long enough to penetrate ¾" into the roof deck. Where the deck is less than ¾" thick, the nail should be long enough to penetrate fully and extend at least ⅛" through the roof deck.

In determining the nail length, consideration should be given to the number of layers of shingles, shingle thickness(es), underlayment and flashings (eaves, sidewall and valley, etc.).

In some cases, the underside of the deck is exposed to view. In this case, using nails of the recommended length may result in the nail points penetrating through the deck and being exposed to view. Consult the roofing material manufacturer and building code requirements for approved alternatives.

NAILING

Proper nailing is essential to good performance. To ensure proper nailing during shingle application:

- Use the correct type, size and grade of nail as specified in the shingle manufacturer's application instructions.
- Use corrosion resistant nails.
- Use the recommended number of nails per shingle.
- Position the nails as required by the shingle manufacturer.
- Align the shingles properly before nailing to avoid exposing nails in the course below.
- Drive the nails straight and flush with the shingle surface.
- Do not break the shingle surface with the nail head.
- Do not drive nails into knotholes or cracks in the roof deck.
- Repair faulty nailing immediately.
- Follow manufacturer's instructions concerning special nailing procedures for steep slopes, high wind areas, and any special requirements.
- Comply with local building codes

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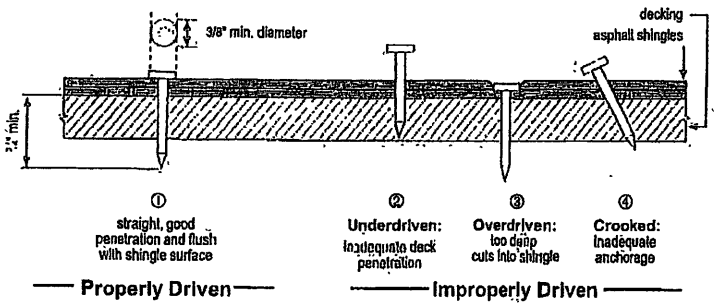

Figure 3-7
Proper and improper application of roofing nails

If a nail does not penetrate the deck properly and cannot be tapped down to be properly driven, remove the nail, repair the hole in the shingle with asphalt roofing cement that complies with ASTM D4586 and place another nail nearby. If necessary, replace the entire shingle. (See Figure 3-7)

QUANTITY AND PLACEMENT OF NAILS

The following practices reflect the general recommendations of most shingle manufacturers. However, the specific recommendations of the shingle manufacturer, as printed on each shingle wrapper, should be followed when applying shingles.

Align each shingle carefully. Whenever possible, make sure that no cutout or end joint is less than 2" from a nail in an underlying course. Start nailing from the end nearest the shingle just laid and proceed across. This will help prevent buckling. To help prevent distortion, do not attempt to realign a shingle by shifting the free end after two nails are in place. Drive nails straight so that the edge of the nail head does not cut into the shingle. Nail heads should be driven flush with the shingle surface, not sunk into it. Figure 3-7 illustrates examples of proper and improper nailing.

NAILING METHOD (NORMAL WEATHER CONDITIONS)

In areas with normal weather conditions, the following application methods should be utilized:

A. Placement of nails on three-tab strip shingles

Each of these shingles, both the conventional 36" long shingles and the "metric" shingles, should be fastened with four nails. When the shingles are applied with an exposure of 5" (5⅝" for metric), the nail locations should be on a line ⅝" above the top of the cutouts, 1" in from each end, and centered over each cutout. The center of the nail should be applied on center at all four nail locations. (See Figure 3-8)

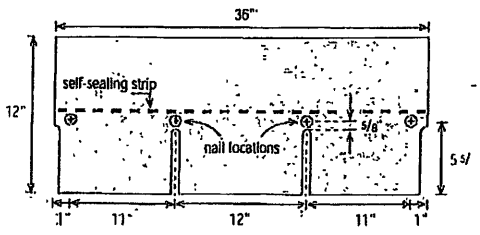

Figure 3-8
Nail locations for three-tab strip shingle

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B. Placement of nails on laminated shingles

Each of these shingles, both the conventional 36" long shingles and the "metric" shingles, should be fastened with four nails. When the shingles are applied with an exposure of 5" (5⅝" for metric), the nail locations should be on a line 5½" (6⅛" for metric) above the butt edge. For laminated shingles, locate nails 1" from each end, with two nails spaced in between. For details, see the manufacturer's application instructions. (See Figure 3-9)

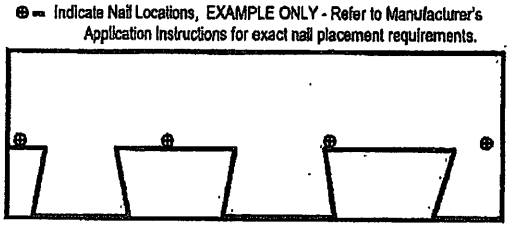

Figure 3-9
Nail locations for laminated shingle

NAILING METHOD (HIGH WIND REGIONS)

(6-nail method)

For areas considered to be high wind regions from historical experience or by local building code authorities, the following six nail method should be considered:

A Placement of nails on three-tab strip shingles

Both the conventional 36" long shingles and the "metric" shingles should be fastened with six nails. When the shingles are applied with an exposure of 5" (5⅝" for metric), the nail locations should be on a line ⅝" above the top of the cutouts, 1" in from each end, and 1" to the left and right of center of each cutout. The center of the nail should be applied on center at all six nail locations. (See Figure 3-10)

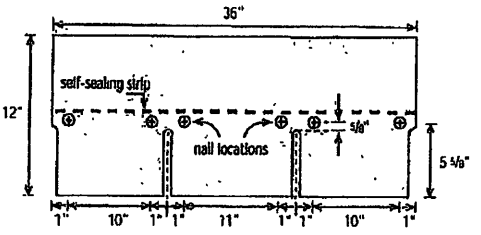

Figure 3-10
Nail locations for three-tab strip shingle

B Placement of nails on laminated shingles

Both the conventional 36" long shingles and the "metric" shingles should be fastened with four or six nails. High wind application should comply with the manufacturer's application instructions. Number and location of nails on laminated shingles depend on the product, on the product design, on course offsets, and on approved test application methods. (See Figure 3-11)

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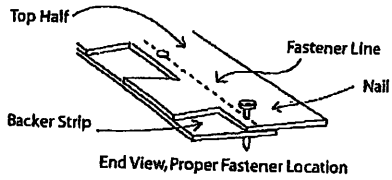

Figure 3-11
Nail locations on laminated shingle

STORAGE

Asphalt roofing materials must be kept dry prior to installation. As a result, make provisions at the job site for protecting them against the weather. Because of the importance of proper storage, techniques discussed in Chapter 2 are reemphasized here:

- Never stack shingle bundles more than 4' high.
- Never store asphalt roofing products in direct contact with the ground. Place them on a raised flat platform.
- Never leave the materials exposed to the weather. Cover them with tarpaulins or plastic bags that are vented to provide free air circulation.
- Never store shingles in extreme cold. Store in a warm place prior to application
- Care must be taken when working with asphalt products that have been stored in temperature below 40° F, to avoid potential problems with the product.

CHAPTER 7
APPLICATION OF SHINGLES ON NEW CONSTRUCTION -DECK PREPARATION

Some building codes have specific requirements for underlayment and/or ice dam protection. The requirements of these codes must be followed. Follow the ARMA directions (below) where permitted.

No roof is better than the quality of its installation. Asphalt roofing materials are no exception. They are designed to give years of service when applied carefully and correctly.

UNDERLAYMENT

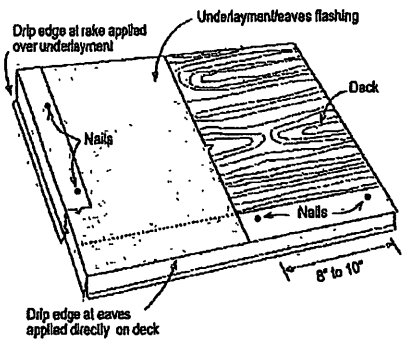

Figure 7-1
Application of Underlayment

After the deck has been properly prepared and is dry, cover it with the appropriate underlayment. Typically, asphalt saturated felt products are specified for use as underlayment. However, ambient conditions may warrant the use of a self-adhered shingle underlayment (a type of modified bituminous sheet material). Refer to "Eave Flashing for Ice Dam Protection" on page 47. Underlayment material used beneath roofing shingles is recommended to comply with one of the following: ASTM D4869, ASTM D6757, ASTM D1970, or as recommended by the individual shingle manufacturer.

On decks having a slope of 4" per foot or greater, one layer of non-perforated underlayment should be applied. The use of asphalt coated base sheets, self-adhered shingle underlayments, polyethylene sheets or laminated waterproof papers could result in vapor retardation — trapping moisture or frost between the covering and the roof deck when the deck is not properly ventilated. Consult with the individual manufacturer for specific recommendations when using these types of products.

[Note]
The underlayment application figures in this chapter all show the proper use of drip edges. Drip edges should be used on all roof rake and eave edges. Drip edge installation is covered in Chapter 3.

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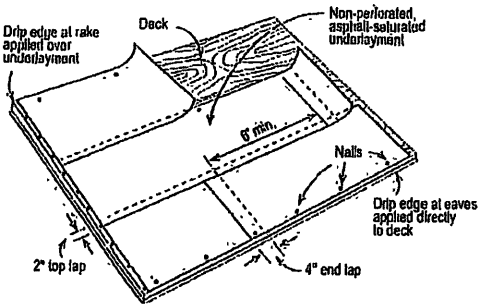

Figure 7-2
Application of Underlayment on Inclines 4/12" or greater

Always lay the felt parallel to the eaves, lapping each course at least 2" over the underlying course. Underlayment should not run perpendicular to the eaves. Secure the felt with nails to hold it in place. (See Figure 7-2) Nails should be driven straight and flush with the surface. If two or more pieces are required to continue a course, lap the ends at least 4". End laps in a succeeding course should be located at least 6' from end laps in the preceding course. Lap the underlayment a minimum of 6" from both sides over all hips, ridges and valleys. Where the roof meets a vertical surface, carry the underlayment at least 4" up the surface.

Underlayment should always be used in new construction as it provides many benefits.

Important reasons for installing underlayment when applying shingles over wood decks include:

- Underlayment is water-resistant and provides secondary protection by helping to shield the deck from wind-driven rain and helping to prevent water from reaching the deck.
- Underlayment keeps the deck dry until shingles are applied, minimizing problems that may result if shingles are placed on wet decks. Shingles should be applied as soon after the application of the felt as possible.
- Meeting Class A or Class C fire ratings when used with proper decking material and shingles. A shingle by itself is not fire-rated, but is, in fact, a component of a roof assembly. In many municipalities, a Class A or Class C fire rating for roof assemblies is required by code or ordinance.
- Installing underlayment helps reduce "picture framing" (the visible outline of deck panels caused by irregularities in roof decking thicknesses).
- Underlayment offers protection from resins that may come from wood board sheathing.

Proper application techniques should be followed to ensure optimum performance of asphalt saturated felt.

CHALK LINE

The dimensional variations of individual strip shingles are seldom significant, but on a large expanse of roof, the accumulated effect of these slight variations could result in diverging butt lines or misaligned cutouts. Whether there is a large expanse of roof or a small one, chalk lines provide visible guides that help ensure the application of the shingles in proper horizontal and vertical alignment with the proper exposure and the intended coverage. Never vary the shingle exposure between courses by more than ±⅛", as this deviation may negatively affect roof performance and aesthetics. Shingle sides should be butted, but not forced together to maintain adequate shingle coverage.

To place a horizontal chalk line parallel to the eaves, measure the appropriate distance on the roof and mark it at three locations — at each end and in the middle as a check against possible measurement errors. Put a nail on the mark at each end, stretch the chalk line between them and pull it taut. Check the alignment of the middle mark, and then snap the line from the center.

Vertical chalk lines are important for aligning cutouts on shingles that are designed to create a pattern from eaves to ridge. They are also important for aligning shingles on each side of a dormer so that when the application of shingles passes it, the shingles and cutouts meet above the dormer in proper alignment without any gaps or overlaps.

On long runs, snap a vertical chalk line in the center of the run and apply shingles to the left and right of the line. Check horizontal chalk lines as the shingle application approaches the ridge so that the upper courses will be parallel to it.

EAVE FLASHING FOR ICE DAM PROTECTION

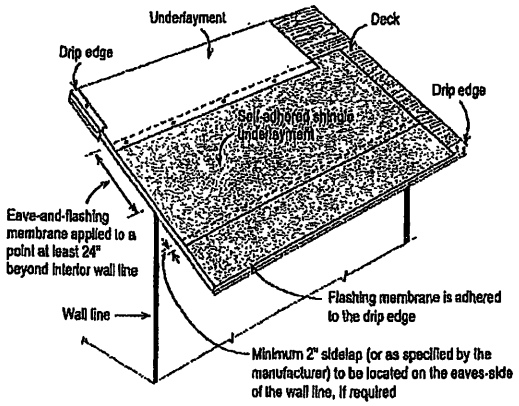

Figure 7-3
Application of self-adhered Shingle underlayment for eave flashing

Ice dams are formed by the continual thawing of snow over the warmer portions of the roof and refreezing over the cold eave. The ice dams can cause the backing up of water and slush under the exposed roofing material and cause damage to the structure. Eave flashing is recommended when applying roofing material to this potentially vulnerable area to help prevent such water penetrations. In climates where icing along the eaves is anticipated or where the average January temperature is 25°F or less, eave flashing must be installed to ensure maximum protection against ice damming damage. The appropriate selection of flashing material and the flashing strip width will depend upon the roof slope and the severity of icing conditions anticipated.

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The recommended method is to use self-adhered shingle underlayment that complies with ASTM D1970, or as approved by the shingle manufacturer or local code. The self-adhered shingle underlayment is applied directly to the deck and is applied at a width to extend up the roof from the eaves or rake edge to a point at least 24" inside the interior wall line (heated space). If the membrane is not wide enough to reach that point, install additional course(s) of membrane as needed, overlapping the previous course by 2" or as specified by manufacturer.

[Note]
When a self-adhered shingle underlayment is used as underlayment, no additional eave flashing application is required.

Self-adhered shingle underlayments are also excellent for use on ridges, hips, flashings and valleys, as well as around dormers, skylights and chimneys. Because most eave flashing materials are vapor retarders, they should not be used beyond recommended areas without proper ventilation. A lack of proper ventilation in these cases will result in the possibility of water vapor condensation under the roof deck.

VALLEY UNDERLAYMENT & FLASHING

Valleys are formed where two sloping roof planes meet at an angle. The sloping planes direct water toward the valley, concentrating the drainage along the joint and making it especially vulnerable to leakage. As a result, one of the most important installation details for good roof performance is proper valley flashing. Consult the appropriate roofing manufacturers for recommendations on a particular application.

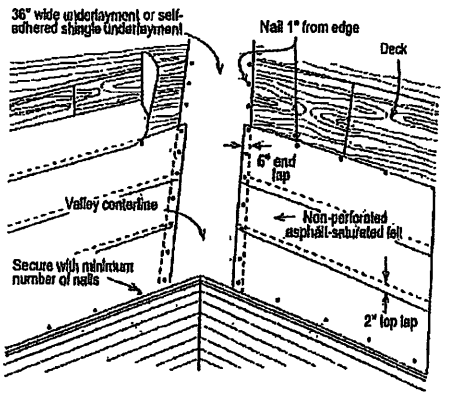

Figure 7-4
Application of underlayment in a valley

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To install underlayment in a valley, first center a 36" wide strip of the appropriate underlayment in the valley and secure it with only enough nails to hold it in place or place a 36" wide strip of self-adhered shingle underlayment directly to the deck. Then trim the horizontal courses of felt underlayment applied on the roof to overlap the valley strip at least 6" (See Figure 7-4). In all valleys the underlayment or self-adhered shingle underlayment should be tight in the valley but not creased or wrinkled.

Following application of the underlayment, roofs with multiple planes require the construction of one of three types of valleys: open, woven or closed cut. Regardless of the type of valley used, it must be smooth, unobstructed, of sufficient capacity to carry water away rapidly and capable of withstanding occasional backing up of water.

A. Open Valleys

The recommended flashing material is a 26-gauge galvanized metal or an equivalent corrosion resistant, non-staining material (check with shingle manufacturer and local code). The width should be no less than 24", but local building codes or shingle manufacturer may require a greater width. (See Figure 7-5)

If the valley is covered with a minimum 36" wide self-adhered shingle underlayment that complies with ASTM D1970, adhered directly to the deck, the valley is ready for the metal valley flashing. If the valley is covered with felt underlayment an additional layer of #50 felt or heavier valley underlayment is required before the metal flashing is applied. Center the strip in the valley, securing the non-self-adhered materials with only enough nails to hold it in place (See Figure 7-5). Nail the strip along a line 1" from the edges, first on one edge all the way up, then on the other while pressing the flashing strip firmly and smoothly into the valley. Laps should be 12" and cemented.

Center the metal flashing in the valley. Trim the lower edge flush with the eaves drip edge. Install it up the entire length of the valley. If two or more strips of flashing are required, lap the upper piece over the lower so that drainage will be carried over the joint, not into it. The overlap should be 12" and fully bonded with asphalt roofing cement.

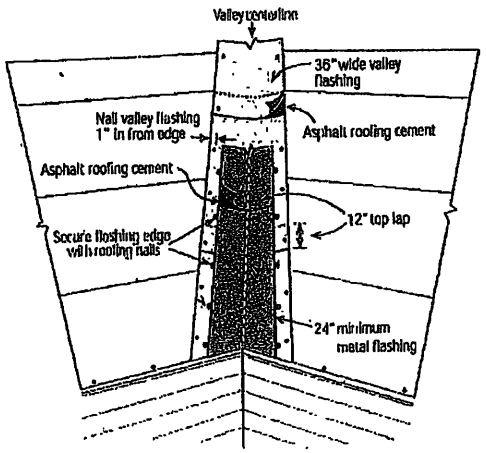

Figure 7-5
Application of corrosion resistant metal as flashing for an open valley
(The figure shows 50# or heavier felt for the valley flashing.)

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Secure the valley metal to the roof deck without puncturing, with roofing nails spaced 8"-12" apart. The valley will be completed with shingle application.

B. Woven and Closed Cut Valleys

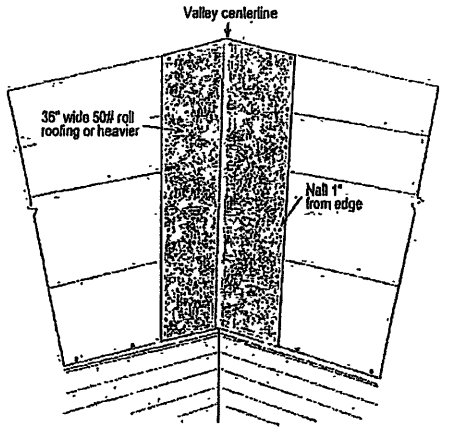

Figure 7-6
Application of flashing for a woven or closed cut valley

If self-adhered shingle underlayment that complies with ASTM D1970 was adhered directly to the deck as shown in Figure 7-4 then no additional valley flashing is required. If the valley was covered with felt underlayment as shown in Figure 7-4, cover the valley with a minimum 36" wide of roll roofing; #50 or heavier center the roll roofing strip in the valley, securing the materials with only enough nails to hold it in place (See Figure 7-6). Nail the strip along a line 1" from the edges, first on one edge all the way up, then on the other while pressing the flashing strip firmly and smoothly into the valley. Laps should be 12" and cemented. The valley will be completed as the shingles are installed. When installing a closed-cut valley installation, weave the first course.

CHAPTER 9
APPLICATION OF LAMINATED SHINGLES ON NEW CONSTRUCTION

No roof is better than the quality of its installation. Laminated shingles are no exception. They are designed to give decades of service when applied carefully and correctly. Laminated shingles are applied in general, similar to strip shingles, but are different in appearance and construction.

For best appearance and shingle function, the manufacturer's application instructions for shingle offsets and repeat pattern must be followed as indicated on the shingle wrapper. Each manufacturer has determined the optimum application pattern (for function and appearance) for each of their products. (See Fig. 9-2 as an example of one method.)

SHINGLE APPLICATION – LAMINATED SHINGLES

While the general application procedures for all asphalt laminated shingles are essentially the same, differences do exist depending upon the product dimensions, exposure, and product design. Thus, it is necessary to study and follow the shingle manufacturer's application directions as printed on the shingle bundle wrapper.

Before beginning to apply shingles, check that all chimneys are completed and all vent pipes, soil stacks and ventilators are in place (See Chapter 10 for flashing and roof penetration details). Also make provisions for the additional flashings that will be required as the shingles are applied, such as those around chimneys and stacks and at vertical wall joints.

If a roof surface is broken by a dormer or valley, start applying the shingles from a rake and work toward the break. If the surface is unbroken, start at the rake that is most visible.

[Note]
The release tape found on the shingles prevents the shingles from sticking together in the package. It should not be removed during application.

No matter where the application begins (left edge, right edge, or center), apply the shingles across with designated course offsets resulting in a diagonal application pattern. If vertical shingle application is being considered (referred to as racking) refer to shingle manufacturer's requirements. Horizontal application is preferred and will ensure that each shingle is fastened properly.

A. Starter Strip

The starter strip may be either a row of shingles trimmed to the shingle manufacturer's recommendations or a strip of mineral-surfaced roll roofing at least 2" wider than the shingle exposure. Precut starter shingles are also available. The starter strip protects the roof deck by filling in the spaces under the shingle joints of the first course of shingles. It should overhang the eaves and rake edges by ¼" to ¾".

Where the drip edge extends out from the eaves and rakes, the shingles may be cut flush with the drip edge or extend out no more then ¾".

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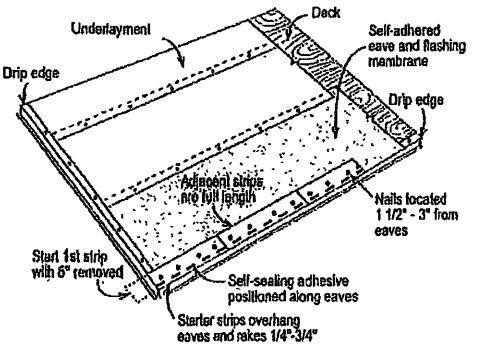

Figure 9-1
Application of starter strip

If self-sealing shingles are used for the starter strip, remove the tab portion of each shingle and position the remaining strip with the factory-applied adhesive face up along the eaves. Trim at least 4" [Figure 9-1 shows 6" removed] from the end of the first shingle in the starter strip. Fasten the starter strips parallel to the eaves along a line 1½"-3" above the eaves. Position the fasteners so that they will not be exposed under the shingle ends in the first course. (See Figure 9-1.)

Manufacturers may require different starter strip techniques or provide starter strip materials that require specific application instructions.

For shingles that have the self-sealing sealant on the top of the shingle and shingles or a strip of mineral-surfaced roll roofing without a self-sealing adhesive are used for the starter strip perform the following procedure. Bond the shingle in the first course to the starter strip by placing a spot of asphalt roofing cement (conforming to ASTM D 4586) about the size of a quarter on the starter strip beneath each shingle corner and two more spots equally spaced between the ends of the shingle. Then press the shingle firmly into the cement.

[Caution]
Excessive use of asphalt cement may cause blistering.

B. First and Succeeding Courses

Proper application of the first course of shingles is the most critical. Be sure it is laid out perfectly straight; check against the chalk lines to ensure proper alignment of subsequent courses. Shingles should be installed so that shingle ends are offset. The first course typically starts with a full shingle, but individual laminated shingles will have specific instructions for beginning the first course of shingles. As a general rule, shingle ends should be offset from the course above and below by at least 4". Make sure that no end joint is less than 2" from any nail in an underlying course. Begin nailing from the end nearest the shingle just laid, and proceed across, aligning each shingle carefully.

For best appearance and shingle function, the manufacturer's application instructions for shingle offsets and repeat pattern must be followed as indicated on the shingle wrapper. Each manufacturer has determined the optimum application pattern (for function and appearance) for each of their products. (See Fig. 9-2 as an example of one method.)

APPLYING THE SHINGLES

The first course starts with a full shingle, while succeeding courses start with portions removed according to the style of shingle being applied. By removing different amounts from the first shingle in each course, shingle joints or multiple thickness areas in one course do not line up directly with those of the course below, creating the desired pattern.

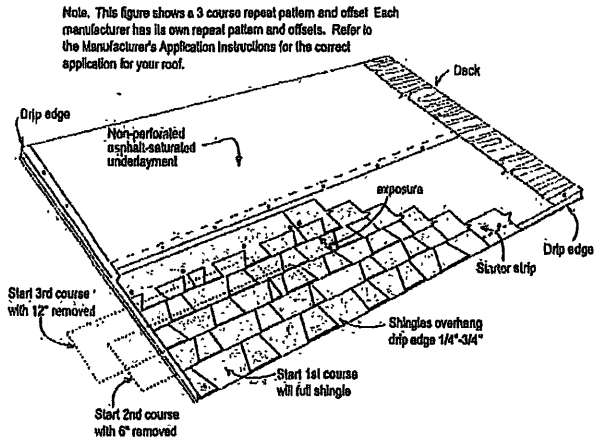

Figure 9-2

For ease of illustration, the 6" method is discussed and shown here in Fig. 9-2. For directions and illustration on proper application methods, consult the manufacturer's application Instructions.

With the 6" method, the first course begins with a full-length shingle. The second course begins with a shingle that is 6" shorter, and the third course starts with a shingle having 12 inches removed. The pattern repeats itself beginning with the fourth course, when a full-length shingle is used.

VALLEYS

Several different methods of treating valleys are possible including the open and closed cut methods. Open or closed cut valleys are the preferred method for laminated shingles. Open valleys are preferred for heavy weight and very thick shingles, because of the difficulty in forming the shingles to the valley to make a cosmetically appealing appearance with the closed cut construction. For all the methods, valley flashing should be in place before shingle application is begun except for open valleys around dormers where the valley flashing must overlap the top courses of shingles along the dormer sidewalls. Thoroughly working all valley materials well into the break of the valley prior to fastening is recommended.

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A. Open Valleys

Snap two chalk lines, one on each side of the valley centerline over the full length of the valley flashing. Locate the upper ends of the chalk lines 6" apart at the ridge (i.e., 3" to either side of the valley centerline). The lower ends of the valley chalk lines should diverge from each other at a rate of ⅛" per foot of the valley length. Thus, for an 8' long valley, the chalk lines should be 7" apart at the eaves; for a 16' valley, they should be 8" apart. The minimum shingle overlap on each side of the metal valley is 6". (See Figure 9-3)

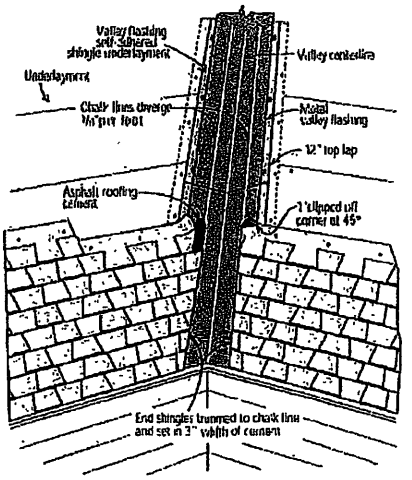

Figure 9-3
Application of shingles in an open valley

As shingles are applied toward the valley, trim the last shingle in each course to fit on the chalk line. Never use a shingle trimmed to less than 12" in length to finish a course running into a valley. If necessary, trim a section off the adjacent shingle in the course to allow a longer portion to be used. Clip 1" from the upper corner of the shingle on a 45° angle to direct water into the valley and prevent it from penetrating between the courses. Finally, to form a tight seal, cement the shingle to the valley lining with a 3" width of asphalt roofing cement (conforming to ASTM D 4586). There should be no exposed nails along the valley flashing.

B. Open Valleys for Dormer Roofs

The valley between a dormer and main roof requires special treatment. Do not install the metal valley flashing until the shingle application reaches a point just above the lower end of the valley when using self-adhered shingle underlayment for the initial valley flashing. (See Figure 9-4)

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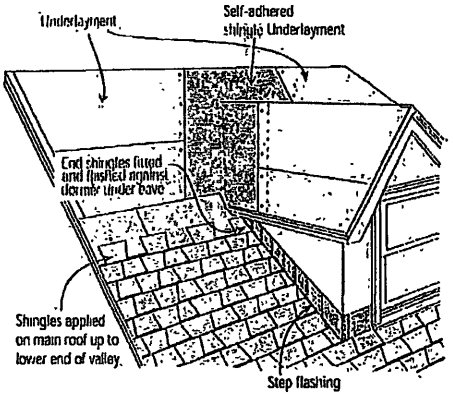

Figure 9-4
Point at which installation of open valley at dormer roof begins

Apply the first or bottom layer of valley flashing (36" wide self-adhered shingle underlayment in the same manner as any open valley flashing). Trim the lower section of the flashing so that it extends ¼" below the edge of the dormer deck. The lower section in contact with the main roof deck should project at least 2" below the point where the two roofs meet. Extend the upper section so that the portion on the main roof extends 18" above the point where the dormer intersects the roof. Trim the portion on the dormer at the ridge. (See Figure 9-5)

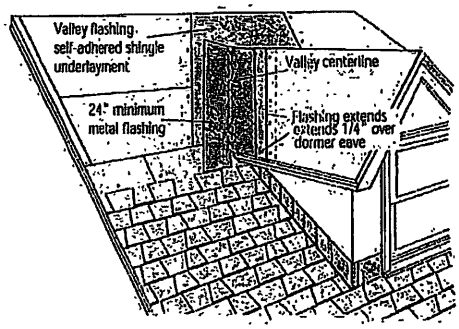

Figure 9-5
Application of flashing for an open valley at a dormer roof

Apply the valley flashing on the other side of the dormer in the same manner, extending the portion on the main roof up and over the portion from the first valley.

Trim the second or top layer of flashing (24" minimum width non-corrosive metal valley flashing) on the dormer side to match the lower end of the underlying strip. Trim the side that will lie on the main deck to overlap the nearest course of shingles. This overlap is the same as the normal lap of one shingle over another for the shingles being applied. For example, for laminates it extends to the top of the shingle exposure.

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C. Closed Cut Valleys

[Note]
The first course and only the first course of shingles from the intersecting roof surface should be woven with the first course of shingles on the starting roof.

With valley flashing already in place, apply the first course of shingles along the eaves of one of the intersecting roof planes and across the valley. The first course and only the first course of shingles from the intersecting roof surface should be woven with the first course of shingles on the starting roof. For proper flow of water over the trimmed shingle, always start applying the shingles on the roof plane that has the lower slope or lesser height. Extend the end shingle at least 12" onto the adjoining roof. Do not make a joint in the valley. If a shingle falls short, add in section so that the joint occurs outside the line of the valley. Apply succeeding courses in the same manner, extending them across the valley and onto the adjoining roof. Press the shingles tightly into the valley. Use normal shingle fastening methods except that no fastener should be within 6" of the valley centerline and two fasteners should be placed at the end of each shingle crossing the valley.

Snap a chalk line 2" from the centerline of the valley on the unshingled side. Then apply shingles on the unshingled side. Trim the shingles as they are being installed to the chalk lines and to ensure a neat installation. Trim 1" on a 45° angle from the upper corner of each end shingle upon installation. This will direct water into the valley. Finally, embed the end of each shingle in a 3" wide strip of asphalt roofing cement. (See Figure 9-8)

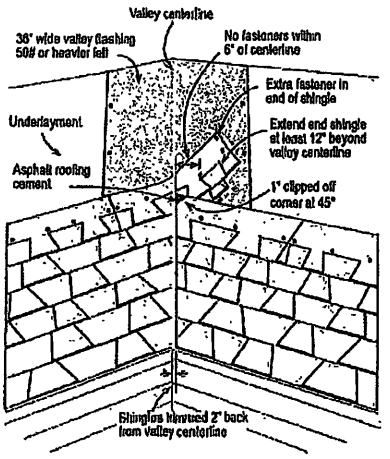

Figure 9-8
Shingle application in a closed cut valley

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CHAPTER 10
FLASHING

All areas on the roof surface where there is an intersection of roof planes or a projection through the roof surface (i.e., chimneys, vent stacks, dormer walls, etc.) require "flashing." Flashing is the construction procedure necessary to make these areas watertight. Careful attention to flashing details is essential for proper leak-free roof performance. Some of the figures showing details may be shown as a strip shingle and/or as a laminated shingle, however, in most cases, the application techniques are identical.

FLASHING AGAINST VERTICAL SIDEWALLS

Roof planes that butt against vertical walls at the end of shingle courses are best protected by metal "flashing shingles" placed over the end of each course. The method is called "step flashing."

The metal flashing shingles are rectangular, 10" long and 2" wider than the expected exposure of the roofing shingles. For example, when used with shingles with a 5" exposure, they are 10" x 7". The 10" length is bent to extend 5" over the roof deck and 5" up the wall surface. Each flashing unit is placed up-roof from the exposed edge of the shingle that will overlap it so that it is not visible when the overlapping shingle is in place. (See Figure 10-1 a & b)

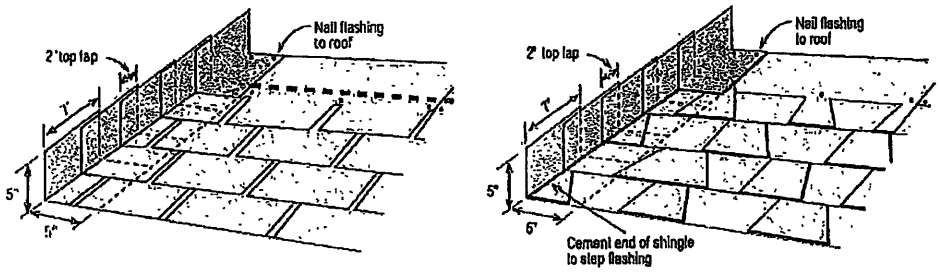

Figure 10-1 a & b
Application of step flashing

To install step flashing, place the first flashing unit over the end of the starter strip and position it so that the end shingle in the first course covers it completely. Secure the horizontal flange to the roof with two nails. Do not nail flashing to the wall as differential movement of the wall and roof could damage the seal. Then apply the first course of shingles up to the wall. Position the second step flashing strip over the end shingle in the first course 5" up from the butt or the same distance as the shingle exposure so that the end shingle in the second course covers it completely. Fasten the horizontal flange to the roof.

The second course of shingles follows; the end is flashed as in preceding courses and so on to the top of the intersection. Because the metal strip is 7" wide, when the roof shingles are laid with a 5" exposure, each flashing unit will overlap the one on the course below by 2".

Bring wall siding down over the vertical sections of the step flashing to serve as counter flashing. Keep wood siding far enough away from the roof shingles so that it may be painted. (See Figure 10-2)

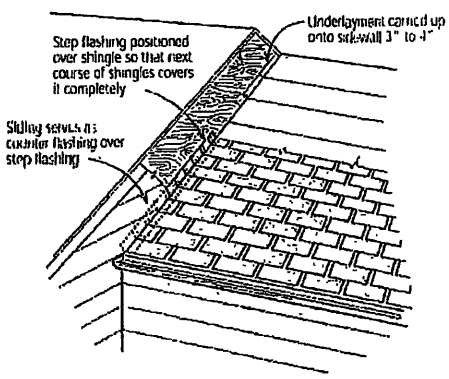

Figure 10-2
Application of step flashing against vertical sidewall

FLASHING AGAINST VERTICAL FRONT WALLS

Apply shingles up the roof until a course must be trimmed to fit at the base of the vertical wall. Plan ahead and adjust the exposure slightly in the previous two courses so that the last course is at least 8" wide. Apply a continuous piece of metal flashing over the last course of shingles by embedding it in asphalt roof cement and nailing it to the roof. The metal flashing strip should be bent to extend at least 5" up the vertical wall and at least 4" onto the last shingle course. Do not nail the strip to the wall. Apply an additional row of shingles in asphalt roof cement, (conforming to ASTM D 4586) over the metal flashing strip, trimmed to the width of the strip. (See Figure 10-3)

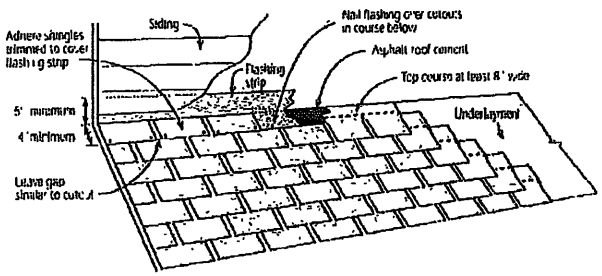

Figure 10-3
Application of flashing against vertical front wall

[Caution]
Excessive use of asphalt cement may cause blistering.

Bring siding down over the vertical flashing to serve as cap flashing. Keep wood siding far enough away from the roof shingles so that it may be painted. Do not nail siding into the vertical flashing.

If the vertical front wall meets a sidewall, as in dormer construction, cut flashing so that it extends at least 7" around the corner. Then continue up the sidewall with step flashing as described earlier.

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SOIL STACKS AND VENT PIPES

Practically all dwellings have vent pipes or ventilators projecting through the roof that are circular in section and require special flashing methods.

Apply shingles up to the vent pipe. Then cut a hole in a shingle to go over the pipe and set the shingle in asphalt roof cement conforming to ASTM D 4586. (See Figure 10-4)

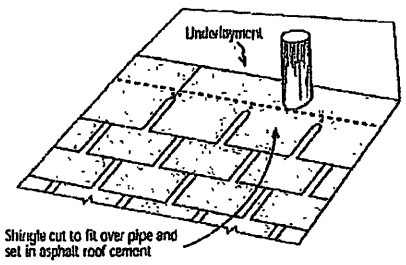

Figure 10-4
Application of shingle over vent pipe

[Caution]
Excessive use of asphalt cement may cause blistering.

A preformed flashing flange that fits snugly over the pipe is then placed over the shingle and vent pipe and set in asphalt roof cement. Place the flange over the pipe to lay flat on the roof. (See Figure10-5 a & b)

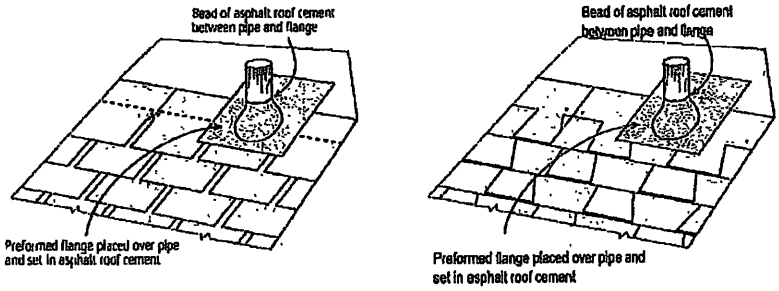

Figure10-5 a & b
Application of flashing over vent pipe

After the flashing is in place, resume shingle application. Cut shingles in successive courses to fit around the pipe and embed them in asphalt roof cement where they overlay the flange. Avoid excessive use of cement as it may cause blistering. Do not drive fasteners too close to the pipe. The completed installation should appear as shown in Figure 10-6 a & b with the lower part of the flange overlapping the lower shingles and the side and upper shingles overlapping the flange.

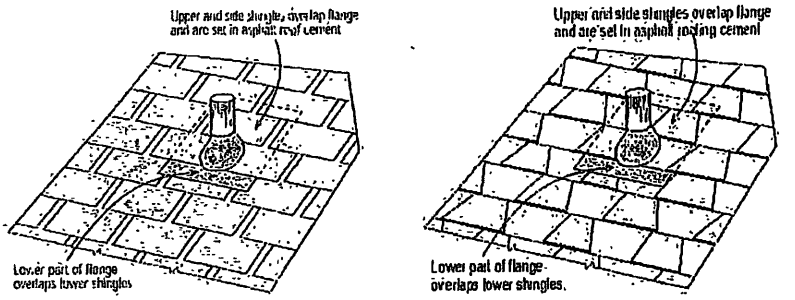

Figure 10-6 a & b
Application of shingles around flashing

Follow the same procedure where a ventilator or exhaust stack is located at the ridge, but bring the shingles up to the pipe from both sides and bend the flange over the ridge to lie in both roof planes, overlapping the roof shingles at all points. Ridge shingles are then positioned to cover the flange. Embed the ridge shingles in asphalt roof cement where they overlap the flange.

FLASHING AROUND CHIMNEYS

To prevent problems that uneven settling can cause chimneys on older homes were usually built on a separate foundation from that of the main structure. This does not eliminate possible differential settling between the chimney and the main structure. It only frees the chimney from the stresses and distortions that would be imposed on it if both were on the same foundation.

Because of these differential movements, flashings at the point where the chimney projects through the roof calls for a construction that will allow movement without damage to the water seal. To accomplish this, it is necessary to apply apron flashings that are secured to the roof deck and counter flashings that are secured to the masonry. If movement occurs, the counter flashing slides over the apron flashing without affecting water runoff.

[NOTE]
It is strongly recommended a cricket be installed on any chimney that is 24" or more wide. The International Residential Building Code (IRC) requires a cricket or saddle be installed on any chimney greater than 30"

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Chimneys that project through the roof surface should have a cricket installed at the intersection of the back face of the chimney and the roof deck. The cricket (or wood saddle) is an important element in preserving the integrity of the flashing that will be installed because it prevents the buildup of ice and snow at the rear of the chimney and diverts water runoff around the chimney. (See Figure 10-7)

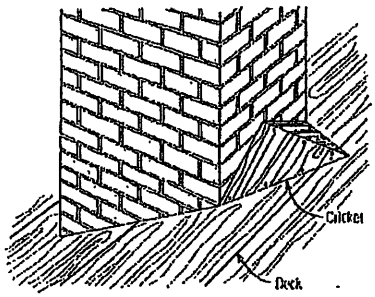

Figure 10-7
Location and configuration of chimney cricket

The cricket should be in place from the start because all roofing materials from the felt underlayment to the roofing shingles are carried over it. If it is not in place, build one as part of the deck preparation prior to applying underlayment and shingles.

Commonly, a cricket consists of two triangular sections of sheathing supported by appropriate framing members, joined to form a level ridge that extends from the centerline of the chimney back to the roof deck. Nail the sections to the deck and to each other along their meeting edge.

Apply shingles up to the front edge of the chimney before any flashings are installed. In addition, apply a coat of asphaltic masonry primer (conforming to ASTM D 41) to the chimney's brickwork to seal the surface and to provide good adhesion at all points where asphalt roof cement will later be applied.

Begin the flashing construction with the installation of 26-gauge corrosion-resistant metal apron flashing between the chimney and the roof deck on all sides.

Apply the apron flashing to the front first, as shown in Figures 10-8 and 10-9. Bend the apron flashing so that the lower section extends at least 4" over the shingles and the upper section extends at least 12" up the vertical face of the chimney. Work the flashing firmly and smoothly into the joint between the shingles and chimney. Set both the roof and chimney overlaps in asphalt roof cement placed over the shingles and on the chimney face. The flashing may be secured against the chimney with one or two nails driven into the mortar joints to hold it in place until the cement sets.

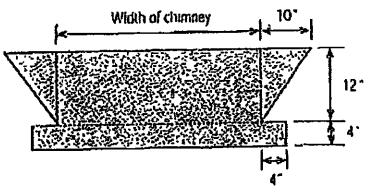

Figure 10-8
Pattern for cutting front apron flashing

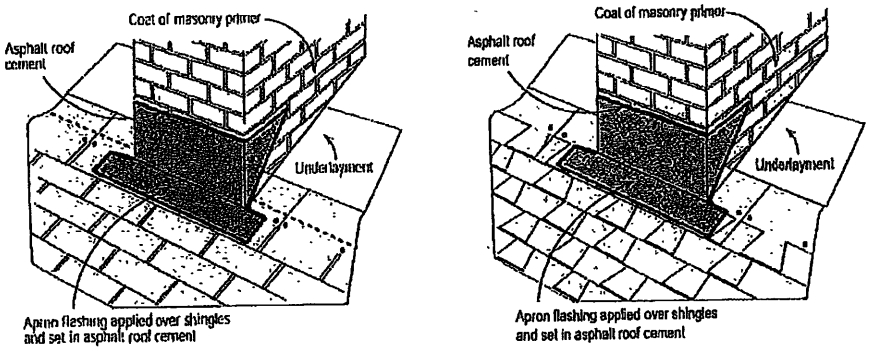

Figure 10-9 a & b
Application of apron flashing at front of chimney

Use metal step flashing for the sides of the chimney, positioning the units in the same manner as flashing a vertical sidewall. Cut, bend and apply the step flashing as shown in Figure 10-10. Secure each flashing unit to the masonry with asphalt roof cement and to the deck with nails. Embed the end shingles in each course that overlaps the flashing in asphalt roof cement.

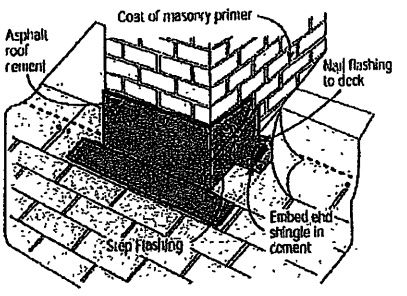

Figure 10-10
Application of step flashing at side of chimney

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Place the rear cricket flashing over the base and the back of the chimney as shown in Figures 10-11 through 10-13. Cut and bend the metal cricket flashing to cover the cricket and extend onto the roof surface at least 6". It should also extend at least 6" up the brickwork and far enough laterally to lap the step flashing on the sides.

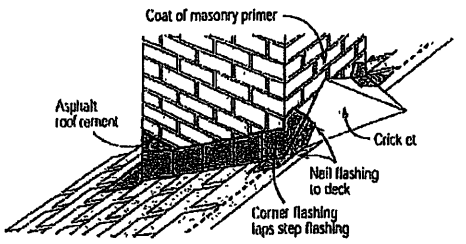

Figure 10-11
Application of corner flashing at rear of chimney

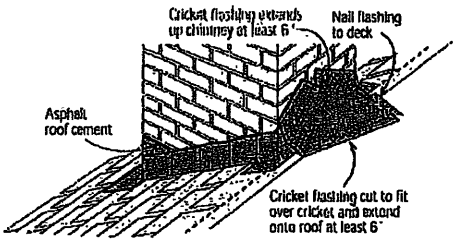

Figure 10-12
Application of flashing over cricket

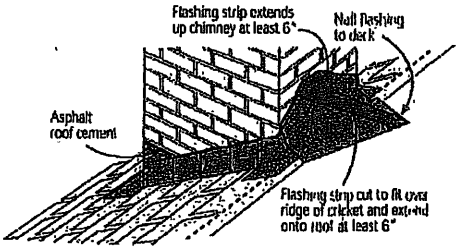

Figure 10-13
Application of flashing over ridge of cricket

If large enough, the base may be covered with shingles. Otherwise, apply the rear apron flashing, bring the end shingles in each course up to the cricket and cement them in place.

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Counter flashings must now be placed over all apron, cricket and step flashings for positive exclusion of water from the joint. Begin by setting the metal counter flashing into the brickwork as shown in Figure 10-14. This is done by raking out a mortar joint to a depth of 1½" and inserting the bent edge of the flashing into the cleared joint. Once in place and being under a slight amount of spring tension, the flashing cannot be dislodged easily. Refill the joint with Portland cement mortar. Finally, bend the flashing down to cover the flashing and to lie snugly against the masonry.

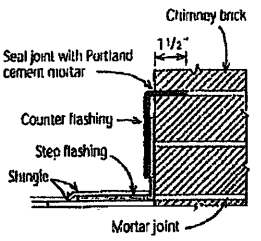

Figure10-14
Application of counter flashing

Use one continuous piece of counter flashing on the front of the chimney as shown in Figure 10-15. On the sides and back of the chimney, use several pieces of similar-sized flashing, trimming each to fit the particular location of brick joint and roof pitch. (See Figure 10-16 a & b.)

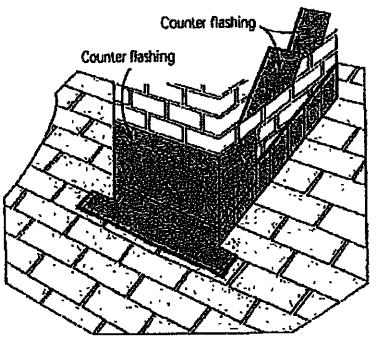

Figure 10-15
Application of counter flashing at front and side of chimney

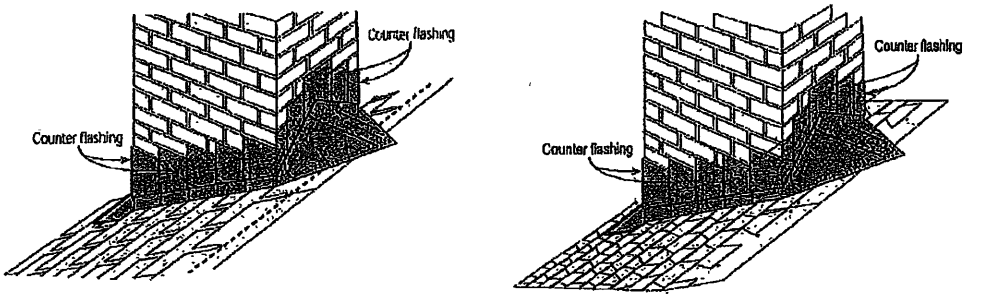

Figure 10-16 a & b
Application of counter flashing at side and rear of chimney

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Start the side units at the lowest point and overlap each at least 3". As this is a metal cricket, it should be left unshingled in case a leak occurs (a leak would not be readily detectable if the cricket were shingled).

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CHAPTER 11
HIPS AND RIDGES

The correct application of hip and ridge products is an important part of a completed roof. Most shingle manufacturers market at least one hip and ridge product. While some are simple, match the shingle, and are easy to apply, others add character to the finished roof. In each case it is important to follow the manufacturer's application instructions regardless of which hip and ridge product is used.

The following application technique is a simple hip and ridge application showing the use of 3-tab strip shingles that can be used with many types of shingles. Care must be taken if you use a three-tab shingle for the hip and ridge that is not made by the same manufacturer of the shingle used on the roof to make sure the colors match. Laminated shingles are not designed to be cut and applied to hips and ridges.

Apply shingles up to a hip or ridge from both sides of the roof before finishing the intersection. To facilitate finishing, adjust the last few courses so that the ridge capping will cover the top courses of shingles equally on both sides of the ridge. There should not be any of the shingle's headlap exposed and the ridge cap should provide at least 2" overlap on each side of the hip or ridge.

Hip and ridge shingles may be made from the shingles used to cover the roof. Cut shingles down to 12" x 12" through the tab cutouts on three-tab shingles or to a minimum of 9" x 12" on two-tab or no-cutout shingles. Taper the lap portion of each cap shingle slightly so that it is narrower than the exposed portion. This produces a neater job. (See Figure 11-1)

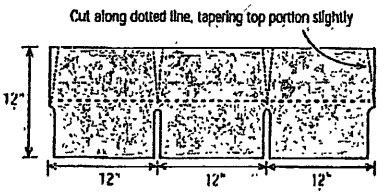

Figure 11-1
Fabrication of hip and ridge shingles from three-tab strip shingles

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To apply the ridge shingles, bend each shingle along the centerline so that it will extend an equal distance on each side of the hip or ridge. Chalk lines may assist in proper alignment. In cold weather, warm the shingle until it is pliable before bending. Apply the shingles with a 5" their designated exposure, or according to the manufacturer's instructions on pre-cut hip and ridge, beginning at the bottom of the hip or from the end of the ridge opposite the direction of the prevailing winds. See Figure 11-2. Secure each shingle as illustrated in Figure 11-3 with one fastener on each side, 5½" back from the exposed end ½" more than the (or ½" from the exposure line) and 1" up from the edge. Length of fastener for hip and ridge shingles should be long enough to penetrate ¾" into the decking or go completely through the decking boards.

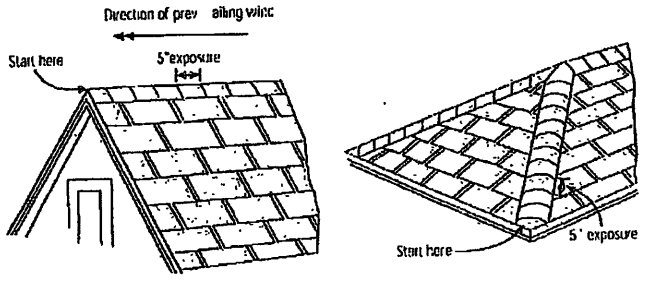

Figure 11-2
Application of hip and ridge shingles

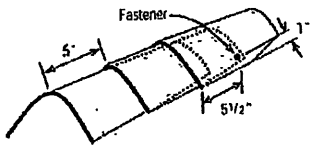

Figure 11-3
Fastener location of hip and ridge shingles

Where two hips meet the ridge as shown in Figure 11-2 or where the ridge cap ends face nailing may be required to hold the hip and ridge shingles in place. If any of the ridge shingles are face nailed, set the ridge shingle in asphalt roofing cement before nailing it in place. It is recommended to cover the head of the nails with a small spot of asphalt roof cement and granules.

NOTE:
If ridge vent is used, consult with individual manufacturer's application instructions.

NOTE:
In high wind areas, hip and ridge shingles that do not have sealant tabs should be hand sealed with quarter sized dots of asphalt roof cement (ASTM D4586) under the leading edge corners of the exposed tab.

03110

CHAPTER 12
APPLICATION OF SHINGLES ON LOW AND STEEP SLOPES

LOW SLOPE APPLICATIONS

Asphalt strip shingles may be used on slopes ranging from 2"-4" per foot if special procedures are followed. Never use shingles on slopes lower than 2" per foot.

Low slopes can lead to problems because water drains slowly from these slopes, creating the greater possibility of water backup and damage from ice dams. The special application method described below for applying shingles on low slopes ensures that the roof remains weather-tight.

A. Underlayment

There are two methods of applying underlayment for low slope application. There is the traditional method shown in Figure 12-1 that is described below. The second method uses the self-adhered shingle underlayment in place of the non-perforated asphalt saturated felt.

On low slope applications, cover the deck with two layers of non-perforated asphalt saturated felt or one layer of an appropriate self-adhered shingle underlayment. Begin by fastening a 19" wide strip of underlayment placed along the eave. Place a full width sheet over the starter sheet with the long edge placed along the eave and completely overlapping the initial layer.

All succeeding courses will be a minimum of 36" wide and should be positioned to overlap the preceding course by 19". Secure each course by using only enough fasteners to hold it in place until the shingles are applied. End laps should be 12" wide and located at least 6 feet from end laps in the preceding course.

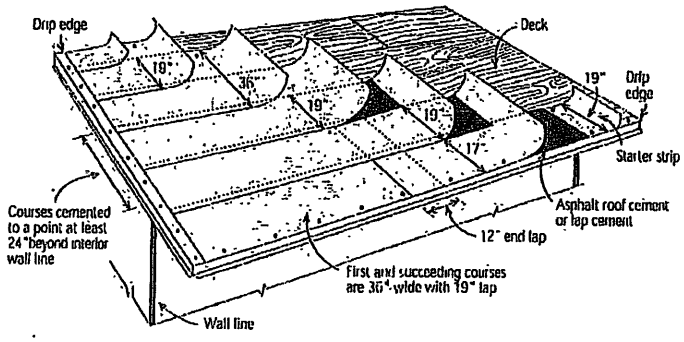

Figure 12-1
Application of underlayment on low slopes where icing along the eave is anticipated

[Note]
Self-adhered shingle underlayments are commonly used for ice dam protection. If one of these products is used, follow the manufacturer's application instructions.

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If the second method using self-adhered shingle underlayment is used on the low slope area, it should be applied as shown in Chapter 7 and figure 7-3. The only change is that you cover the entire low slope deck with the self-adhered shingle underlayment. When the entire roof is covered with self-adhered shingle underlayment, adequate ventilation of the attic space is required. Using self-adhered shingle underlayment over the entire deck is a moisture barrier, the installer must ensure that ventilation requirements are met. See ARMA Technical Bulletin on Moisture control.

In roof areas where a steep slope (greater than 4" slopes) transitions into a low slope roof area (less than 4" slopes), the low slope underlayment application should extend at least 24" up on the steep slope roof. The transition area between the steep slope and low slope is an area that needs special attention due to water build up that can occur in transition areas.

B. Eave Flashing for Ice Dam Protection

The preferred method for ice-dam protection is the use of self-adhered shingle underlayment as shown in Chapter 7. The following method is also acceptable.

Wherever there is a possibility of ice build-up along the eave or a backup of water from pine needles or leaves, cement all laps in the underlayment courses from the eave to a point at least 24" beyond the interior wall line of the building using asphalt roofing cement (conforming to ASTM D 4586) or asphalt lap cement (conforming to ASTM D 3019). The cemented double ply underlayment serves as the eave flashing. (See Figure 12-1)

To construct the eave flashing, cover the entire surface of the initial underlayment starter course with a continuous layer of asphalt roof cement applied at the rate of 2 gallons per 100 ft.^{2}; alternatively lap cement may be used at a rate of 1 gallon per 100 ft.^{2}.

Consult with the individual manufacturer, as specifications may vary. Place the first course over the starter, pressing it firmly into the cement.

After the first course is in place, coat the upper 19" with cement. Position the second course and press it into the cement. Repeat the procedure for each course that lies within the eave flashing distance. It is important to apply the cement uniformly so that the overlapping felt will float completely on the cement without touching the felt in the underlying course. Avoid excessive use of cement as it may cause blistering. Asphalt roofing cement conforming to ASTM D 4586 is recommended.

After completing the eave flashing, secure each successive course by using only enough fasteners to hold it in place until the shingles are applied. Use care when walking on the eave flashing prior to application of shingles.

STEEP SLOPE APPLICATIONS

Recent architectural trends that make much greater use of steep slopes have created radical departures from traditional roof concepts. Mansard roofs are perhaps the best examples of these trends.

Steep slopes tend to reduce the effectiveness of factory-applied self-sealing adhesives especially on colder or shaded areas of the roof. Thus, special application methods may be necessary.

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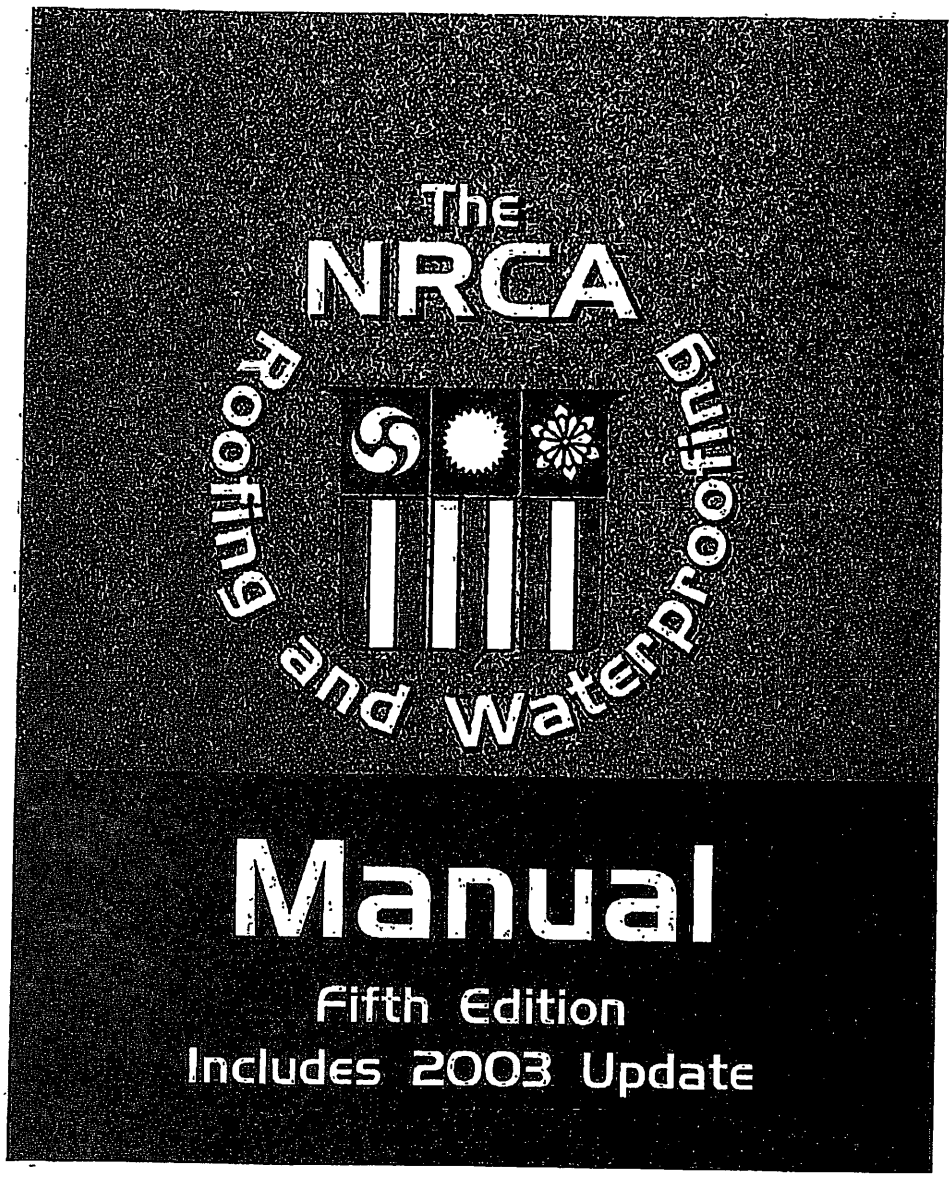
The
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Roofing and Waterproofing Manual
Fifth Edition
Includes 2003 Update

03114

1. GENERAL INFORMATION

Asphalt shingles have been used in North America since the early 1900s and are the most common type of roof covering used for steep-slope roof system construction. Asphalt shingles are factory manufactured roofing materials that are installed in courses to create a multi-layered, overlapping, water-shedding roof covering.

Asphalt shingles first were produced around 1901 and came into general use about 1910. Around 1915, machinery was developed for roller-die cutting of granular roll roofing materials into irregular shapes on a continuous production line. These new products were more fire resistant than wood shingles; offered more colors, shapes and patterns; and were less expensive. Single unit shingles often were 12 inches by 16 inches (300 mm by 410 mm). Early strip shingles were 10 inches to 13½ inches (250 to 340 mm) by 36 inches (910 mm).

An asphalt shingle generally is composed of asphalt, fillers, a reinforcing mat and a granule surfacing. They are available in a variety of colors, shapes and thicknesses. Asphalt shingle roof systems typically are applied over wood decks, such as structural wood panels, wood boards or planks, and are attached to decks with nails. An underlayment, positioned between asphalt shingles and a roof deck, is part of an asphalt shingle roof system.

2. COMPONENTS

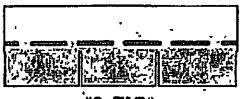
2.1 Asphalt Shingles

Asphalt shingles are categorized in different ways depending on their reinforcements and shapes. Asphalt shingles that use organic reinforcing mats are referred to as "organic-reinforced asphalt shingles," and those that use glass fiber reinforcing mats are referred to as "glass fiber-reinforced asphalt shingles."

The shapes or styles of asphalt shingles are identified as follows:

- strip shingles — These shingles are in a strip form and are the most common type of asphalt shingles produced. They generally are longer in width than height. Common dimensions for standard shingles are 12 inches by 36 inches (300 mm by 910 mm). For metric shingles, the common dimensions are approximately 13 inches by 39⅜ inches (330 mm by 1 m). These dimensions can vary depending on the manufacturer, and some newer products are available in larger dimensions than traditional standard- or metric-sized asphalt strip shingles. Products referred to as "3-tab", "4-tab", "random tab" and "no-cut out" shingles all are categorized as strip shingles. Most strip shingles are "self-sealing," that is, they contain adhesive seal strips that bond to overlying or underlying courses of shingles for increased wind resistance.
- laminated strip shingles — Sometimes called "dimensional" or "architectural" shingles, these shingles have additional material laminated to strips to create random thicknesses thereby giving the shingles more dimensional looks. Most laminated shingles are "self-sealing," that is, they contain adhesive seal strips that bond to overlying or underlying courses of shingles for increased wind resistance. Dimensions and weights can vary depending on the manufacturer, and some newer products are available in larger dimensions than traditional standard- or metric-sized asphalt strip shingles.
- individual shingles — Individual shingles typically are smaller than strip shingles, and more pieces are required to cover the same roof area than with strip shingles. Particularly in the past, individual shingles were known for their unique visual patterns. Scalloped, fish scale, diagonal, diamond and octagon are a few of the patterns that can be achieved with individual shingles depending on their design, and some of these products still are available in some regions of North America. Some individual shingles offer a locking feature for increased wind resistance, because individual shingles typically do not contain self-sealing adhesive strips. The "T-lock" design is an example of this locking type feature.

Table 1: Asphalt shingles

PRODUCT	APPROX. SIZE		TYPICAL EXPOSURE	QUANTITY PER SQUARE	
	WIDTH	LENGTH		SHINGLES	BUNDLES
SELF-SEALING STRIP SHINGLE  "3-TAB"	12 to 13-1/4 inches (300 to 337 mm)	36 to 39-3/8 inches (910 mm to 1 m)	5 or 5-5/8 inches (125 or 143 mm)	65 to 80	3
STRIP SHINGLE MORE THAN ONE THICKNESS PER STRIP LAMINATED	11-1/2 to 15 inches (290 to 380 mm)	36 to 39-3/8 inches (910 mm to 1 m)	4 to 8 inches (100 to 203 mm)	64 to 90	3 to 5
SELF-SEALING STRIP SHINGLE NO CUT OUT	12 to 13-1/4 inches (300 to 337 mm)	36 to 39-3/8 inches (910 mm to 1 m)	5 or 5-5/8 inches (125 or 143 mm)	65 to 81	3 or 4
INDIVIDUAL LOCK DOWN BASIC "T"-LOCK DESIGN	18 to 22-1/4 inches (460 to 565 mm)	20 to 22-1/2 inches (510 to 572 mm)	-	72 to 120	3 or 4
OTHER TYPES AVAILABLE FROM SOME MANUFACTURERS IN CERTAIN AREAS OF THE COUNTRY					

2.1.1 Materials

Asphalt shingle products are manufactured from three basic components: asphalt and fillers, reinforcing mat and surfacing. Asphalt strip and laminated strip shingles also use adhesives to provide self-seal strips.

2.1.1.1 Asphalt and Fillers

The weatherproofing material used to manufacture asphalt shingles is asphalt flux. Asphalt flux is obtained from the fractional distillation of petroleum that occurs toward the end of the petroleum refining process. Asphalt flux is further refined by air blowing to produce roofing-grade asphalt at an oil refinery and then is delivered to an asphalt roofing material manufacturer. Some manufacturers do their own air blowing.

Asphalt may be used in two processes: first as a saturant and second as the primary coating and weatherproofing material for an asphalt roofing product.

Saturant-grade asphalt — Asphalt used in the saturation process is a "soft," less viscous asphalt than coating asphalt and only is used for asphalt shingles that are reinforced with organic mats. It is used to impregnate an organic reinforcing mat before application of a coating asphalt.

Coating-grade asphalt — Coating asphalt is more viscous than saturant asphalt. Mineral additives, or "fillers" are added to coating asphalt to stabilize the bitumen, reduce its natural flow characteristics and increase fire resistance, making it more suitable as a coating material. Some examples of mineral additives used are limestone, fly

ash, traprock, slate dust or other rock particulates. Filler materials may differ among manufacturers or manufacturing sites.

Some manufacturers have developed asphalt shingle materials using asphalt that has been modified with various polymers. The most common polymer currently used is styrene butadiene styrene (SBS). Polymers can alter the basic physical characteristics of asphalt and may provide enhanced weathering and aging characteristics.

2.1.1.2 Reinforcing

All asphalt shingles are reinforced with a component that is designed to support the asphalt. Reinforcement most commonly is made out of one of the following materials:

- Organic Mats

During the years, organic mats have been produced from various combinations of cotton rag, wood fiber and other cellulose fibers. Currently, wood and other cellulose fibers are the reinforcement types most widely used in organic mats. Before organic reinforcing mats are coated with coating grade asphalt, it is first impregnated with a soft, saturant-grade asphalt intended to fill voids between fibers.

- Glass Fiber Mats

Glass fiber mats are composed of thin inorganic glass fibers. The fibers may be continuous or random and are bonded together with plastic binders or resin. Unlike organic mats, glass fiber mats used for asphalt shingles are not saturated with a soft asphalt before the application of coating grade asphalt.

2.1.1.3 Surfacing

Asphalt shingles most commonly are surfaced with coarse mineral granules.

Mineral granules are used for the following reasons:

- to protect an underlying asphalt coating from the degrading effects of ultraviolet light and weathering. Therefore, the granules must be opaque, properly graded for maximum coverage and densely applied over the coating-grade asphalt surface
- to increase the external fire resistance of an asphalt roofing product
- to provide a greater variety of design possibilities and aesthetic choices because of their wide range of texture, color and color blends.
- to add weight, which increases wind resistance.

Mineral granules either are made from natural colored rock granules or rock granules colored by a ceramic-coating process. Ceramic granules are currently the most commonly used coarse mineral surfacing.

Many asphalt shingle products are available with special granule surfacings that use zinc or copper particles to minimize algae growth. Zinc or copper particles are applied with a granule surfacing, or some granules may be coated with a zinc or copper compound. Once exposed to moisture, copper or zinc granules produce an algaecide for a period of time. The duration of time and effectiveness of the algaecide will vary from region to region depending on climatic conditions.

Although less common, a few asphalt shingle products are available that use foil laminate surfacing in place of mineral granule surfacing.

On the back side of asphalt shingles, finely ground minerals are applied to prevent the shingles from sticking together in a package or bundle. The materials most frequently used as fine mineral surfacings are talc and mica.

2.1.1.4 Self-sealing Strip

Commonly, asphalt strip shingles and laminated shingles contain adhesive, self-sealing strips. A self-sealing strip gives an asphalt shingle increased wind resistance by securing the leading edge of the shingle. A self-sealing strip is generally composed of an asphaltic-based, heat-sensitive adhesive that is designed to adhere to the overlying or underlying course of shingles. A modifier, similar to SBS-modified bitumen, may be added to the adhesive to make it tackier, allowing the adhesive to seal at lower temperatures. Typically, individual shingles, such as "T-Lock" shingles, do not contain this type of adhesive self-sealing strip.

During the manufacturing process, a strip of cellophane may be applied to each shingle to prevent the self-seal strips from bonding the shingles together when packaged. When packaged for shipping, the self-sealing strips align with cellophane strips. However, when strip shingles or laminated strip shingles are installed on a roof, self-sealing strips will not align with cellophane strips but will correctly bond to shingles above or below. For this reason, cellophane strips do not need to be removed from shingles before application.

2.1.2 Standards

The following American Society for Testing and Materials (ASTM) standards apply to asphalt shingle products:

- ASTM D 225, "Standard Specification for Asphalt Shingles (Organic Felt) Surfaced With Mineral Granules." This standard addresses material mass, and low and high temperature behavior, as well as other physical properties.
- ASTM D 3018, " Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules." This standard addresses fire test classification, wind resistance, loss of volatile matter after heating and other properties.
- ASTM D 3462, "Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules." This standard addresses tear strength, fastener pull-through resistance and pliability, as well as other physical properties.

NRCA recommends that organic-reinforced asphalt shingles conform to ASTM D 225, and glass fiber-reinforced asphalt shingles comply with ASTM D 3462.

2.2 Underlayment

NRCA recommends the use of underlayments with asphalt shingle roof systems. An underlayment is applied over a roof deck before the application of asphalt shingles. An underlayment performs two primary functions: it provides temporary weather protection until a roof covering is installed, and it provides a secondary weatherproofing barrier should moisture infiltrate the asphalt shingles.

In addition, underlayments generally are necessary with asphalt shingle roof systems for the following reasons:

- to comply with local building codes
- to maintain a Class A, B or C fire rating for a roof assembly
- to meet the requirements of the manufacturer for a material or system warranty

There are different underlayment configurations that can be used for asphalt roof systems:

- single layer of underlayment
- single layer of self-adhered membrane
- double layer of underlayment

2.2.1 Asphalt-saturated Felt

Asphalt-saturated felt underlayment is the most common underlayment used in steep-slope roof systems and typically uses an organic reinforcing mat.

The weatherproofing material used to manufacture roof underlayment felt is asphalt flux. Asphalt flux is obtained from the fractional distillation of petroleum that occurs toward the end of the petroleum refining process. Asphalt flux sometimes is further refined by air blowing to produce roofing-grade asphalt at a refinery or at a product manufacturer's facility.

Depending on the type of underlayment, asphalt may be used in two processes: first as a saturant and second as a coating.

Saturant-grade asphalt — Asphalt used in the saturation process is a "soft," less viscous asphalt than a coating asphalt and is used to impregnate organic reinforcing mats. A saturant-grade asphalt has a lower melting point than a coating-grade asphalt.

Coating-grade asphalt — If a felt underlayment is a coated felt, a coating-grade asphalt is applied to the felt after the saturation process. The coating asphalt is more viscous than a saturant asphalt. Mineral additives, or "fillers," are added to coating asphalt to stabilize the bitumen and reduce its natural flow characteristics and increase fire resistance and weatherability, making it more suitable as a coating material.

Underlayments are reinforced with mats that are designed to support the asphalt. Reinforcing mats of different thicknesses are used to produce underlayments of different weights. These reinforcements, sometimes referred to as carriers, are most commonly made from of organic fibers. However, some underlayments are produced that use reinforcing mats made from glass fibers.

- Organic Mats

During the years, organic mats have been produced from various combinations of cotton rag, wood fiber and other cellulose fibers. Currently, wood and other cellulose fibers are the types of reinforcements most widely used in organic mats. Organic mats then are saturated with a soft, saturant-grade asphalt intended to fill voids between fibers.

- Glass Fiber Mats

Glass fiber mats are composed of inorganic glass fibers. The fibers may be continuous or random and are bonded with plastic binders or resin. Additionally, these glass fiber mats may be further reinforced with chopped glass fiber strands. The mats then are coated with asphalt. These fiberglass reinforced felt underlayments differ from perforated glass fiber ply sheets used in bituminous, low-slope roof systems.

- Polyester or Synthetic Mats

Although not as common, some underlayments now are available that use synthetic fibers, such as polyester, as reinforcing mats.

The following American Society for Testing and Materials (ASTM) standards apply to asphalt-saturated organic felt underlayments:

- ASTM D 226, "Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing." This standard addresses material characteristics and physical properties, and provides two classifications: Type I, commonly called No. 15 asphalt felt and Type II, commonly called No. 30 asphalt felt.
- ASTM D 4869, "Standard Specification for Asphalt-Saturated Organic Felt Shingle Underlayment Used in Roofing." This standard addresses material characteristics and physical properties, and provides two classifications: Type I (No. 15), Shingle Underlayment, and Type II (No.30), Heavy Duty Shingle Underlayment.

NRCA recommends that asphalt-saturated/coated organic felt underlayments comply with the minimum physical property values listed in ASTM D 226, Type I (i.e., No. 15) or ASTM D 4869, Type I (i.e., No. 15). The primary difference between these two standards is that ASTM D 226 has higher requirements for the mass of felts and saturants. However, ASTM D 226 addresses asphalt-saturated organic felts with or without perforations. When used as underlayments, only nonperforated asphalt felts should be used.

2.2.2 Polymer-modified Bitumen Sheet Underlayments

Polymer-modified bitumen sheet membrane products are now being used as underlayments in some steep-slope roof systems. Some of these materials are marketed for use specifically as underlayments for steep-slope roof systems. Others are heavy, nonporous base sheets commonly used in low-slope roof systems.

Bitumen used in this type of underlayment is an asphalt that has been modified with polymers. The common polymers currently used are atactic polypropylene (APP) and styrene butadiene styrene (SBS). These polymers alter the basic physical characteristics of asphalt and provide enhanced weathering, aging and sealing characteristics. Polymer-modified bitumen base sheets generally are reinforced with either a glass fiber or polyester mat. Polymer-modified bitumen products used as underlayments range in thickness from approximately 35 mils to 90 mils (0.9 mm to 2.3 mm). In some cases, self-adhering polymer-modified bitumen membranes, most often used as ice-dam protection membranes, are installed over roof decks as underlayments. Self-adhering polymer modified underlayments range from 20 mils to 60 mils thick (0.5 mm to 1.5 mm). However, NRCA recommends the use of a minimum thickness of 40 mils (1.1 mm).

Some materials are more resistant to wrinkling and distortion upon exposure or after installation and exhibit better water-shedding properties than traditional asphalt-saturated organic felts. As a result, more of these types of underlayments are used for projects where a higher degree of underlayment performance is desired.

2.2.3 Ice Dam Protection Membranes

A specialized type of underlayment is an ice dam protection membrane. This underlayment provides additional protection from moisture intrusion along the eaves and in valleys where ice dams can occur during winter.

An ice dam protection membrane may consist of:

- a single layer of self-adhering polymer-modified bitumen membrane
- two plies of asphalt-saturated, nonperforated felt, first ply sheet is fastened to a deck, and the second ply sheet is adhered to the first with roof cement or cold adhesive.

The most common product used for ice dam protection is a self-adhering, polymer-modified bitumen membrane. The bitumen used in this type of membrane is an asphalt that has been modified with polymers, typically SBS. These polymers alter the basic physical characteristics of the asphalt and provide enhanced weathering and sealing characteristics.

Self-adhering, polymer-modified bitumen membranes generally are reinforced with either glass fiber or a thin layer of polyethylene on the top side. These membranes should not be exposed for extended periods of time before the application of asphalt shingles. Some polymer-modified bitumen membrane products incorporate a granule surfacing to provide a more slip-resistant surface for workers. A release paper covers the bottom side of such a membrane to prevent it from sticking to itself after it is wound into a roll.

The following American Society for Testing and Materials (ASTM) standard applies to modified bitumen ice dam protection membranes:

- ASTM D 1970, "Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials used as Steep Roofing Underlayment for Ice Dam Protection." This standard addresses thickness, tear resistance, adhesion properties, low-temperature flexibility and thermal stability, as well as other physical properties.

NRCA recommends that self-adhering, polymer-modified bitumen sheet membranes used as ice dam protection membranes on asphalt shingle roof systems be a minimum of 40 mils (1.0 mm) thick and comply with ASTM D 1970.

2.3 Asphalt Roof Cements

Roof cements commonly are used in the application of asphalt shingle roof systems. The base material used in the manufacture of roofing cement is an air-blown asphalt. The asphalt is thinned, or "cutback", with a petroleum-based solvent to create a softened, workable mixture. Some roof cements contain mineral fibers as stabilizers. Some manufacturers are now offering modified bitumen roof cements.

There are two common types of asphalt roof cement: flashing cement and lap cement. Flashing cements commonly are used on vertical surfaces and are of a trowelable consistency. Lap cements are used more specifically for bonding asphaltic materials together, and their consistencies are characterized as either trowelable or brushable.

Asphalt roof cements also are available in different grades. The two most common grades are winter or summer grades. The primary difference between the winter and summer grades is their softening point temperatures; winter grades have lower softening point temperatures than summer grades.

Common uses for asphalt roof cement in asphalt shingle roof systems are:

- to bond two layers of felt underlayment together to form an ice dam protection membrane along the eaves in place of a self-adhering modified bitumen membrane
- as a bedding cement for the purpose of sealing the base or flange of a metal accessory to a roof system
- to provide a temporary seal around roof penetrations or at walls prior to installing flashing components
- to manually seal the tabs or leading edges of asphalt shingles applied to more extreme slopes or in some cold weather applications

The following American Society for Testing and Materials (ASTM) standards apply to asphalt roof cement used as a utility cement or flashing cement:

ASTM D 2822, "Standard Specification for Asphalt Roof Cement." This standard addresses composition, pliability, high-heat behavior and adhesion properties; as well other physical requirements. Type I is a cement com-

posed of a low-softening point asphalt, and Type II is composed of a high-softening point asphalt. These classifications are further categorized by the intended application: Class I for dry surfaces or Class II for wet surfaces.

- ASTM D 4586, "Standard Specification for Asphalt Roof Cement, Asbestos Free". This standard addresses composition, pliability and high-heat behavior, as well other physical requirements. The Type I and Type II classifications are the same as ASTM D 2822; however, this standard does not differentiate between wet or dry surfaces.

The following ASTM standard applies to asphalt roof cement used as a lap cement:

- ASTM D 3019, "Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non Fibered, Asbestos Fibered, and Non Asbestos Fibered." Three types of lap cement are described in this standard: Type I, brushing consistency with no stabilizers: Type II, heavy brushing or light troweling consistency with a quantity of short-fibered asbestos stabilizers: Type III, heavy brushing or light troweling consistency with nonasbestos stabilizers.

3. DESIGN CONSIDERATIONS

3.1 Roof Deck

A roof deck provides a structural substrate over which a roof system is applied. A roof deck also must be able to provide adequate withdrawal resistance for fasteners used to attach a roof system. A roof deck material of long-term expected service life is important.

Asphalt shingles may be applied over the following substrates:

- wood plank
- wood board
- structural wood panels

For new construction, NRCA recommends designers specify roof deck slopes intended for the application of steep-slope materials at 4:12 (18 degrees) or greater. Asphalt shingles should be applied only over continuous or closely spaced wood plank or board decking and not over a spaced, or "skipped," application of wood plank or board decking.

The proper thickness and species of wood decking required for a specific roof assembly is determined by the design loads, including uplift, anticipated for the roof assembly and the distance between the supporting members. End joints of each piece of decking should be staggered. The end joints, except for matched ends (e.g., tongue-and-groove) should also be centered over the supporting members.

3.1.1 Wood Plank and Board Decking

Asphalt shingles may be applied over wood plank or board decking that is not warped, cupped or bowed. The terms wood "plank" and wood "board" generally are differentiated by thickness. The Western Wood Products Association (WWPA) defines the term plank as "a piece of lumber, from 2 but not including 5 inches thick, generally used with wide face horizontal ...". The term "board" is defined by the WWPA as "... term generally applied to lumber when the nominal size is 1 inch thick and 2 or more inches wide." Wood boards used for decks should be a minimum of 6 inches (150 mm) nominal width.

A wood plank or board roof deck is composed of solid-sawn dimensional lumber. It is typically supported by wood beams, often glue-laminated timber or glulams, and/or solid lumber joists, purlins or rafters. Wood planks or boards may be single or double tongue-and-groove, straight-edged, ship-lapped, or grooved for splines or longitudinal edges.

3.1.2 Structural Wood Panel Decking

Structural wood panel decking consists of either plywood or oriented strand board (OSB).

- Plywood Roof Decks

A plywood roof deck is composed of panels made of thin wood layers called veneers that are peeled from logs. The veneers are laid at right angles to each other, then glued together under heat and pressure. This cross-lamination adds strength and stability to the all-veneer panels. Panels consist of a number of cross-laminated layers that vary in number according to a panel's thickness.

Oriented Strand Board (OSB) Roof Decks

An OSB roof deck is composed of panels made from layers of compressed, glued wood strands. These strand layers are oriented at right angles to one another before being glued and formed into panels.

NRCA is concerned with potential fastener-holding problems and dimensional stability because of the effects of moisture where OSB and other nonveneer products are used as roof decking.

All plywood and wood-based panel roof decks suitable for application should be made from plywood or wood-based panels rated for structural use as roof sheathing. Most building codes require a label on plywood or wood-based panels ensuring that the plywood or wood-based panel complies with the criteria set forth in U.S. Product Standards (PS) PS 1-95, "Construction and Industrial Plywood", for all-veneer plywood or PS 2-92, "Performance Standard for Wood-Based Structural-Use Panels;" or APA—The Engineered Wood Association (APA) standard PRP-108, "Performance Standards and Policies for Structural-Use Panels," for structural-use panels (e.g., oriented strand board, all-veneer plywood).

Performance standards PS 1-95 and PS 2-92, which were initiated by APA—The Engineered Wood Association, formerly the American Plywood Association, have been developed under the "Procedures for the Development of Voluntary Product Standards" of the U.S. Department of Commerce. Performance standard PRP-108 was developed by APA—The Engineered Wood Association.

NRCA recommends plywood or wood-based panels intended for use as roof sheathing meet or exceed the requirements set forth by PS 1-95, PS 2-92 or PRP-108. Some roof material manufacturers will allow application of roof products over other wood substrates.

When plywood is used as a roof deck material, NRCA recommends the use of a minimum 15/32 inch (12 mm) thick or ½ inch (13 mm) nominal thickness exterior-grade plywood for 16 inch (410 mm) rafter spacings, and ⅝ inch (16 mm) nominal thickness exterior-grade plywood for 24 inch (610 mm) rafter spacings. When OSB is used as a roof deck material, a minimum of 15/32 inch (12 mm) thick exterior-grade OSB is recommended for 16 inch (410 mm) rafter spacings. The proper thickness of the structural wood panels required for a specific roof assembly is also determined by the design loads anticipated for the roof assembly and the distance between the supporting members.

All wood panel roof decks should consist of panels rated for structural use as roof sheathing. For particularly demanding applications, such as prefabricated panelized roof deck systems where cross-panel strength and stiffness or shear properties are critical, designers are recommended to use panels meeting the standard requirements for "Structural I Rated Sheathing."

Wood sheathing panels should be spaced approximately 1/8 inch (3 mm) apart to allow for expansion. End joints of wood sheathing panels that do not occur over supporting members should be blocked to provide adequate support for the sheathing panel ends.

3.1.3 Preservative-treated and Fire-retardant-treated Wood

Caution should be exercised when roof decks are constructed of wood that has been treated with an oil-borne preservative. Many roofing material manufacturers recommend that wood roof decks be constructed with wood that has been treated with a nonoil preservative pressure treatment or with nontreated, air- or kiln-dried lumber. For additional information regarding preservative wood treatment, consult the American Wood Preservers Association (AWPA).

Because of the deterioration of some fire-retardant-treated wood panels caused by chemical reaction, special care should be given to investigate the use of fire-retardant-treated wood panel decks in the design of a steep-slope roof assembly.

3.1.4 Other Deck Types

NRCA recognizes that other types of structural decking are becoming more common in steep-slope roof system construction, specifically in the commercial sector; however, NRCA recommends that asphalt shingles be attached only to structural wood panel decks or to wood plank or board decks. NRCA does not recommend the direct attachment of shingles to gypsum, concrete plank, cementitious wood fiber or similar, nonwood materials.

If deck types other than structural wood are used, NRCA suggests that a nailing substrate consisting of structural wood panels, such as plywood be installed over a structural deck.

Examples of deck types over which NRCA suggests a layer of plywood are:

- Steel roof decks
- Poured and precast, structural concrete decks

When installing asphalt shingle roof systems, NRCA does not recommend the installation of a nailing substrate over cementitious wood fiber deck panels, poured and precast lightweight insulating concrete, or poured and precast gypsum roof decks.

For ventilation purposes, if necessary, and to allow acceptable clearance for proper fastener penetration of the plywood nailing substrate, NRCA suggests the use of wood battens or metal channels attached over a structural deck to raise and separate the plywood panels from the deck surface below. The design, placement, spacing, height and attachment of wood battens or metal channels are the responsibilities of a designer. A complete roof assembly, including the structural deck, plywood nailing substrate and roof system, should be designed to meet local building code requirements. Key factors to consider during the design phase are fire resistance, structural loading, ventilation, and wind-resistance requirements of the applicable building code.

3.1.5 Steep-slope Compact Roof Assemblies

Steep-slope compact or "warm" roof assemblies are configured with each component placed immediately on top of its preceding component. Insulation is placed directly on top of or beneath a deck (or vapor retarder), and the primary roof covering is applied directly on top of rigid insulation or a deck. The name "compact" is given to these systems because each component is in immediate contact with its adjacent component with no space for ventilating the roof assembly.

In some instances, a lack of ventilation in steep slope compact roof assemblies has caused problems with premature shingle failure because of heat build-up. Other problems, such as shingle buckling, underlayment buckling and deck warping, have been reported with steep-slope compact roof assemblies and may be related to moisture accumulation.

Many asphalt shingle manufacturers will not issue warranties for shingles installed over nonventilated steep-slope compact roof assemblies. Contact asphalt shingle manufacturers to obtain warrant information and/or limitations for a steep-slope compact roof assemblies. For more information about ventilating steep-slope compact roof assemblies, see the Moisture Control section of *The NRCA Roofing and Waterproofing Manual, Fifth Edition*.

3.1.5.1 Nail-base Insulation Systems

Some types of steep-slope compact roof assemblies are constructed using nail-base insulation. Nail-base insulation is composed of a layer of insulation that is factory-adhered or laminated directly to a nailable wood panel, such as plywood or OSB. The wood panel serves as the nailing surface for underlayment and asphalt shingle roof system. When nail-base insulation is used, the insulation adhered directly to the wood panel prevents any ventilation from occurring between the shingles and insulation. A lack of ventilation and the heat-resistant properties of insulation increases the temperature to which shingles are subjected during high-temperature periods. The increased temperature may prematurely age the asphalt in the shingles and reduce the shingles' service life.

Some types of nail-base insulations provide a narrow ventilation space between the insulation and wood panel by using spacers to separate the two components. The amount of ventilation provided by these products is limited but may prevent heat buildup to some extent. Problems have been reported with venting nail-base insulation products caused by moisture accumulation in the limited ventilation space in the vented panels and vapor drive through the joints of both vented and non- vented panel joints. The types of problems that have been reported are condensation within the ventilation space, dimensional changes in wood panels, underlayment buckling and the resulting shingle buckling. Designers should carefully consider moisture control when they specify nailbase insulation systems.

3.2 Underlayment and Roof Slope

Adequate drainage of water from a roof's surface is essential for the satisfactory performance of asphalt shingles and the prevention of premature deterioration. The limitations imposed by a roof deck's slope must be taken into account during design of a roof system.

Asphalt shingles are designed for use as multi-layered, water-shedding systems. Asphalt shingles rely on slope to shed water off a roof's surface.

3.2.1 Underlayment Configurations

There are different underlayment configurations that can be used for asphalt shingle roof systems. Generally, these configurations can be categorized as follows:

- single layer of underlayment
- single layer of self-adhering underlayment
- double layer of underlayment

A "single layer of underlayment" is one layer of underlayment fastened to the deck before application of a roof covering. For single layer applications, all felts should be applied horizontally in shingle fashion and lapped a minimum of 2 inches (50 mm) over the preceding felt sheet. Endlaps should be a minimum of 4 inches (100 mm). An underlayment should be fastened with nails or staples, as necessary to hold the felts in place until the installation of a primary roof covering. (See Figures 1 and 2)

A "single-layer of self-adhering underlayment" consists of one layer of self-adhering, polymer-modified bitumen sheet membrane applied over a roof deck. This type of membrane is designed to be used as an ice dam protection membrane. Designers should note that these types of membranes, when installed over an entire roof area, act as air and vapor retarders. Potential problems with ventilation, moisture control and vapor retarder placement should be considered during the design phase. See Figures 1 and 2.

A "double-layer underlayment" is two layers of underlayment fastened to a roof deck before the application of asphalt shingles. When a double-layer underlayment is required, felt should be applied horizontally in shingle fashion. For double-layer applications, all felts should be lapped a minimum of 19 inches (480 mm) over the preceding felt sheet. Endlaps should be a minimum of 4 inches (100 mm). An underlayment should be fastened appropriately for the slope of the roof to hold the felts in place until a primary roof covering material is applied. See Figures 3 and 4

When a double-layer configuration is used and underlayment layers are identical materials, they are commonly installed in shingle fashion with 19 inches (480 mm) overlap and 17 inches (430 mm) exposure. However, if one layer is used to "dry-in" the building temporarily or underlayments of two differing compositions are used, it is common for each layer to be applied in a single-layer configuration.

3.2.2 Roof Slope

The following are recommendations for underlayments used with asphalt shingles with respect to roof slope.

- On roof decks having a slope of 4:12 (18 degrees) or more, a minimum of one layer of No. 15 asphalt-saturated felt underlayment should be applied horizontally in shingle fashion to serve as the underlayment. See Figures 1 and 2.

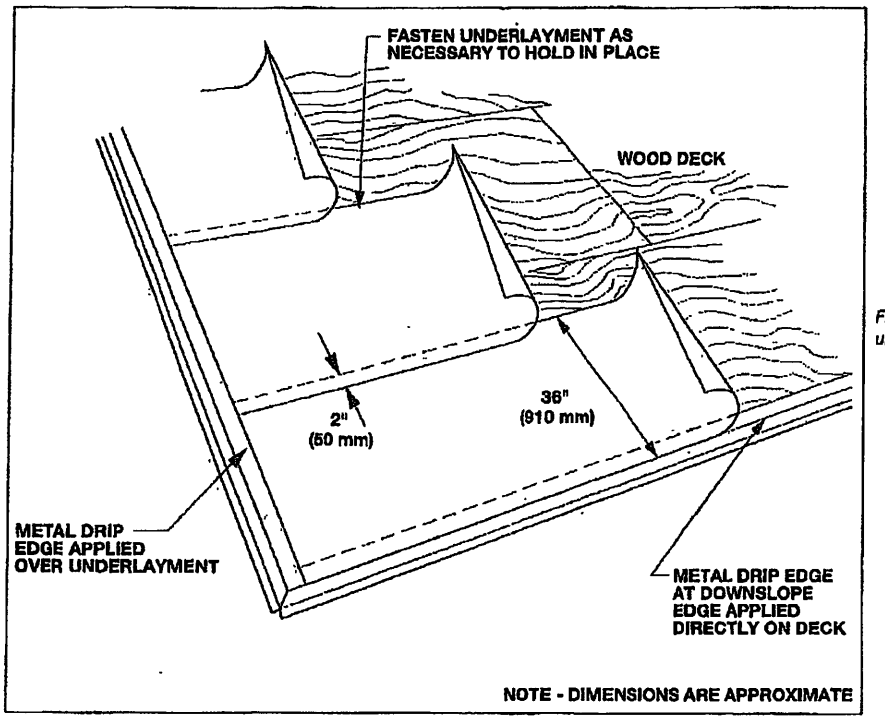


Figure 1: Single layer underlayment

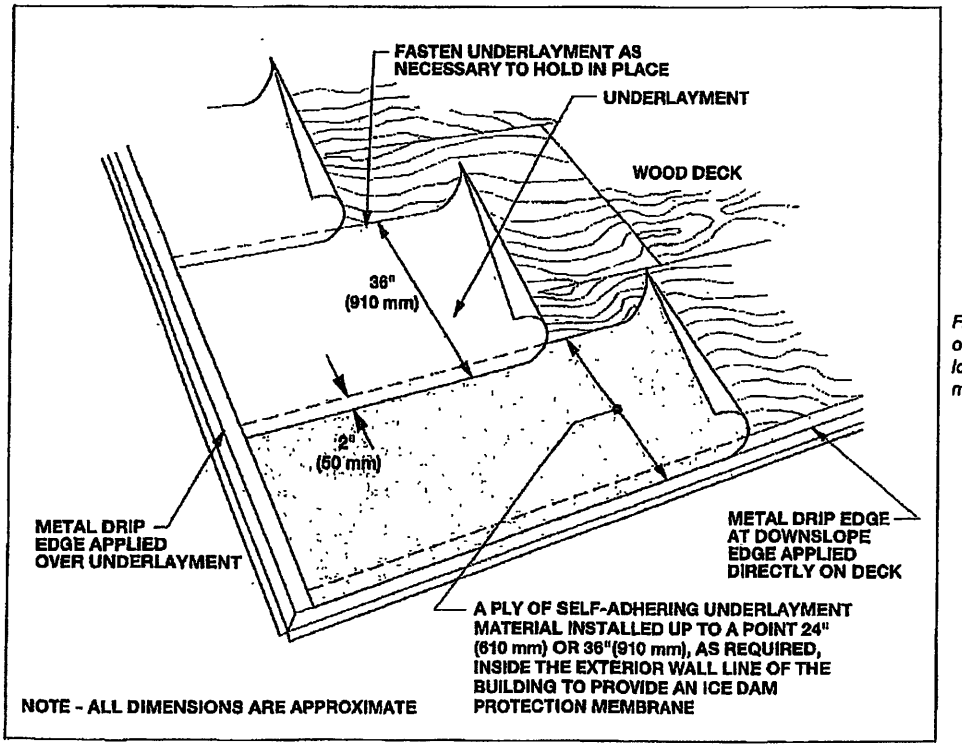


Figure 2: Single layer of underlayment with ice dam protection membrane

For roof decks having slopes of 3:12 (14 degrees) up to 4:12 (18 degrees), a minimum of two layers of No. 15 asphalt-saturated underlayment should be applied horizontally in shingle fashion, with 17 inch (430 mm) exposure and 19 inch (480 mm) underlap. See Figures 3 and 4.

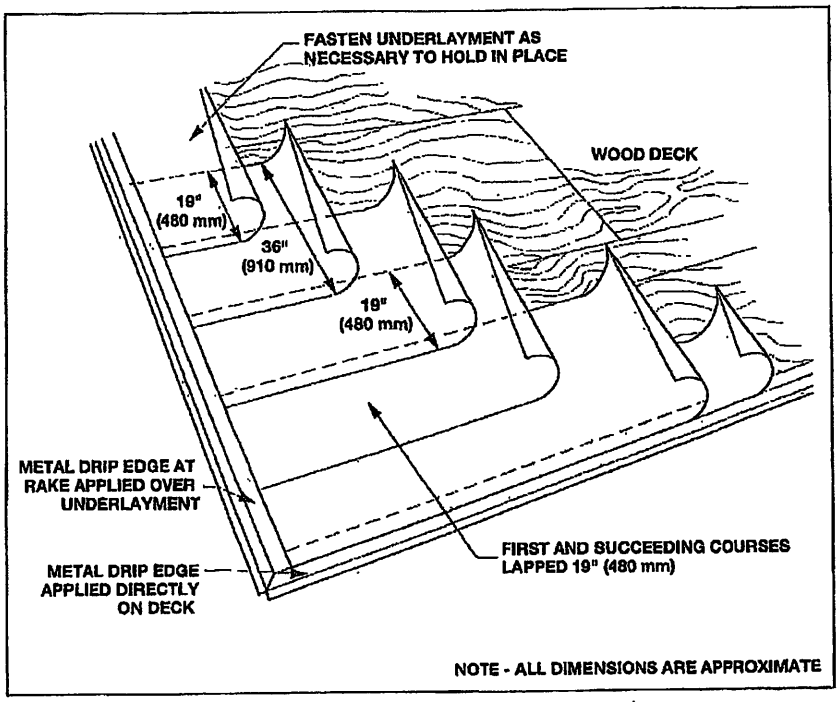


Figure 3: Double layer of underlayment

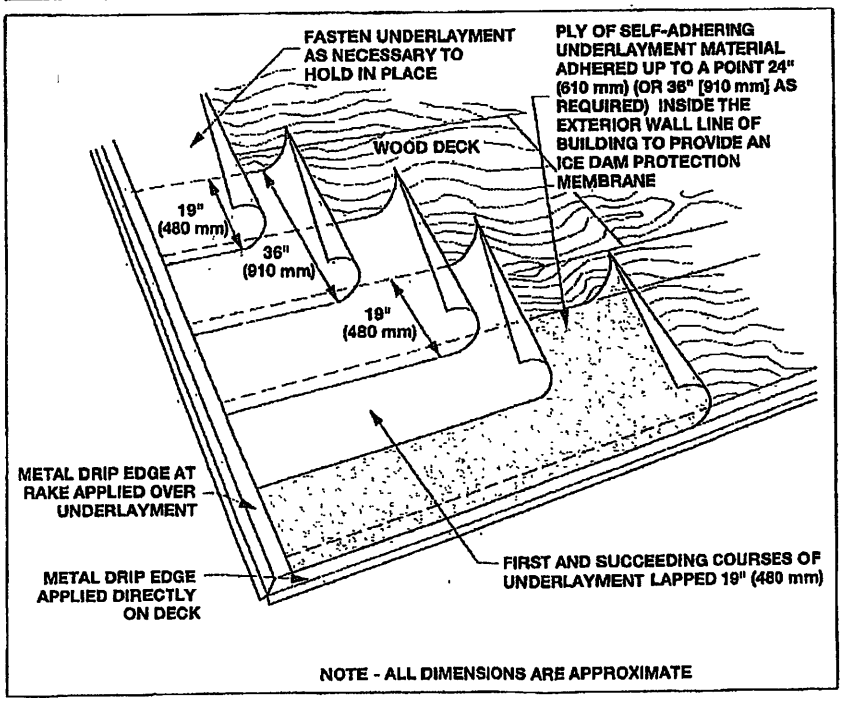


Figure 4: Double layer of underlayment with ice dam protection membrane

Some manufacturers will allow application of asphalt shingles on lesser slopes. However, NRCA does not recommend application of asphalt shingles on slopes less than 4:12 (18 degrees) for new construction.

3.3 Ice Dam Protection Membranes

Regardless of the type of underlayment required or roof slope, in locations where the average temperature for January is 30° F (-1° C) or less, NRCA suggests installation of an ice dam protection membrane. See Figure 5). An ice dam protection membrane generally is a self-adhering polymer-modified bitumen membrane. NRCA recommends that these types of self-adhering membranes be a minimum of 40 mils (1.0 mm) thick and comply with ASTM D 1970.

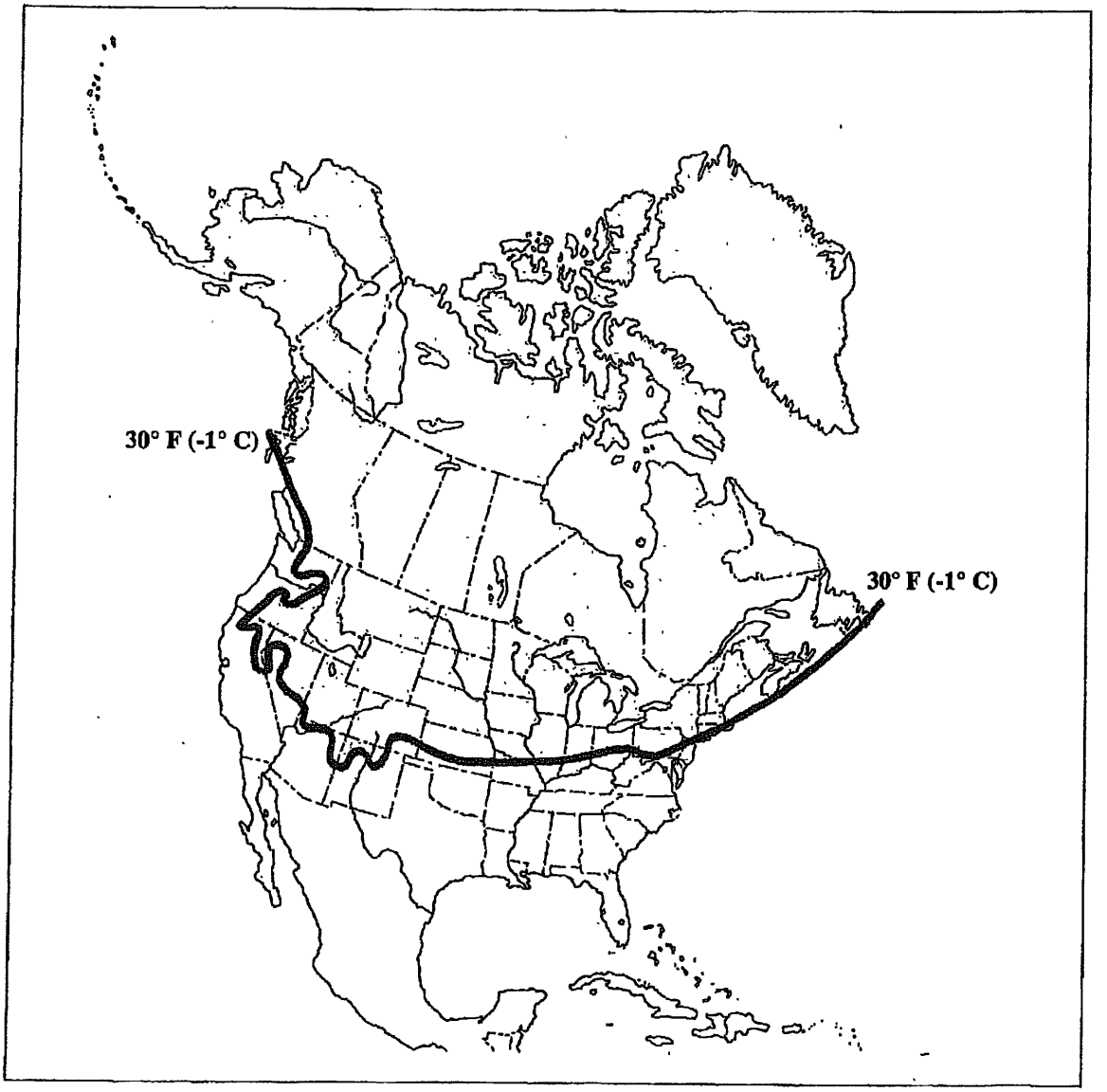


Figure 5: Approximate area of North America that has an average January temperature below 30° F (-1° C). Map courtesy of the Coastal Weather Research Center, University of Alabama.

Underlayment felts, as well as polymer-modified bitumen base sheets, cemented together with asphalt roof cement or cold adhesive also can be used as ice dam protection membranes.

An ice dam protection membrane should be applied starting at a roof system's eaves, and extending upslope a minimum of 24 inches (610 mm) from inside the exterior wall line of a building. For slopes less than 4:12 (18 degrees), NRCA recommends ice dam protection membranes be applied starting at the eaves and extending a minimum of 36 inches (910 mm) upslope from inside the exterior wall line of a building. See Figure 6.

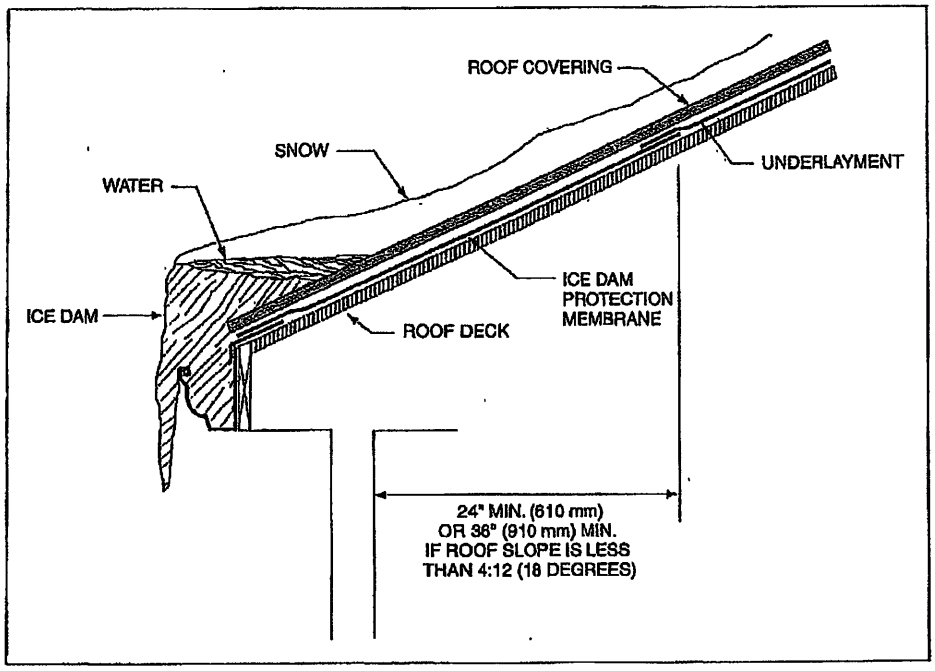


Figure 6: Example of ice damming

Ice dam protection membranes cannot be relied upon to keep leaks from occurring. Careful consideration of roof ventilation, insulation and project specific detailing for particular climatic conditions are vital. Also, self-adhering modified bitumen underlayments must not be left exposed for long periods of time. Self-adhering modified bitumen underlayments should be covered with primary roofing material as soon as practical to prevent premature degradation of the modified bitumen underlayment. See manufacturers' individual product requirements for additional information.

Designers should note that these types of membranes, when used as underlayments over entire roof area, tend to act as vapor retarders. Potential problems with ventilation, moisture control and vapor retarder placement should be considered during the design phase.

3.4 Fasteners

NRCA recommends that roofing nails used to apply asphalt shingles to wood plank, wood board or wood panel roof decks be round-headed, sharp-pointed, 11- or 12-gauge (0.105 or 0.12 inch [2.67 or 3.06 mm]) galvanized steel or the equivalent corrosion-resistant roofing nails. Nail head sizes recommended are ¾ inch (10 mm) to ⅞ inch (12 mm) in diameter. Nail heads should be low- profile, smooth and flat. Shanks should be barbed or otherwise deformed for added pull-out resistance. Nails should comply with ASTM F 1667, "Specification for Driven Fasteners, Nails, Spikes and Staples," Type I, Style 20. Not all nails that comply with ASTM F 1667, Type I, Style 20 have dimensions or shanks NRCA recommends.

Nails should be long enough to penetrate through all layers of roofing materials and achieve secure anchorage into the roof deck. Nails should extend through the underside of plywood or other acceptable wood panel decks and penetrate at least ¾ inch (19 mm) into wood plank or board decks.

Nails should be driven straight, flush and snug to the surface of asphalt shingles.

The nailing of hips, ridges and some roof accessories may require the use of longer nails because fasteners must penetrate through more layers of roofing and/or material.

For full-width shingles, a minimum of four nails should be used per shingle. See Figure 7.

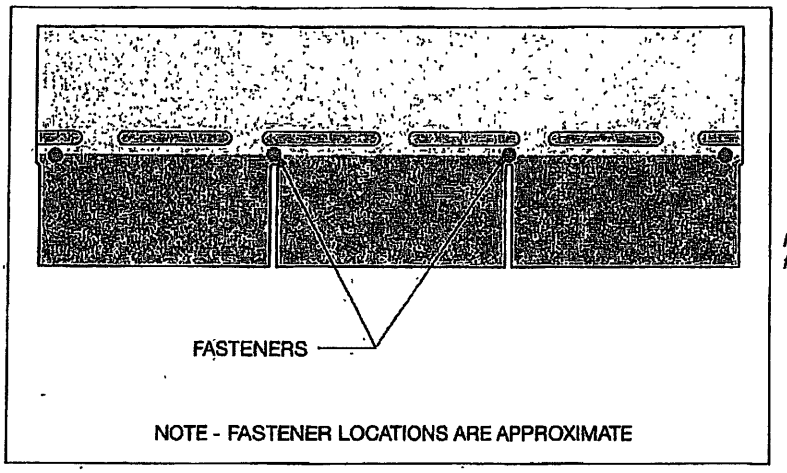


Figure 7: Approximate fastener locations for four-nail pattern

Six nails per full-width strip shingle may be required by building codes in some high-wind areas. See Figure 8.

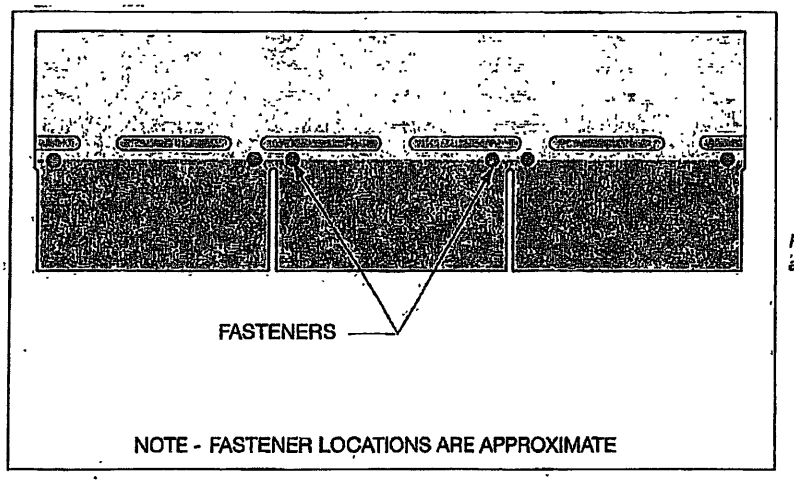


Figure 8: Approximate fastener locations for a six-nail pattern

For roof slopes 18:12 (56 degrees) and greater, NRCA recommends that asphalt shingles be fastened with six nails and manually sealed with asphalt flashing cement. The latter process is commonly known as "hand tabbing." Some manufacturers require six nails per shingle and hand tabbing on slopes as low as 12:12 (45 degrees) depending on the shingle product. Consult manufacturers for specific product requirements.

For individual shingles, a minimum of two nails should be used per shingle.

The locations for asphalt shingle fasteners as shown in Figures 7 and 8 and manufacturers' printed installation instructions should be recognized as the approximate locations where attachment is intended. Actual consistent fastener placement in the exact locations depicted is not possible in the application of asphalt shingles under normal rooftop conditions. The application of asphalt shingles in a rooftop environment is not an exact process and minor deviations from the intended fastener locations should be anticipated and tolerated.

3.5 Exposure and Appearance

Starter courses for asphalt shingles are consistent for each shape or style of shingle. Typical exposure for standard size strip shingles is 5 inches (125 mm) and for metric size strip shingles is 5 ⅝ inches (143 mm). The offset patterns illustrated only apply to three-tab shingles. Laminated strip shingles vary in style and appearance and each manufacturer's installation guidelines should be consulted for specific exposure and offset instructions.

3.5.1 Starter Courses

Before the first course of shingles is installed, a starter course is applied directly over the underlayment or ice dam protection membrane along the eave of a roof system. Its primary purpose is to shed water that may migrate through the joints and cut-outs of the shingles in the overlying first course.

NRCA suggests using self-sealing asphalt shingles for starter courses. To prepare the starter course consisting of self-sealing shingles, cut the exposed tab portion off of enough shingles to accommodate the total length of the downslope perimeter roof edge (e.g., eaves). Then, cut approximately 3 to 6 inches (76 to 152 mm) off the end of the first shingle. (See Figure 17.) Alternatively, a 9 inch (229 mm) or wider starter strip of mineral-surfaced asphalt roll roofing material may be applied along the downslope edges of the roof to serve as a starter course.

The lower edge or edges of the roofing material should be even with the outer edge of the perimeter metal flashing if extended drip edge flashing is used. (See Figure 8A.) If an "L"-type metal flashing or no flashing is used, extend the starter course beyond the perimeter eave and rake edges ¼ to ¾ inch (6 to 19 mm), according to the manufacturer's recommendations, to assist in directing runoff away from the fascia board and other underlying building components. Fasten the starter course with roofing nails along a line that is parallel to and 2½ to 4 inches (65 to 100 mm) above the downslope perimeter edges of the roof. Place the nails in such a way that the nail heads will not be exposed through the overlying shingle's cutouts or at butt joints between individual shingles that make up the first course.

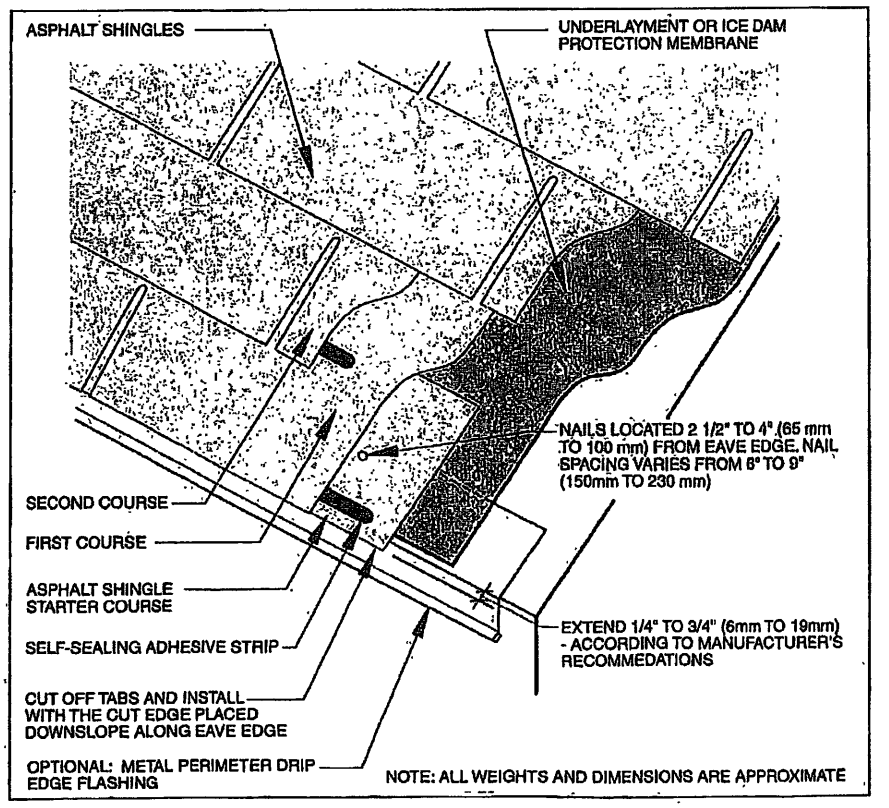


Figure 8A: Example of a starter course of asphalt shingles

3.5.2 Offset Patterns

There are several offset or side-lap gauge patterns used with three-tab shingles, and the pattern used generally is selected based on manufacturer or installer preference, regional or climatic experience, or common practice. However, there are three general pattern variations that are common for the application of square-butt, three-tab strip shingles.

Following are descriptions of these three patterns.

- Cutouts that break joints on thirds, or the 4-inch method — A cutout is the section of a three-tab asphalt shingle that has been cut out at a factory to separate individual tabs. For standard size shingles, the offset pattern is achieved by offsetting the consecutive shingle courses by 4 inches (100 mm) as shown in Figure 9. For metric-sized shingles, the offset pattern is achieved by offsetting each consecutive course 112 mm (4⅜ inches) . Cutouts are also referred to as key-way or water-slots. However, it is the gauging of these cutouts in neighboring shingle courses that gives a shingle roof system a particular pattern. See Figure 9.

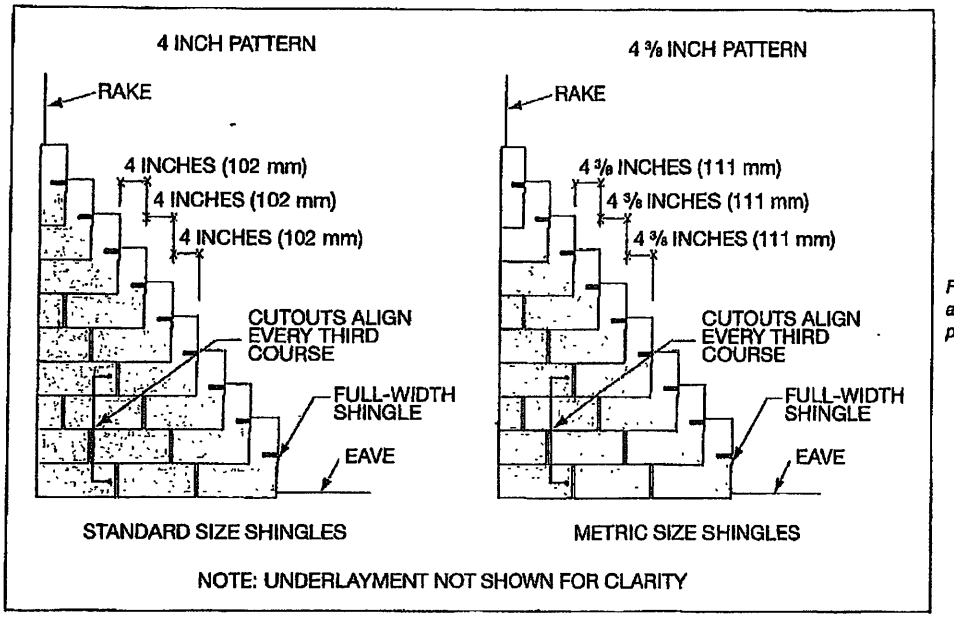


Figure 9: Example of aesthetics of a 4-inch pattern

- 5- and 5⅝-inch methods — A more random visual affect of a finished roof system can be achieved by offsetting cutouts in neighboring courses. For standard-sized shingles, the offset pattern is usually accomplished by removing approximately 5 inches (125 mm) from each consecutive course (after the first full-width shingle in the first course). For metric-sized shingles, this offset pattern is achieved by offsetting each consecutive course 143 mm (5⅝ inches) as shown in Figure 10.

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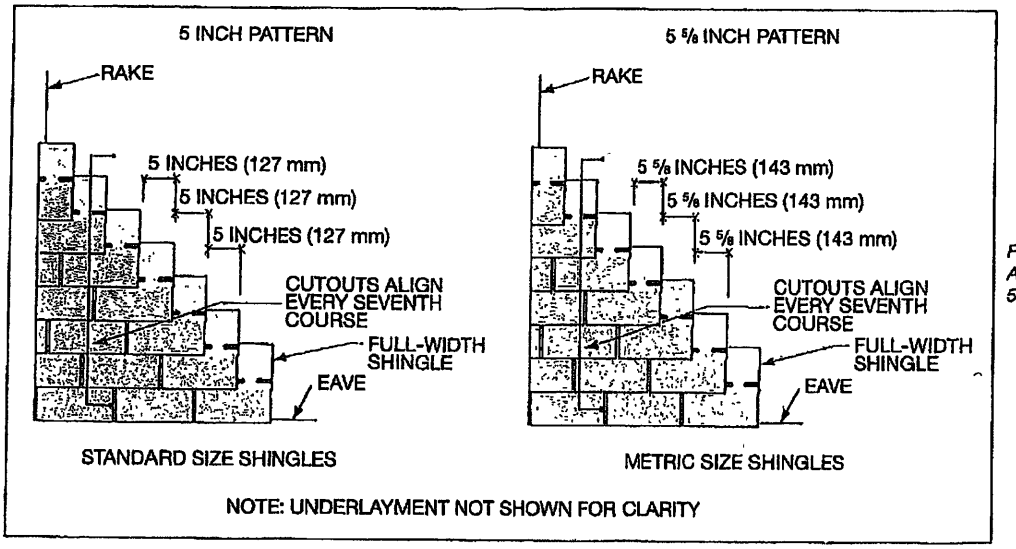

Figure 10: Aesthetics of a 5-inch pattern

- Cutouts that break joints on halves, or the 6-inch method — This procedure will establish a sidelap gauge pattern for a roof system whereby the cutouts break joints on halves with the course below the cutouts line up in every other course. For standard-size shingles, the offset pattern is achieved by offsetting consecutive shingle courses by 6 inches (150 mm). For metric- sized shingles, the offset pattern is achieved by offsetting each consecutive course 168 mm (6 ⅝ inches). (see Figure 11).

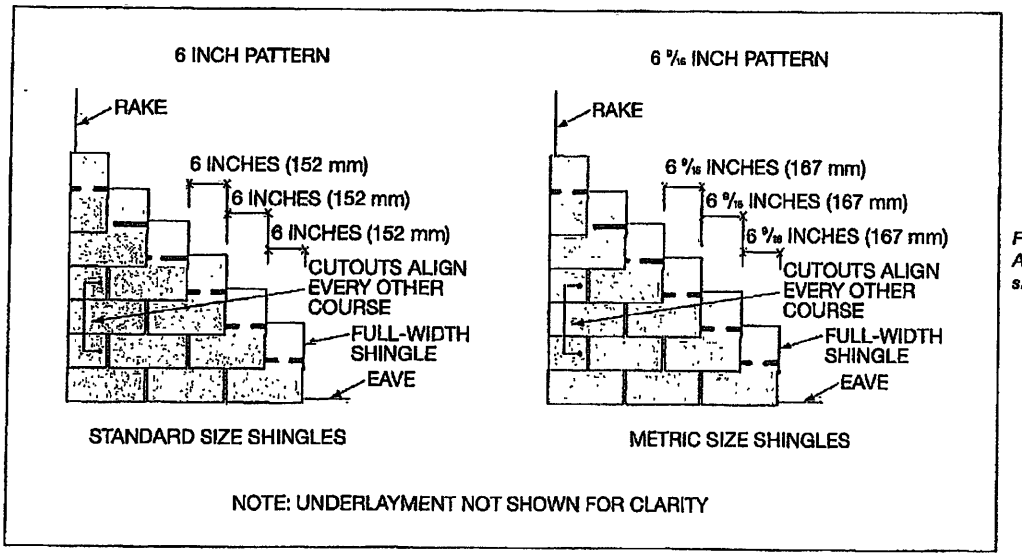

Figure 11: Aesthetics of a six-inch pattern

Because of the brittleness of some asphalt shingles and potential shading problems, NRCA does not recommend application of asphalt strip shingles using the racking method unless specifically recommended or instructed by manufacturers. Some laminate shingles require racking by manufacturers. Refer to a particular manufacturer's application instructions for the specific shingle being applied.

3.6 Flashings

Because asphalt shingle roof systems are frequently interrupted by the intersection of adjoining roof sections, adjacent walls or penetrations such as chimneys and plumbing soil-pipe stacks, all of which create opportunities for leakage, special provisions for weather protection must be made at these locations. The components used to control water entry are commonly called flashings. Careful attention to flashing details is essential to successful long-term roof system performance, regardless of roof system construction.

Flashings in this section are divided into the following categories:

- perimeter edge metal
- penetrations
- valleys
- vertical surfaces

Metal flashing should be fabricated from materials of thick enough gauges to achieve at least the expected design lives of the steep-slope roof systems used with them.

Metal used in flashings for asphalt shingle roof systems should be of a type and minimum thickness commensurate with the anticipated service life of the roof system.

3.6.1 Perimeter Edge Metal

Depending on the severity of climate, anticipated rainfall and freeze-thaw cycling, the use of perimeter edge metal should be considered. Where climate and/or roof edge construction dictates the need for perimeter edge metal, NRCA recommends a corrosion-resistant metal be specified for perimeter edge metal. See Figure 12.

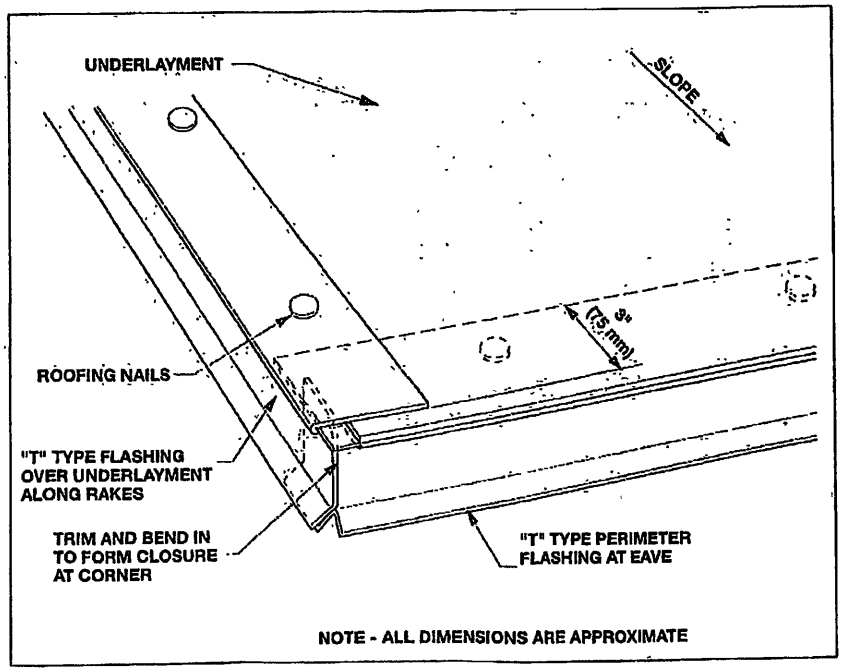

Figure 12: Perimeter edge metal at eave and rake

Where climate or roof edge construction dictates the need for perimeter edge metal, the type and minimum thickness of the metal should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests perimeter edge metal for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum
- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be area practices. Refer to the Introduction for additional information about area practices.

3.6.1.1 Bleeder Strips

Bleeder strips, also referred to as "rake starters," may be installed in place of or in combination with edge metal along the rake edges of a roof. Bleeder strips perform a function similar to starter strips that are used for a starter course and provide an extended straight edge that each course's terminating rake shingle may be cut to match.

3.5.2 Penetration Flashings

There are many other smaller penetrations that need to be flashed into asphalt shingle roof systems, such as plumbing soil stack vents, exhaust vents, furnace or water heater flue pipes, electrical standpipes and others. This is typically accomplished with the use of some type of flat flange that extends around a penetration and is installed under shingles on the upslope side of a flange. Attached and sealed to the flange is a cylinder, rectangular box or neoprene gasket that is used to seal around a penetration. These flashing components are often supplied by other trades but may be installed by a roofing contractor. See Figure 13.

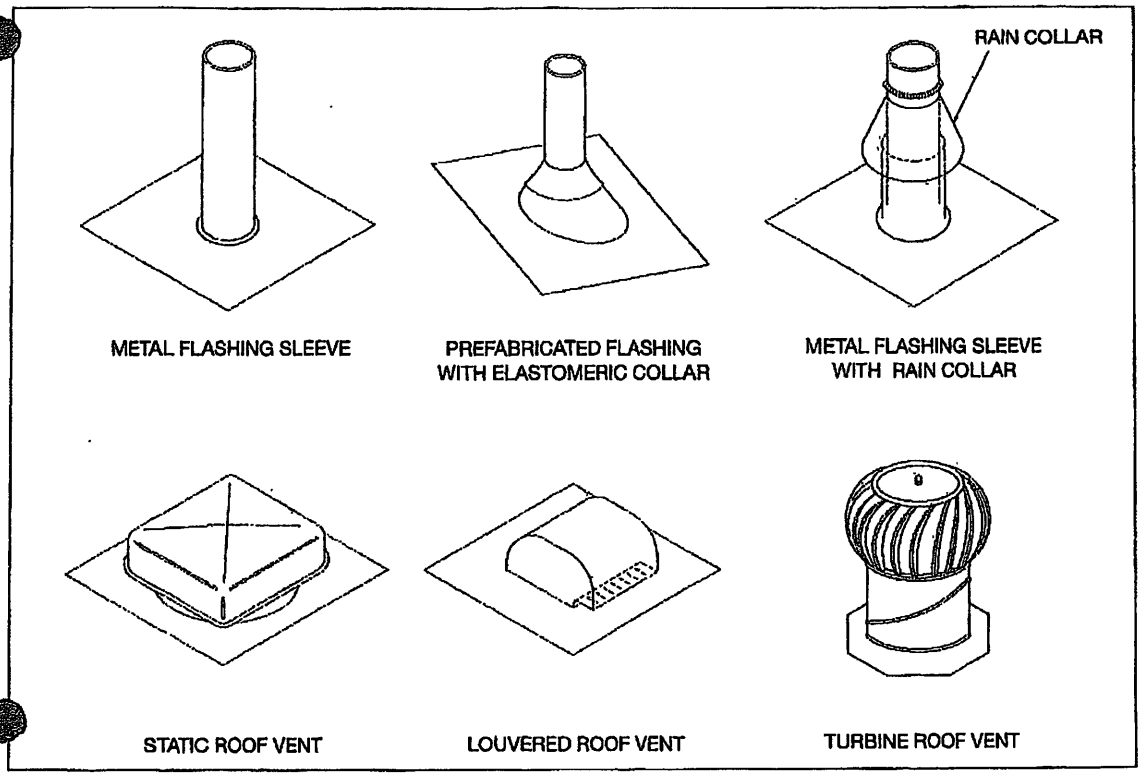

Figure 13: Examples of penetration flashings

The type and minimum thickness of the metal used for penetration flashings should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests metal penetration flashings for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum
- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper
- 4 pound (0.062 inch [1.57 mm] thick) lead.

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be area practices. Refer to the Introduction for additional information about area practices.

3.6.3 Valley Construction

A valley is created at the downslope intersection of two sloping roof planes. Water runoff from the portions of roof areas sloping into a valley flows toward and along the valley. Because of the volume of water and the lower slope along a valley line, such an area is especially vulnerable to leakage. A clear, unobstructed drainage way is desired in valleys, so the valley may carry water away quickly and perform successfully for the life of the roof system.

Where roofs of two equal slopes join to form a valley, the slope of the valley is less than that of the two adjacent fields of the roof. For example, where two sloped roofs with slopes of 4:12 (18 degrees) intersect at a valley, the actual valley slope is only about 3:12 (14 degrees).

With asphalt shingle roof systems, there are three basic types of valleys:

- open valleys
- closed-cut valleys
- woven valleys

These three general types of valleys are constructed only after the necessary layer(s) of underlayment and any valley lining material specified have been applied to a deck.

Valley underlayment construction consists of an additional full-width 36 inch (910 mm) sheet of No. 15 or No. 30 asphalt-saturated underlayment felt or polymer-modified bitumen underlayment, base sheet or ice dam protection membrane. This valley underlayment is centered in a valley. Valley underlayment sheets are secured with only enough roofing nails to hold them in place until the balance of valley materials are applied. The courses of underlayment from the fields of two adjoining roof areas are extended so that each course overlaps the valley underlayment by at least 12 inches (300 mm). A valley is then lined with the balance of the valley flashing. Another recognized installation method is weaving intersecting underlayment courses through a valley in addition to the sheet centered in the valley.

To prevent leakage it is important with all types of valley construction to avoid placing fasteners near the center of a valley. Generally, underlayment fasteners should be kept back from the center of the valley a minimum of 8 inches (200 mm). However, on low-sloped roof valleys or in climates where freeze-thaw cycling or intense rainfall may be regularly anticipated, holding nails back further from the center of the valley is not uncommon.

3.6.3.1 Open Valleys

Open valleys are typically lined with sheet metal. A metal valley is constructed by installing typically 8 feet or 10 feet (2.4 m or 3 m) lengths of corrosion-resistant metal through the valley. Asphalt shingles are lapped onto either side of the valley metal, leaving a clear space between the roofing material to channel water runoff down the valley. An example of open valley construction using metal valley material is illustrated in Figure 14.

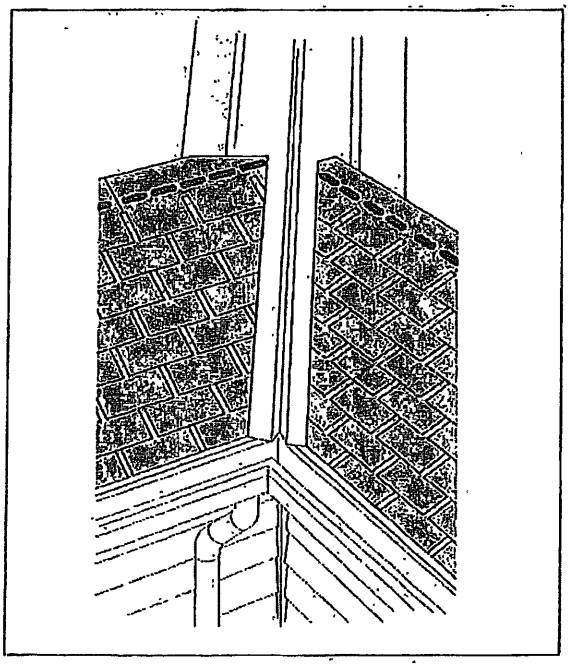

Figure 14: Typical open valley using metal valley flashing

The type and minimum thickness of the metal used in an open valley should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests valley metal for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum
- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper
- 4 pound (0.062 inch [1.57 mm] thick) lead.

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be area practices. Refer to the Introduction for additional information about area practices.

NRCA also suggests that valley metal be formed with a "W"-shaped splash diverter or rib in the center. A center rib can be especially beneficial in valleys where adjoining roof areas are of unequal slope because the rib helps prevent "wash over" of runoff. A center rib should not be less than 1 inch (25 mm) high. For easier installation and for controlling thermal expansion and contraction, NRCA suggests that valley metal pieces used with asphalt shingle roofing be no longer than 10 feet (3 m). NRCA recognizes that "V-"shaped valley metal performs satisfactorily in certain environments but not when a valley is formed by two roof slopes.

NRCA recommends that valley metal for use with asphalt shingles be a minimum of 18 inches (460 mm) wide. This means that the flanges on either side of a metal valley center line are approximately 8 inches (200 mm) wide. Having a flange width of approximately 8 inches (200 mm) allows asphalt shingles to lap onto a flange at least 4 inches (100 mm).

Open valleys permit clear, unobstructed drainage and are advantageous in locations where fallout from surrounding foliage settles on a roof system and tends to accumulate in valleys. Valley metal should be made from a material sufficiently thick enough to achieve at least the expected design life of a steep-slope roof covering.

3.6.3.1.1 Enhanced Open Valleys

In some climates, particularly those in areas prone to accumulations of snow and ice or regular freeze-thaw cycling, open valley construction can be enhanced by one of the following procedures:

- lining a valley with a self-adhering modified bitumen underlayment material before application of the metal valley
- stripping in the flanges on either side of a metal valley with a 9 inch to 12 inch (230 mm to 300 mm) strip of self-adhering modified bitumen underlayment material. The self-adhering material is adhered onto the valley metal flange and an underlying width of similar self-adhering membrane material
- tapering the valley so that it is wider at the low point than it is at the high point.

Tapering a valley has the following advantages:

- allows for increase in water runoff volume to be received at the downslope end
- allows any ice that may form within a valley to free itself when melting and slide down and exit the valley rather than lodging somewhere along the length of the valley

A valley's width or the amount of space between the intersecting asphalt shingles, should increase uniformly so the valley widens as it continues downslope. The difference in the width of the upper end of a valley and lower end is referred to as the taper. In most climates, the amount of valley taper is suggested to be approximately ⅛ inch (3 mm) for 12 inches (300 mm). For example, in a valley 16 feet (5 m) long, the distance between asphalt shingles should be 2 inches (50 mm) greater at the bottom of the valley than at the top.

3.6.3.2 Closed-cut valleys

In closed-cut valleys, shingles on one side of the valley are installed across the valley and shingles from the other side are cut about 2 inches (50 mm) off the center line of the valley and may be sealed with asphalt roof cement. See Figure 15.

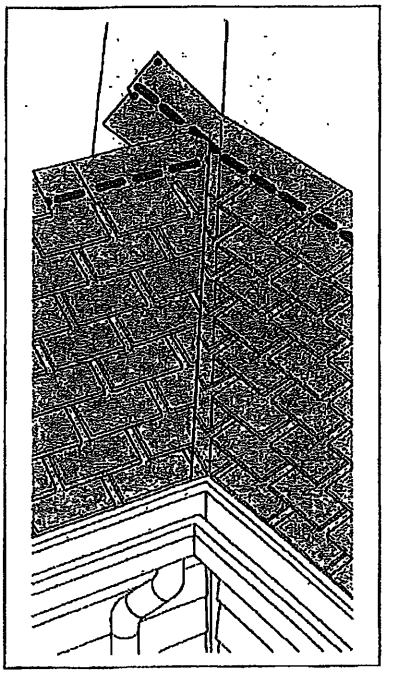

Figure 15: Closed-cut valley

3.6.3.3 Woven Valleys

Shingles from adjoining roof areas are woven to form a closed valley. The woven valley method illustrated in Figure 18, is generally limited to strip shingles on roof systems where the valley slopes are at least 4:12 (18 degrees). Where heavy accumulations of debris or plant growth may accumulate between shingle cutouts and joints, a woven valley may hamper runoff. Therefore, as with all valley types, specifying a woven valley should be carefully considered to be sure it is beneficial for a particular project.

NRCA does not recommend the use of woven valleys with laminated or individual locking-type shingles. Laminated shingles can be difficult to use to create a woven valley. When laminated shingles from opposite sides of a valley are woven, they can make for a relatively thick buildup of material, which can make the resultant valley irregularly sloped and slower draining. Individual locking-type shingles cannot be used with woven valley construction because nails are required for each tab, which would mean placing nails at or near the center of a valley. See Figure 16.

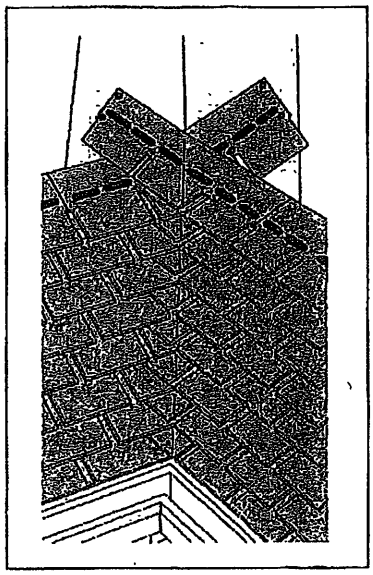

Figure 16: Woven valley

3.6.4 Vertical Surfaces

There are four types of metal flashings that are commonly used at locations where a roof system abuts a vertical wall:

- apron flashing — a metal used at a head-wall transition, such as the downslope side of a chimney.
- step flashing — used at a side-wall transition, such as the side of a dormer.
- cricket or backer flashing — used at the upslope side of a roof penetration, such as a chimney
- counterflashing — secured to a vertical wall and used to cover and protect the top edge of an apron, step and cricket (or backer) flashing.

Figure 17 shows a chimney penetration and the use of all four flashing types.

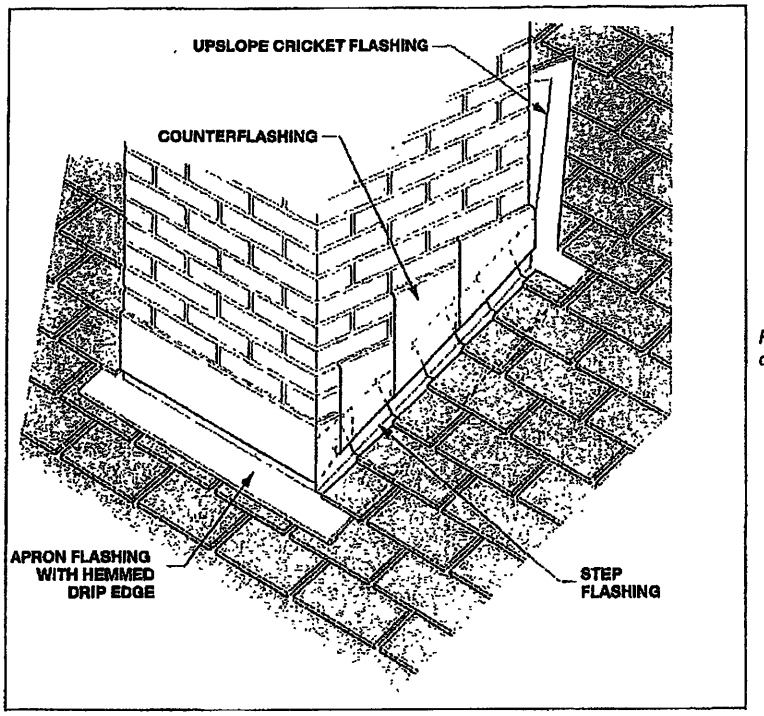

Figure 17: Basic sheet metal flashing components used at chimney

Generally, before flashings are applied, an asphalt-saturated felt underlayment should be applied to a roof deck around roof penetrations. However, in moderate and severe climates, before an underlayment is applied, an ice dam protection membrane may be installed around the base of chimneys or curbs. If appropriately specified and constructed, an ice dam protection membrane can assist in keeping water from migrating into a roof system at these roof-to-wall intersections during times of severe freeze-thaw cycling.

3.6.4.1 Apron Flashings

Apron flashings provide a weatherproofing transition material where a roof area intersects a head wall. Common locations for apron flashings are the front downslope side of a dormer or chimney, curbed roof penetrations and clerestory transitions. See Figure 18.

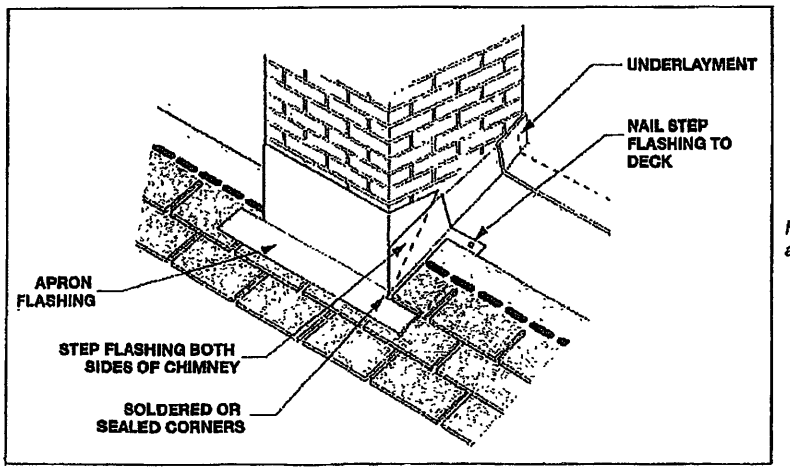

Figure 18: Apron flashing at chimney

The type and minimum thickness of the metal used for apron flashing should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests metal apron flashings for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum
- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper
- 4 pound (0.062 inch [1.57 mm] thick) lead.

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be area practices. Refer to the Introduction for additional information about area practices.

3.6.4.2 Step Flashings

When a roof area intersects a side wall, individual pieces of metal flashing are installed at the end of each shingle course. This is referred to as step flashing. See Figure 19.

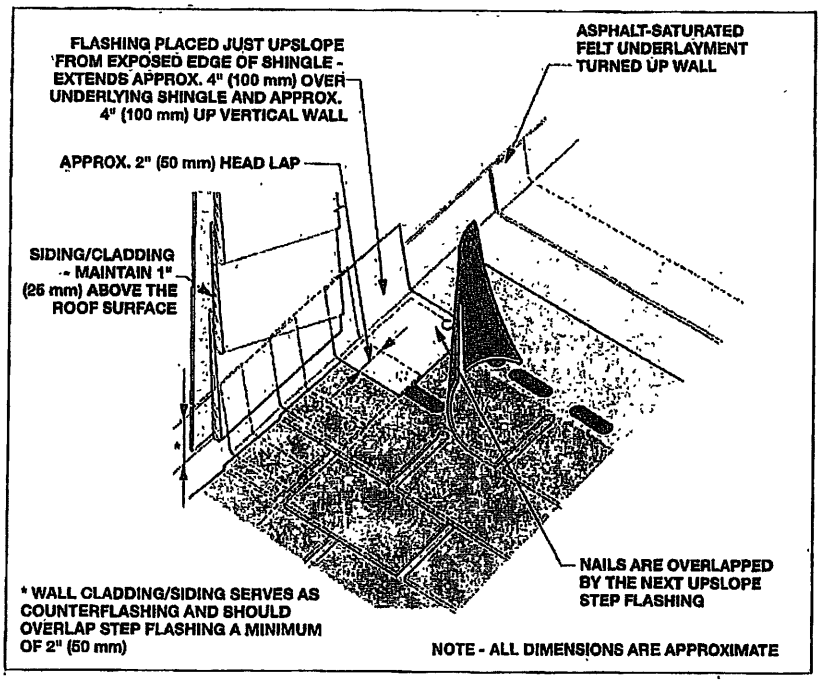

Figure 19: Use of metal step flashing for weatherproofing the intersections of sloping roof and vertical wall

The type and minimum thickness of the metal used for step flashing should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests metal step flashing for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum

- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper
- 4 pound (0.062 inch [1.57 mm] thick) lead.

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be regional practices. Refer to the Introduction for additional information about regional practices.

For most regions, NRCA suggests using metal step flashing that is 7 inches (180 mm) long by 8 inches (200 mm) wide for standard-size shingles, so a 2 inch (50 mm) minimum step flashing headlap is achieved and a 4 inch (100 mm) extension is obtained onto each underlying shingle and 4 inches (100 mm) up the vertical surface.

Many suppliers and contractors are continuing to use a narrow width of step flashing (as narrow as 5 inches [125 mm]), so only 2 ½ inches (64 mm) extends out onto underlying shingles. Experience has shown this detail can work in some relatively mild geographic areas.

For nonstandard shingles, the length of step flashing can be determined by using the general guideline:

Exposure + 2 inches = length of step flashing

(Exposure + 50 mm = length of step flashing)

For example, if a shingle's exposure is 8 inches (200 mm), the size of the step flashing would be 8 inches (200 mm) wide by 10 inches (250 mm) long.

Special attention needs to be paid to the first (i.e., bottom most) step flashing where an eave intersects a continuous vertical surface to ensure water is diverted to the outside of the wall covering. See Figures 20 and 21.

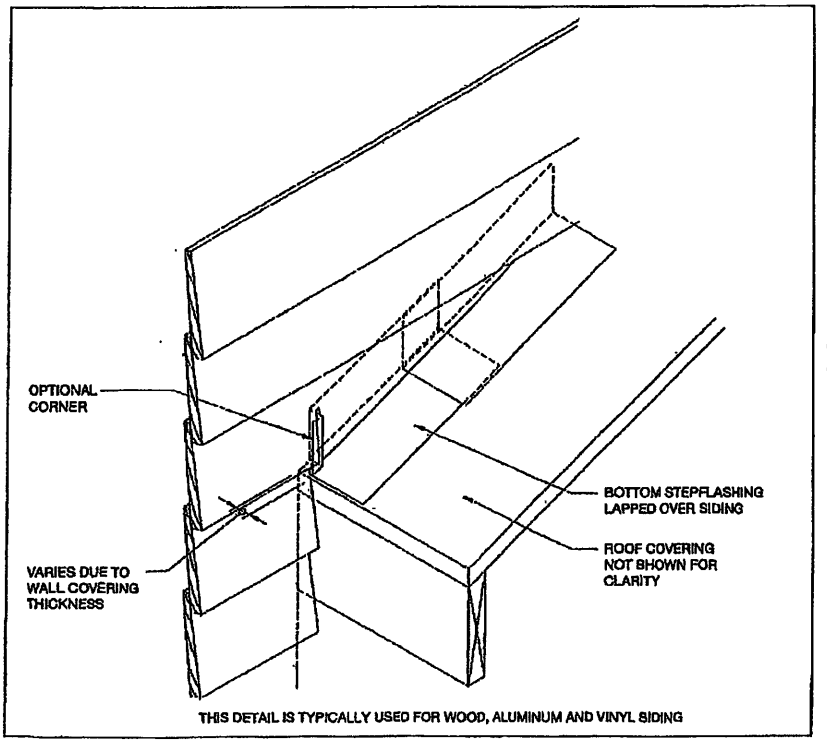

Figure 20: Soldered one-piece step flashing at eave-to-wall interface

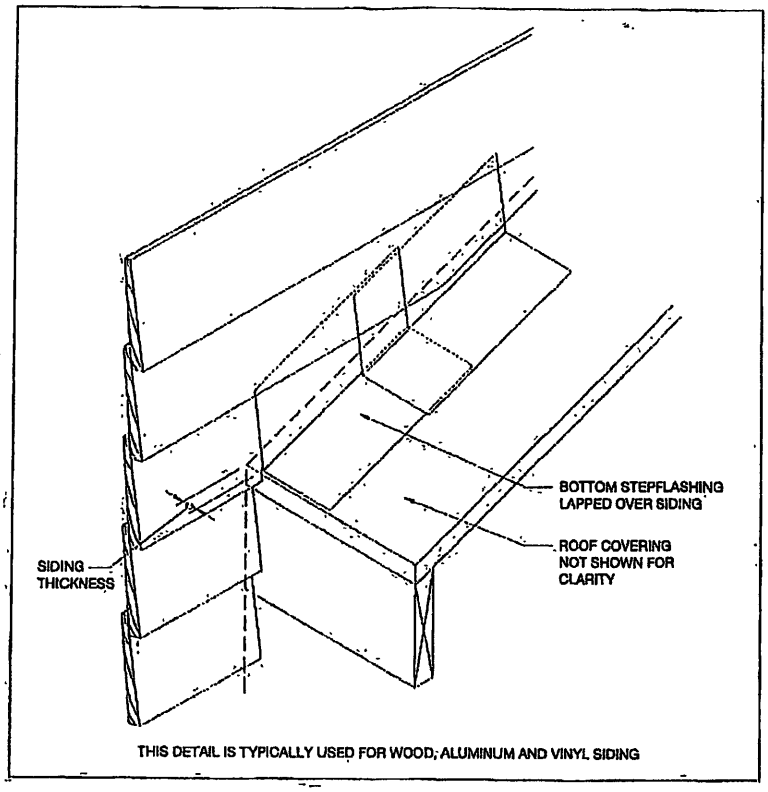

Figure 21: Step flashing at eave-to-wall interface

3.6.4.3 Cricket or Backer Flashings

When a roof area intersects the upslope side of a chimney or curbed roof penetration, either a cricket or backer flashing is installed. A cricket diverts water around the penetration, and a backer flashing provides a weatherproofing transition material where the roof intersects the back of the penetration. See Figure 22.

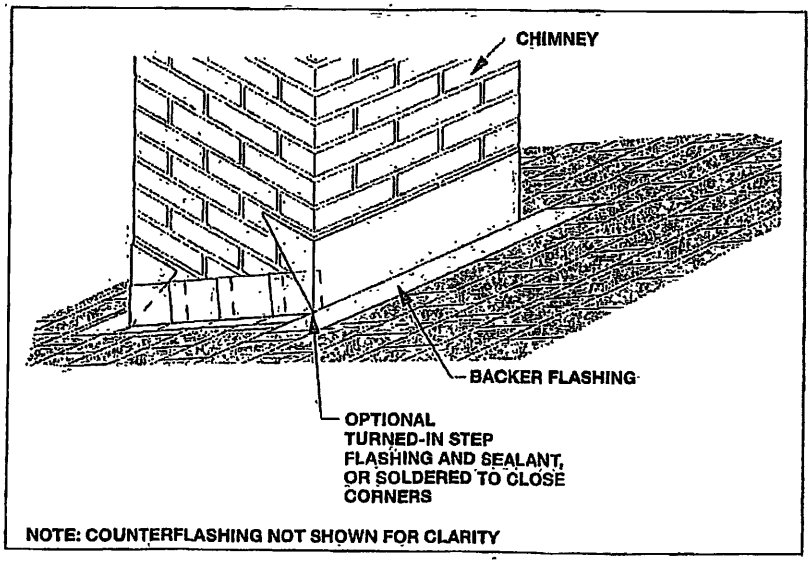

Figure 22: Example of sheet metal backer flashing at chimney

NRCA recommends that designers specify crickets at the upslope side of chimneys or curbed roof penetrations when:

- a large volume of water, snow, ice or debris is expected
- the chimney or curb is more than 24 inches (600 mm) wide
- the roof slope is 6:12 (27 degrees) or greater
- the average January temperature is 30° F (-1° C) or lower and significant accumulations of snow and ice are anticipated on the upslope side of the chimney or curb

The type and minimum thickness of the metal used for cricket or backer flashings should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests metal cricket and backer flashings for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum
- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper
- 4 pound (0.062 inch [1.57 mm] thick) lead.

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be area practices. Refer to the Introduction for additional information about area practices.

For metal crickets wider than 18 inches (460 mm), NRCA suggests wood framing be installed at the underside to support the metal cricket.

In some instances, a roof deck at the upslope side of a chimney or curbed roof penetration forms a cricket. When this occurs, it is generally treated in the same way as a dormer where similar valley and ridge detailing conditions occur, and asphalt shingles are used to cover the main surface area of the cricket. Figures 23, 24 and 25 illustrate examples of crickets used behind chimneys.

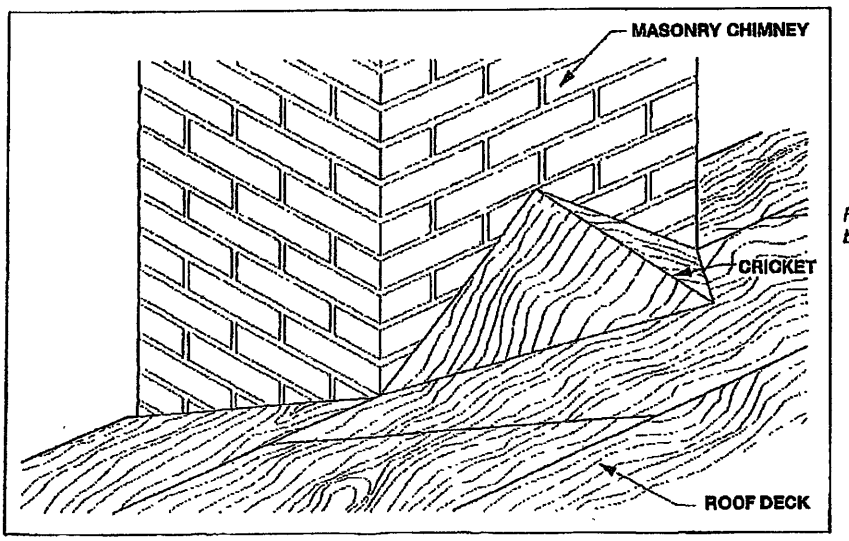

Figure 23: Example of wood cricket built on upslope of chimney

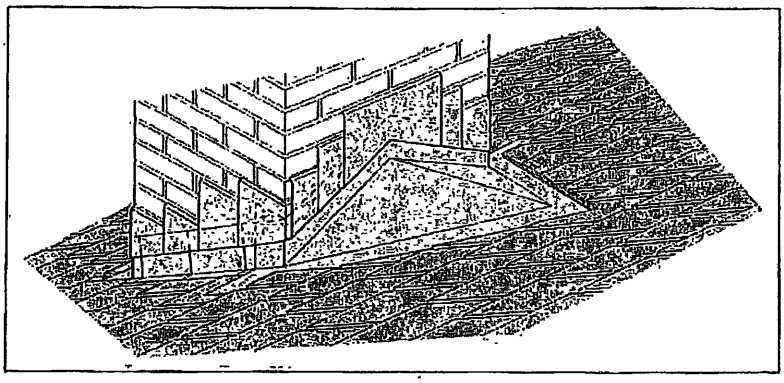

Figure 24: Example of cricket flashing for upslope portion of masonry chimney

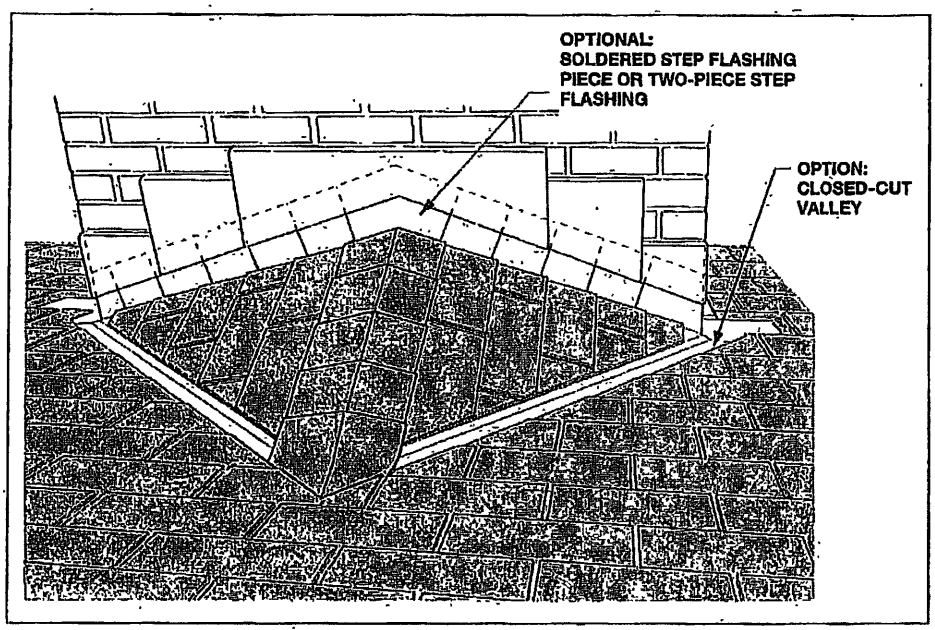

Figure 25: Example of cricket roofed-in with shingles

Generally, before any valley metal is applied, an asphalt-saturated felt underlayment should be applied to a roof deck around a chimney. However, in moderate and severe climates, before an underlayment is applied, an ice dam protection membrane should be installed around a chimney. If appropriately specified and constructed, an ice dam protection membrane can assist in keeping water from migrating into a roof system at the intersection with a chimney during times of severe freeze-thaw cycling.

3.6.4.4 Counterflashings

Apron, step, cricket and backer flashings require some form of counterflashing to cover and protect their top edges from water intrusion. In many instances, the wall covering or cladding material performs the counterflashing function. Where this does not occur, a metal counterflashing mounted to the vertical wall should be installed along the top edge of flashing metal. See Figures 26, 27 and 28.

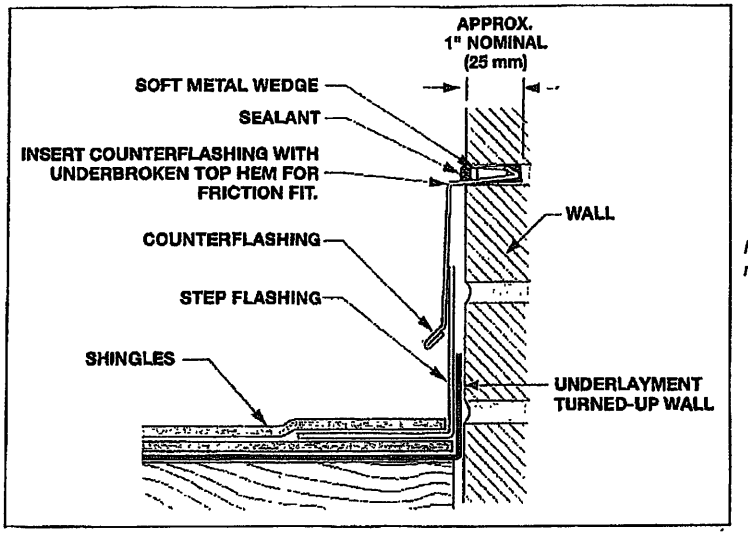

Figure 26: Metal counterflashing inset in masonry mortar joint

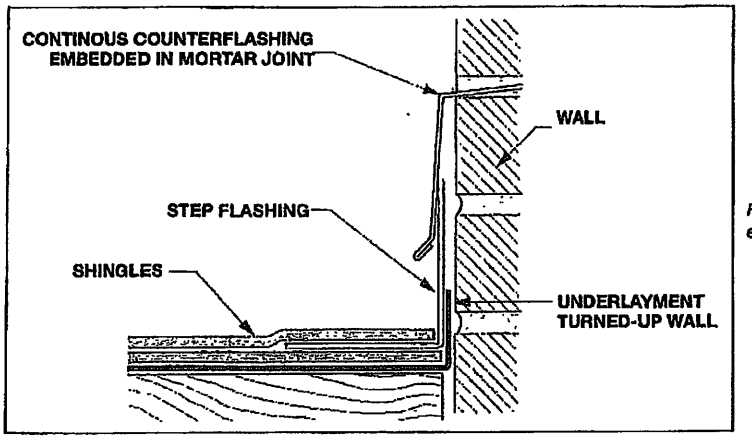

Figure 27: Through-wall metal counterflashing embedded in masonry

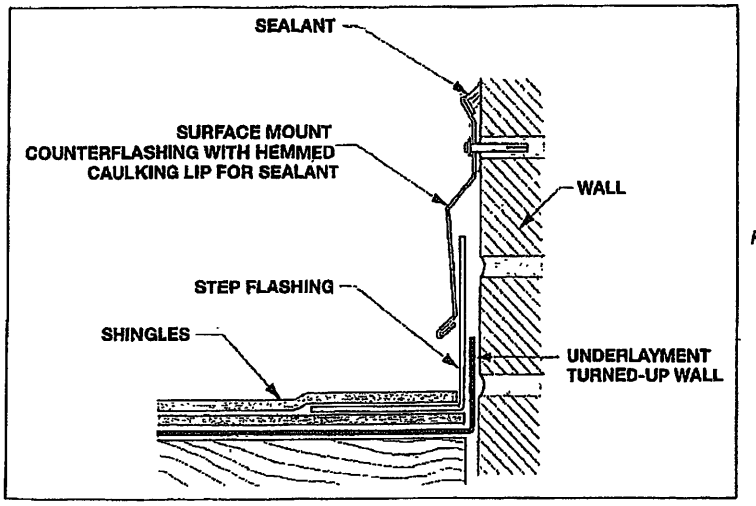

Figure 28: Surface mount metal counterflashing

The type and minimum thickness of the metal used for counterflashings should be commensurate with the anticipated service life for the asphalt shingle roof system. NRCA suggests metal counter flashings for asphalt shingle roof systems be fabricated from one of the following metal types and minimum thicknesses.

- 26 gauge (0.019 inch [0.48 mm] thick) galvanized steel
- 26 gauge (0.019 inch [0.48 mm] thick) prefinished galvanized steel
- 0.032 inch (0.81 mm) thick aluminum
- 0.032 inch (0.81 mm) thick prefinished aluminum
- 26 gauge (0.018 inch [0.46 mm] thick) stainless steel
- 16 ounce (0.022 inch [0.56 mm] thick) copper
- 16 ounce (0.026 inch [0.66 mm] thick) lead-coated copper

In some regions, particularly those with mild climates, other types of metal and/or metals of lesser thickness than are shown above may be used successfully. NRCA considers these applications to be area practices. Refer to the Introduction for additional information about area practices.

Where wall cladding counterflashes wall flashing metal (e.g., step flashing), NRCA recommends that the cladding material and underlayment extend past and cover the top edge of the flashing metal a minimum of 2 inches (50 mm).

3.7 Standards Applicable to Asphalt Shingle Roof Assemblies

The following standards apply to asphalt shingle roof assemblies:

- ASTM E 108, "Standard Test Methods for Fire Tests of Roof Coverings." This standard contains a test method to assess and classify a roof assembly's resistance to external fire exposure. A material is rated as Class A, B or C. The Class A rating denotes the greatest resistance to external fire exposure, and Class C denotes the least resistance.
- ANSI/UL 790, "Tests for Fire Resistance of Roof Covering Materials." This standard contains a test method to assess and classify a roof assembly's resistance to external fire exposure. A material is rated as Class A, B or C. The Class A rating denotes the greatest resistance to external fire exposure, and Class C denotes the least resistance. This standard is similar to ASTM E 108.
- ASTM D 3161, "Standard Test Method for Wind Resistance of Asphalt Shingles." In this test, asphalt shingle test assemblies are exposed to an air velocity of 60 mph (27 m/sec). An assembly fails if shingle tabs lift or if locking ears, for interlocking shingles only, disengage or tear loose during the two-hour test period.
- UL 997, "Wind Resistance of Prepared Roof Covering Materials." Similar to ASTM D 3161, this standard contains a test method to gauge wind resistance of prepared roof covering materials installed on a test deck. The test panel is subjected to a 60 mph (27 m/s) for two hours. An assembly fails if any full shingle tab or any free portion of a shingle lifts up or if locking ears, for interlocking shingles only, disengage or tear loose during the test period.
- UL 2218, "Impact Resistance of Prepared Roof Covering Materials." This standard evaluates a roof covering's resistance to impact. Four classifications—Class 1, 2, 3, or 4— are contained in the standard and relate to the roof system ability to withstanding impacts from 1¼, 1½, 1¾, and 2 inch (32, 38, 44 and 50 mm) steel balls, respectively.

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Laminated Shingles

Landmark™ Series and Landmark™ TL

12

YOUR OBJECTIVE:
To learn the correct procedure for installing Laminated shingles.

LANDMARK™ SERIES AND LANDMARK™ TL

Landmark shingles have the installer-friendly WideTrack QB™ feature, which provides 1½" wide nailing area and specially formulated Quadra-Bond laminating adhesive. *(See Figure 12-3).*

Landmark Special is impact resistant and is specially manufactured with a reinforced fiberglass scrim to meet UL 2218 Class 4 impact resistance rating.

NOTE: Landmark Special must be installed over a clean deck (no roof-overs) to obtain the UL 2218 rating. It is strongly recommended that impact resistant cap shingles made from XT 30 IR shingles be installed on all hips and ridges. Some insurance carriers may not consider the roof system as compliant to UL 2218 Class 4 without impact resistant cap shingles.

Landmark TL is unique because its patented Tri-Laminate™ design combines three layers of material to provide a dramatically thick shingle with a wood shake style.

With the exception of Landmark TL, closed-cut valleys are preferred by CertainTeed when applying these shingles. **Open valleys are recommended when applying Landmark TL;** however closed-cut valleys are also acceptable. Woven valleys are not recommended for Landmark TL because the tri-laminated shingle can buckle and become damaged when shaped into the valley. **Nails are required as fasteners for Landmark TL,** staples are not allowed.

STANDARD OR STEEP SLOPE UNDERLAYMENT: Shingle underlayment* meeting ASTM D 4869 Type I standards is suggested. CertainTeed's Roofers' Select™, ShingleFelt™, or RoofWrap™ is preferred.

LOW SLOPE UNDERLAYMENT: One layer of WinterGuard™ or its equivalent*, or two layers of 36" (915 mm) wide felt shingle underlayment lapped 19" (485 mm) must be applied over the entire roof.

IMPORTANT: When installing LandMark TL on low slopes, one layer of WinterGuard or an equivalent waterproofing shingle underlayment must be applied over the entire roof. **Applying two layers of felt shingle underlayment is not an acceptable alternative to WinterGuard.** One layer of shingle underlayment meeting ASTM D4869 applied over the required WinterGuard is also recommended.

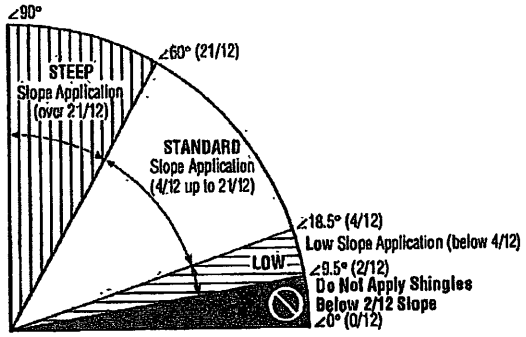


Figure 12-1: Slope definitions.

THE ROOF DECK* MUST BE AT LEAST: ⅜" (9.5 mm) thick plywood, **or** 7/16" (11 mm) thick non-veneer, **or** nominal 1" (25 mm) thick wood deck.

COLD WEATHER CLIMATES (ALL SLOPES): Applying WinterGuard or its equivalent* is strongly recommended wherever there is a possibility of ice build-up.

FLASHING: Corrosion-resistant flashing must be used to help prevent leaks where a roof meets a wall, another roof, a chimney or other objects that penetrate a roof.

SEALING: Shingle sealing may be delayed if shingles are applied in cool weather and may be further delayed by airborne dust accumulation. If any shingles have not sealed after a reasonable time period, hand sealing may be necessary.

CAUTION: To prevent cracking, shingles must be sufficiently warm to allow proper forming for hips, ridges and valleys.

WARRANTY: These shingles are warranted against manufacturing defects and are covered by SureStart™ protection. See the warranty itself for specific details and limitations.

*

For technical questions, information on acceptable alternative application methods and materials, or a copy of the product warranty, contact the sources listed below:		Warranty	Alternate Instructions	Technical Questions
Your supplier or roofing applicator		✔		
CertainTeed Home Institute	800-782-8777	✔	✔	
CertainTeed-RPG Technical Services	800-345-1145	✔	✔	✔

FASTENING

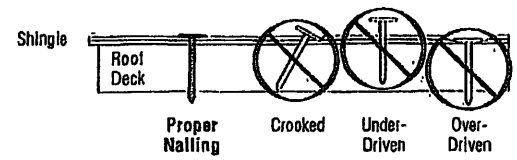


Figure 12-2: Proper and improper nailing.

IMPORTANT: For decks ¾" (19 mm) thick or thicker, nails must go at least ¾" (19 mm) into the deck. On thinner decks, nails must go at least ⅛" (3.2 mm) through the deck.

Nails must be 11- or 12-gauge roofing nails, corrosion-resistant, with at least ⅜" (9.5 mm) heads, and at least 1" (25 mm) long. **LandMark TL requires nails at least 1¼" long.**

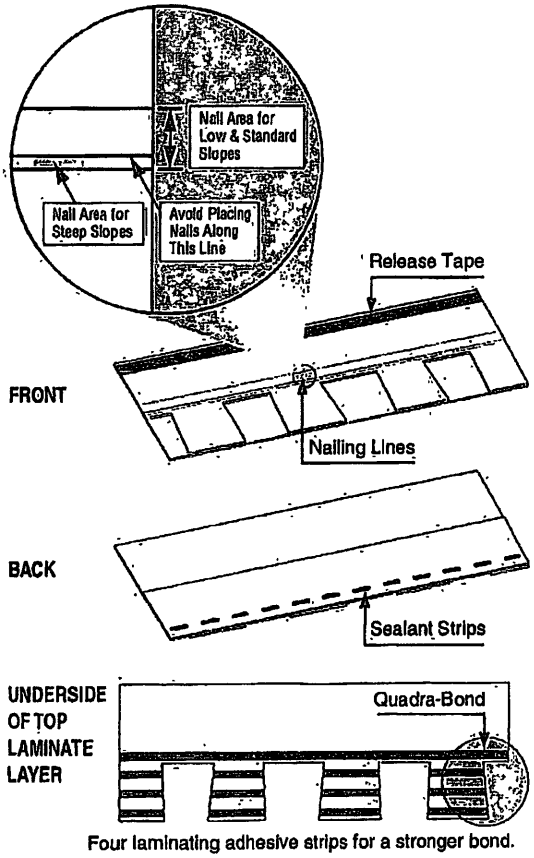
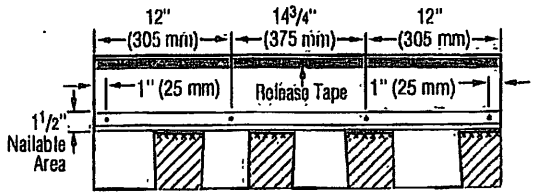


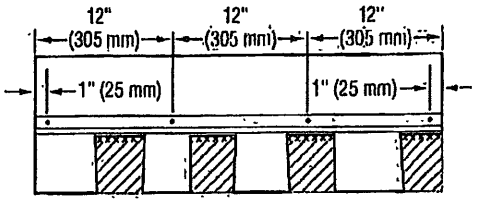
Figure 12-3: WeatherTrack QB™ features a wider nail area and extra-strong Quadra-Bond construction.

LOW AND STANDARD SLOPE

WIDETRACK QB METRIC DIMENSIONS



WIDETRACK QB ENGLISH DIMENSIONS



LANDMARK TL

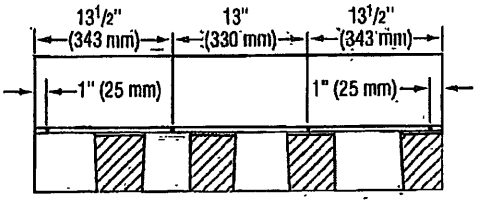


Figure 12-4: Use four nails for every full shingle.

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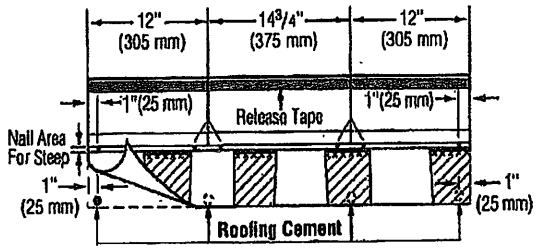
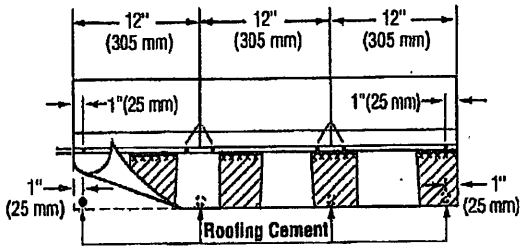
STEEP SLOPE

Use six nails and four spots of asphalt roofing cement for every full laminated shingle. See below. Asphalt roofing cement should meet ASTM D 4586 Type II. Apply 1" spots of asphalt roofing cement under each corner and at about 12" to 13" in from each edge.

WIDETRACK QB METRIC DIMENSIONS



WIDETRACK QB ENGLISH DIMENSIONS



LANDMARK TL

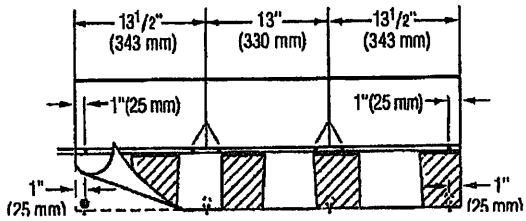


Figure 12-5: Use six nails and four spots of asphalt roofing cement on steep slopes.

CAUTION: Excessive use of roofing cement can cause shingles to blister.

ONE CLEAN-DECK APPLICATION METHOD FOR ENGLISH DIMENSION SHINGLES

FIVE-COURSE DIAGONAL METHOD ("SEVENS AND FOURTEENS")

PREPARING THE DECK:

- Apply underlayment as required. CertainTeed suggests that a layer of shingle underlayment be applied. For UL fire rating, underlayment is generally required. Apply flat and unwrinkled.
- Snap horizontal and vertical chalklines to assure shingles will be correctly aligned. Expose all shingles 5" (125 mm).

CAUTION: Use of other installation methods may result in an objectionable pattern.

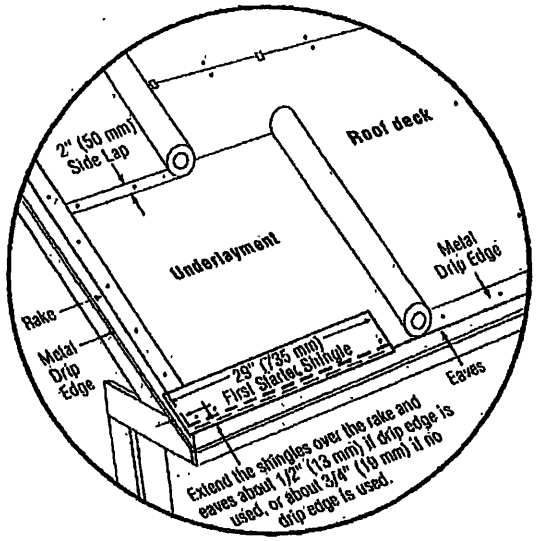


Figure 12-6: Standard slope underlayment and starter drip edge details.

STARTER COURSE:

1. Use CertainTeed Swiftstart or Universal Starter, or use standard three-tab self-sealing shingles with the lower 5" tab portions removed to provide starter shingles that are 7" in height *(Figure 12-7)*.

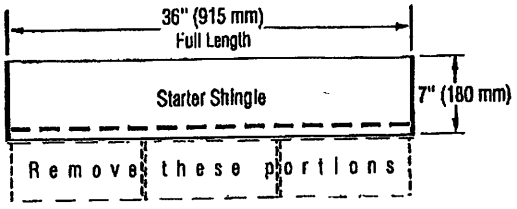


Figure 12-7: Make starter shingles by removing the lower 5" tabs.

2. For the first starter, cut 7" from one side of the starter shingles.
3. Apply the 29" piece to the lower left corner of the roof. Make sure there is 1/2" overhanging the rakes and eaves if drip edge is being used. If you are not using drip edge, make the overhang 3/4".
4. Use full 36" long, 7" wide starter shingles for the rest of the course.

1ST COURSE: Apply a full shingle at the lower left corner of the roof. Make the lower edge and left edge lie flush with the edges of the starter course *(Figure 12-8)*.

2ND THROUGH 5TH COURSES:

CAUTION! Failure to follow instruction steps 1-5 below will bring joints too close together and may cause unattractive patterns!

1. Cut 7" off the left end of the first shingle and save this piece for later use. Apply the 29" long piece over and above the first-course shingle. Leave the bottom 5" tab portion of the first-course shingle exposed *(Figure 12-8)*.
2. Cut 14" off the first shingle of the third course and save this for later. Install the 22" long piece over and above the second-course shingle.
3. Apply the previously removed 14" long piece over and above the third-course shingle.
4. Apply the previously removed 7" long piece from the second course over and above the fourth-course shingle.
5. Install a full shingle against the right edge of each shingle in courses one through five.

CONTINUING UP THE ROOF:

1. Beginning again with a full shingle, repeat the five-course pattern up the left rake *(Figure 12-10 – see B)*.
2. Fill-in courses across the roof in a stepped diagonal fashion using full shingles *(Figure 12-10 – see A and B)*. Do not run courses straight across.

IMPORTANT: Do not align joints of shingles closer than 3 ½" from one another.

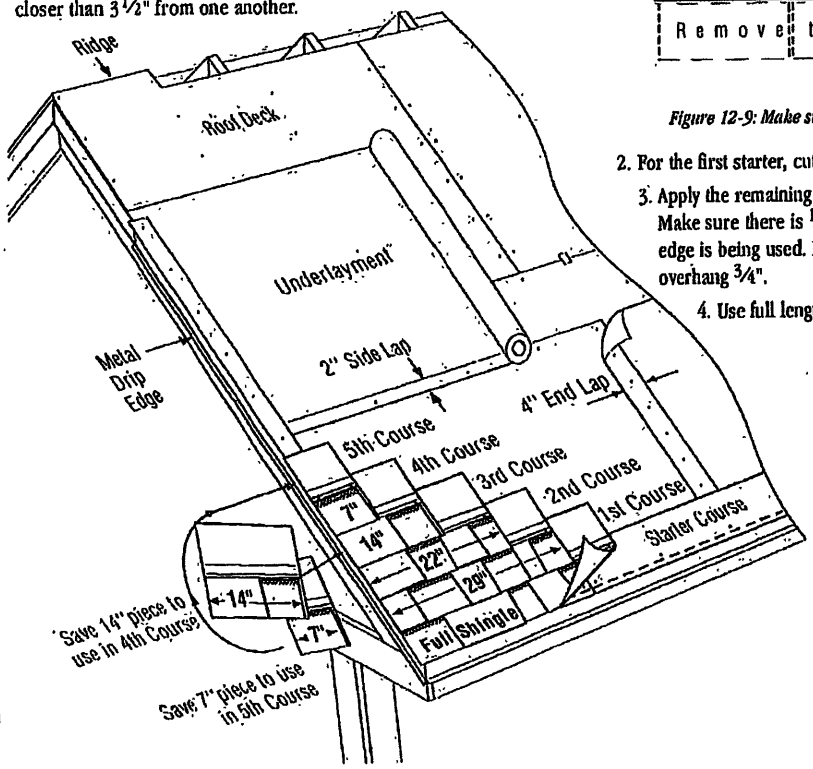


Figure 12-8: Applying the first 5 courses on a standard slope.

TWO CLEAN-DECK APPLICATION METHODS FOR METRIC DIMENSION AND LANDMARK TL SHINGLES

★ FIVE-COURSE DIAGONAL METHOD (6" AND 11") FIVE-COURSE DIAGONAL METHOD (5⅝" AND 11¼")

NOTE: The 6" and 11" method is shown below. The 5⅝" and 11¼" method follows the same application instructions as the 6" and 11" method except the dimensions of the shingle cut-offs in the second and third courses are 5⅝" and 11¼" respectively.

CAUTION: Use of other installation methods may result in an objectionable pattern.

PREPARING THE DECK:

- Apply underlayment as required. CertainTeed suggests that a layer of shingle underlayment be applied. For UL fire rating, underlayment is generally required. Apply flat and unwrinkled.
- Snap chalklines to assure shingles will be correctly aligned. Expose all shingles 5⅝" (143 mm).

STARTER COURSE:

1. Use CertainTeed Swiftstart Starter, or three-tab self-sealing shingles with the lower tab portions removed. Be sure that the starter shingles are at least 7⅝" in height. *(Figure 12-9)*.

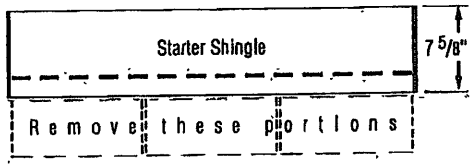


Figure 12-9: Make starter shingles that are 7⅝" in height.

2. For the first starter, cut 6" from one side of the starter shingle.
3. Apply the remaining piece to the lower left corner of the roof. Make sure there is ½" overhanging the rakes and eaves if drip edge is being used. If you are not using drip edge, make the overhang ¾".
4. Use full length starter shingles for the rest of the course.

Figure 12-10: "Five-Course Diagonal Method" installation schematic.

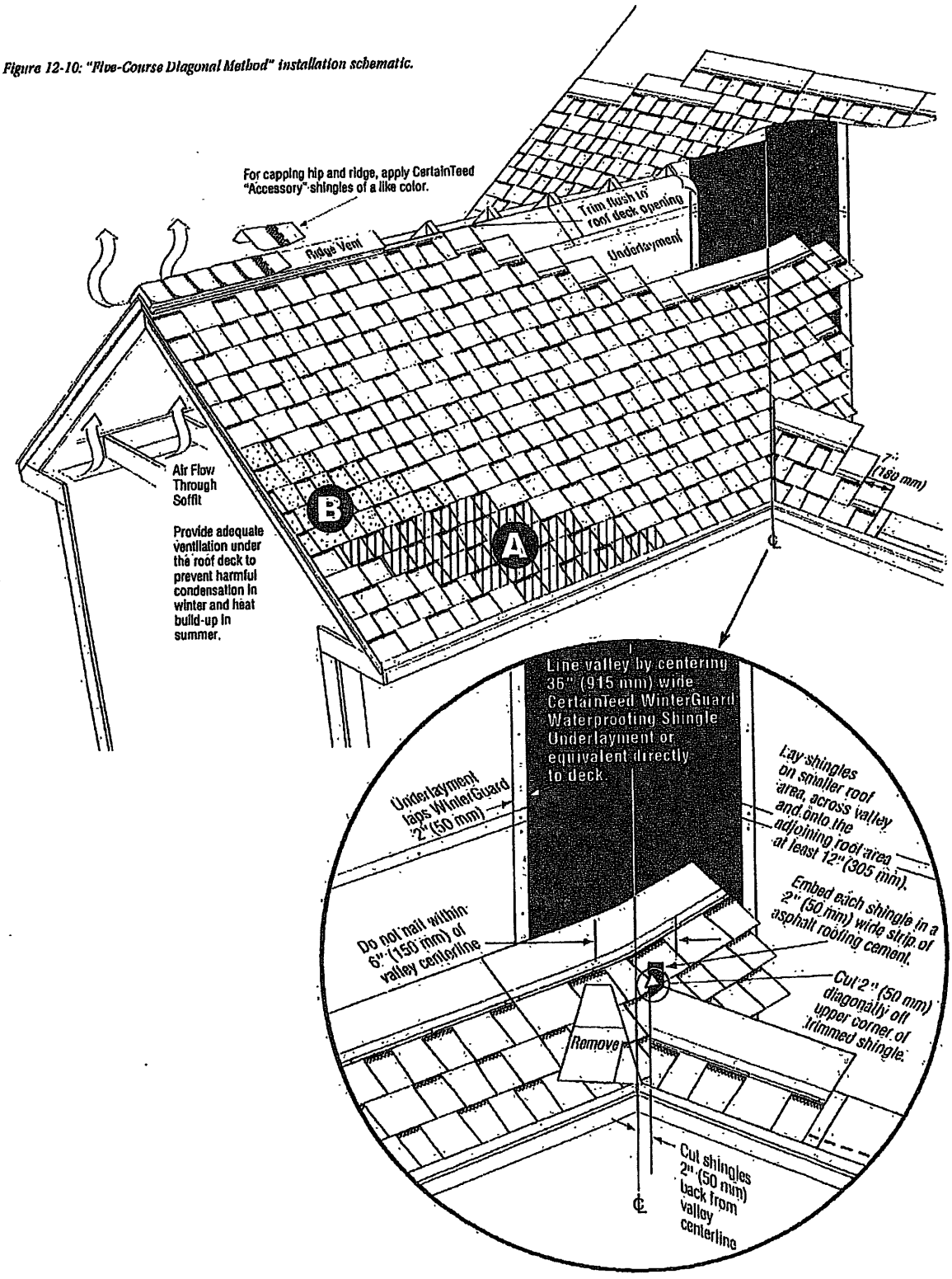


Figure 12-11: Highlight of closed-cut valley details.

1ST COURSE: Apply a full shingle at the lower left corner of the roof. Make the lower edge and left edge lie flush with the edges of the starter course *(Figure 12-12)*.

2ND THROUGH 5TH COURSES:

CAUTION! Failure to follow instruction steps 1-5 below will bring joints too close together and may cause unattractive patterns!

1. Cut 6" off the left end of the first shingle and save this piece for later use. Apply the 32¾" (34" for Landmark TL) long piece over and above the first-course shingle. Leave the bottom 5⅝" tab portion of the first-course shingle exposed *(Figure 12-12)*.
2. Cut 11" off the first shingle of the third course and save this for later. Install the 27¾" (29" for Landmark TL) long piece over and above the second-course shingle.
3. Apply the previously removed 11" long piece over and above the third-course shingle.
4. Apply the previously removed 6" long piece from the second course over and above the fourth-course shingle.
5. Install a full shingle against the right edge of each shingle in courses one through five.

CONTINUING UP THE ROOF:

1. Beginning again with a full shingle, repeat the five-course pattern up the left rake.
2. Fill-in courses across the roof in a stepped diagonal fashion using full shingles. Do **not** run courses straight across.

IMPORTANT: Do not align joints of shingles closer than 3½" from one another.

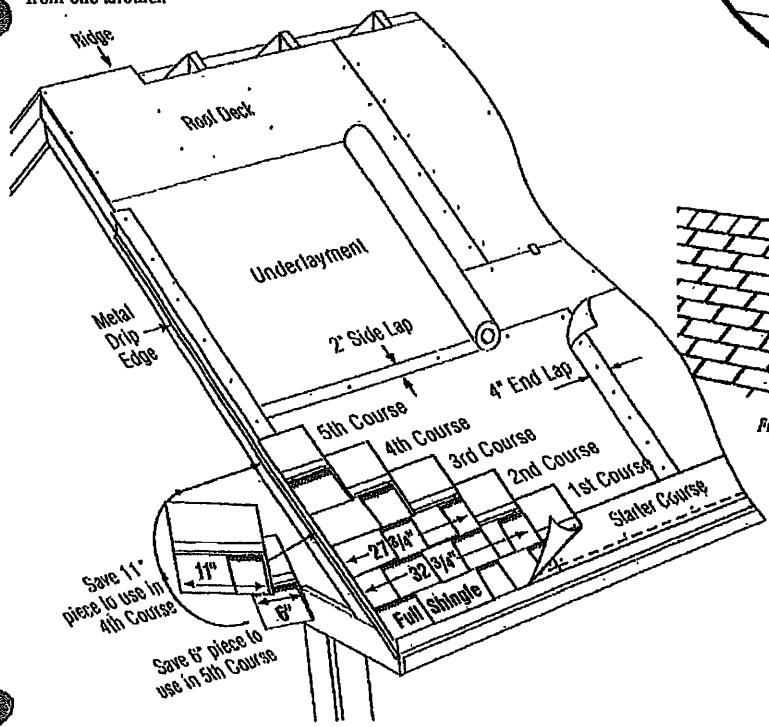


Figure 12-12: Applying the first 5 courses of Metric dimension. Note: The LandMark TL dimensions differ.

CHIMNEY FLASHING

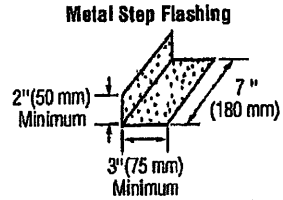


Figure 12-13: Step flashing minimum dimensions.
*NOTE: Use 7⅝" or more for Metric dimension and LandMark TL shingles.

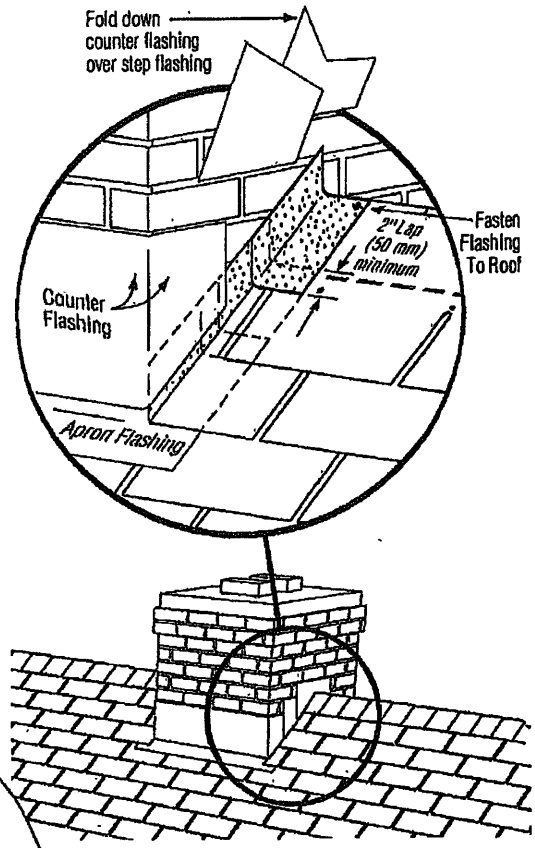


Figure 12-14: Flashing around a chimney.

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ONE ROOF-OVER METHOD FOR ENGLISH DIMENSION SHINGLES

PREPARING THE ROOF SURFACE FOR REROOFING

- Make the surface of the old roof as smooth as possible by replacing missing shingles. Split and nail flat all buckled, raised tabs and curling shingles.
- It's a good idea to cut old shingles back flush to the rakes and eaves.
- We suggest that you apply corrosion-resistant drip edge along the rakes and eaves, covering the edges of the old shingles. This will provide a uniform and straight edge that will help prevent water from seeping under the shingle edges.

"NESTING" COMBINED WITH THE FIVE-COURSE DIAGONAL METHOD ("SEVENS AND FOURTEENS")

NOTE: Nesting is preferred over "bridging" methods when reroofing because nesting sheds water best and looks better. Nesting, as described below, is an easy application over square-tab asphalt strip shingles with a 5" exposure. If you are covering a different type or size shingle, you may need to cut back the tabs so that nesting is possible. To do this, simply cut off the leading edge of all old shingles when they are lapped less than 2½" by the new shingles. This permits a flat nested application that avoids lifted edges and slumps.

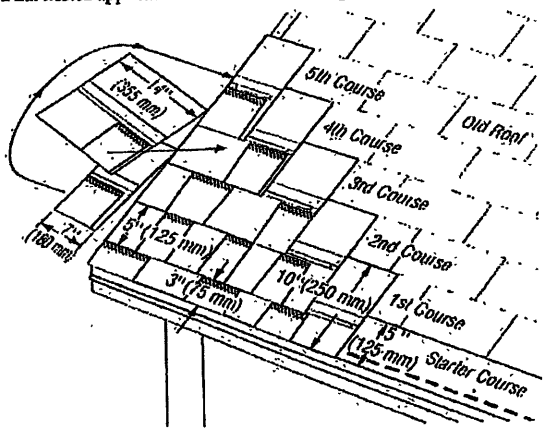


Figure 12-15: Five-Course Diagonal, Nested.

STARTER COURSE:

1. Remove the tabs and the top 2" from standard self-sealing shingles, leaving 5" by 36" strips.
2. Cut 7" off the length of the first strip, apply the 29" remaining piece over the old first course at the lower left corner, overhanging the rakes and eaves ½" if drip edge is used, or ¾" if no drip edge is used.
3. Continue with full-length starter shingles along the eaves

1ST COURSE:

1. The first-course shingles are made of full LandMark shingles with 2" cut off the bottom of the tabs.
2. Align the first-course strips with the left and lower edges flush with the starter course.

2ND THROUGH 5TH COURSES:

CAUTION! Failure to follow instruction steps 1-5 below will bring joints too close together and may cause unattractive patterns!

1. Cut 7" off the left end of the first shingle and save this piece for later use. Apply the 29" long piece over and above the first-course shingle. For this and all succeeding courses, align the top edge of the shingle to be applied with the bottom edge of old shingles in the next course. Exposure of first course only is reduced to 3".
2. Cut 14" off the first shingle of the third course and save this for later. Install the 22" long piece over and above the second-course shingle.
3. Apply the previously removed 14" long piece over and above the third-course shingle.
4. Apply the previously removed 7" long piece from the second course over and above the fourth-course shingle.
5. Install a full shingle against the right edge of each shingle in courses one through five. Remember that course one shingles are only 10" wide.

CONTINUING UP THE ROOF:

1. Beginning again with a full shingle, repeat the five-course pattern up the left rake.
2. Fill-in courses across the roof in a stepped diagonal fashion using full shingles. Do not run courses straight across.

IMPORTANT: Do not align joints of shingles closer than 3 ½" from one another.

TWO ROOF-OVER METHODS FOR METRIC DIMENSION AND LANDMARK TL SHINGLES

The same methods used for clean-deck application of these shingles are used for roof-overs. Application of these shingles ***over*** English dimension shingles is not recommended — due to the high cost of workmanship and greater risk of worker error.

HIPS AND RIDGES

SHADOW RIDGE™ ACCESSORY SHINGLES FOR HIPS AND RIDGES

Shadow Ridge shingles have an accented shadow line that is designed to complement these shingles. Simply fold along the pre-cut lines and detach individual cap pieces. Save valuable installation time compared to cutting 3-tab shingles.

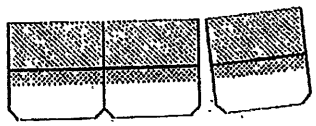


Figure 12-16: Shadow Ridge accessory shingles detach easily from three-piece units to make 72 individual cap pieces.

There are 24 three-piece units in each Shadow Ridge bundle, providing 72 individual caps that will cover 30 linear feet (33¾ linear feet, Metric) of a hip or ridge. Each English dimension cap piece is 12" by 12" (Metric caps are 13¼" by 9⅞") and features clipped corners on the bottom edge of the exposed portion.

APPLICATION IS AS FOLLOWS:

1. Apply shingles up to the hip or ridge on both sides, then trim flush.

   NOTE: The last course of shingles should have an exposure of 5" (5⅝" for metric) or less when the shingle cap or ridge vent is fastened in place. Otherwise, a potential water leak could occur at exposed shingle end joints. The figures used in this section illustrate the application of accessory shingles over a ridge vent; application directly to the roof deck is very similar.

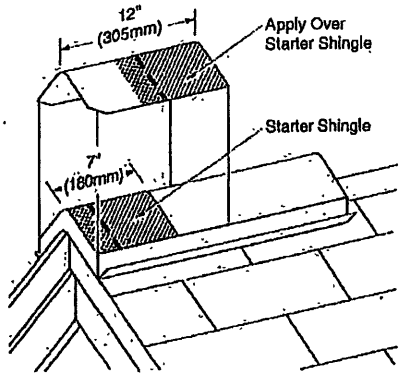


Figure 12-17: Apply a full cap shingle over the starter piece, flush with the bottom and side edges of the starter.

2. Install caps beginning at the bottom of a hip or at either end of a ridge. Apply a starter piece that has the bottom 5" (5⅝" for metric) removed *(Figure 12-18)*. Fasten the starter with two nails located about 3" from the rake edge, and 1" in from each side edge. Make sure fasteners used to apply caps penetrate at least ¾" into or through the decking.

   NOTE: To assist in proper alignment when ridge vent is not used, snap a chalk line parallel to the hip or ridge along the line where the side edges of the cap shingles should be.

3. Apply a full cap shingle over the starter (*Figure 12-18*), and place fasteners at 5⅝" (6¼" for metric) up from the exposed bottom edge and 1" in from each side. Nails must not be exposed on the finished roof. All nail heads must be driven straight and must not cut into the shingle surface.

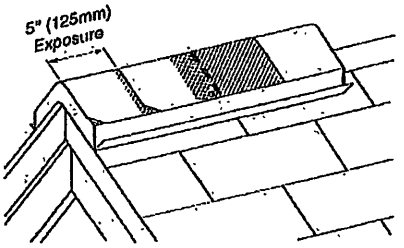


Figure 12-18: Install cap shingles at their correct exposure and cover all fasteners.

NOTE: Each cap has a laying/alignment notch at the top edge to center the piece on the ridge line, and two notches on each side to indicate the correct exposure and shadow-line placement (*Figure 12-19*). The side notches of the cap being applied should be aligned with the top edge of the previously applied cap.

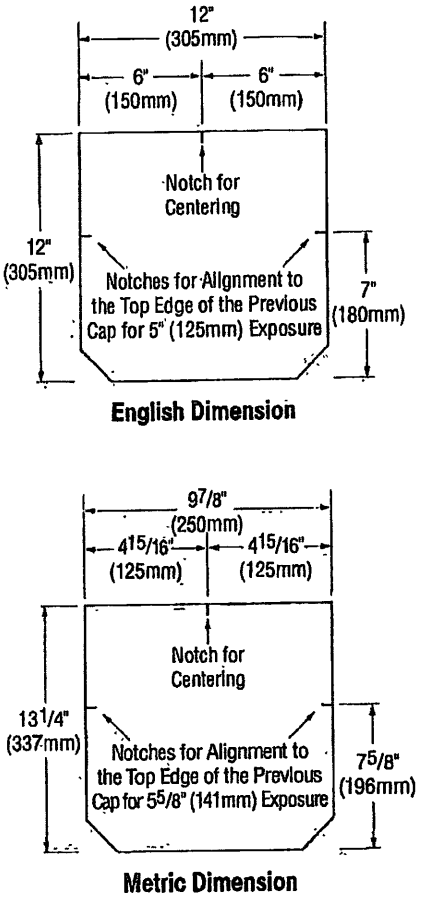


Figure 12-19: Each Shadow Ridge shingle has a centering notch and two side-alignment notches to help ensure proper placement.

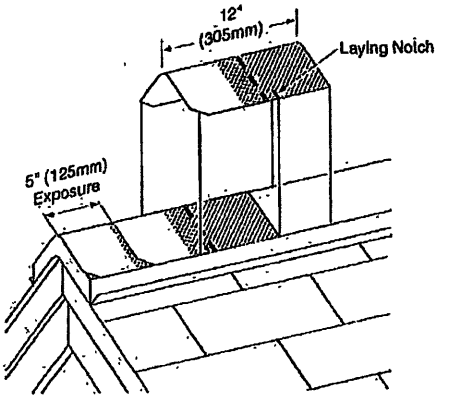


Figure 12-20: Use laying notches to center shingles on hips and ridges, and to locate the correct exposure.

MOUNTAIN RIDGE HIGH-PROFILE HIP AND RIDGE ACCESSORY

Use Mountain Ridge accessory shingles to cover hips, ridges or rake edges. One box will cover 20 linear feet. To prevent damage to shingles during application, they must be sufficiently warm to allow proper forming.

FASTENING

IMPORTANT: Use two nails to fasten each shingle. Nails must be **minimum 1¾" (45 mm) long.** For the 4" (100 mm) starter shingle, place fastener 1" (25 mm) in from each side edge and about 2" (50 mm) from the rake (or eave) edge, making sure the fastener goes ¾" into the deck or all the way through. For each full Mountain Ridge shingle, place fasteners 8⅝" (219 mm) up from its exposed butt edge and 1" (25 mm) in from each side edge.

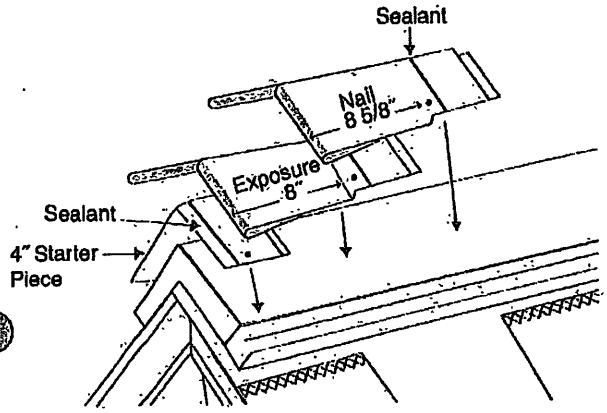


Figure 12-21: Hip and ridge application.

HIP, RIDGE AND RAKE SHINGLE APPLICATION

Apply the primary field roofing up to the hip or ridge from both sides of the roof and trim flush or lap over one side, not more than half the width of a Mountain Ridge shingle.

Assure that the installed Mountain Ridge shingles properly cover hip and ridge field shingles on both sides and the field shingles applied along rake edges. For a rake edge installation, cut the field shingles flush to the rake edge. Apply Mountain Ridge shingles ensuring they fit securely against the rake board. **To assist in proper alignment, snap a chalk line parallel to the hip, ridge or rake along the line where the side edges of the Mountain Ridge shingles should fall.**

Prepare a 4" **Starter shingle** by cutting off the lower 8" color granule butt portion of one Mountain Ridge shingle. Apply the 4" starter piece (with sealant nearest the outer edge) over the bottom corner of the hip or rake, or on either end of the ridge, overhanging the corner or end by approximately ½" and bending the starter shingle along its centerline to form into place (see figures below.) Install a nail on each side about 2" up from the starter shingle's exposed butt edge and 1" in from each side edge of the shingle. The 8" piece that was cut off may be used to finish the opposite end of hip, ridge or rake.

Next, apply a full Mountain Ridge shingle over the installed starter shingle, bending it along its centerline and forming into place over the hip, ridge or rake, flush with the bottom and side edges of the starter shingle. Install a nail on each side of the shingle 8⅝" up from the bottom edge and 1" in from each side edge.

Continue application of the Mountain Ridge shingles along the hip, ridge or rake as shown. Expose Mountain Ridge shingles 8", covering all fasteners.

Here's a Tip...In the winter put hip and ridge cap shingles in your truck with the heater blasting for 20 minutes so the caps don't crack when formed. (Thanks to Mark Dulz, Richmond, MI.)

03159

OWENS CORNING | CULTURED STONE

The Preferred Name In Stone®

MANUFACTURER'S INSTALLATION INSTRUCTIONS

Cultured Brick® Product Installation Instructions are available separately from your Dealer and can also be found at www.culturedstone.com

Building code requirements vary from area to area. Check with local authorities for building code requirements in your area. Carefully read all Installation Instructions before proceeding with your Cultured Stone® products application. Observe safety precautions. Cultured Stone® products are covered by a 50-Year Limited Warranty when installed in accordance with the manufacturer's Installation Instructions. See warranty on page 7.

ESTIMATING THE STONE REQUIRED

Determine the amount of Cultured Stone® products needed by measuring the area to be covered. Measure the length times the height to arrive at the gross square footage of flat stone needed. Subtract square footage for window, door and other openings. Measure the linear feet of outside corners to determine the amount of corner pieces needed. One linear foot of corner pieces covers approximately ¾ of a square foot of flat area. Subtract the flat area covered by the linear feet of corner pieces from the square footage of flat stone required. You may wish to obtain some extra stone to allow for cutting and trimming. In addition, be sure to verify whether the texture chosen is sold based on coverage with a ½" mortar joint or tight-fitted. Most texture coverages are listed for a ½" joint, the exceptions being Drystack Ledgestone, European Castle Stone, Pro-Fit® Ledgestone and Pro-Fit® Alpine Ledgestone. If you are installing a texture, which states coverage is for ½" mortar joint, in a tightfit application, increase stone by 10-22%.

Formula:

Length x Height = Wall Area
Window Width x Window Height = Window Area
Lineal Feet of Corners Required x .75 = Wall Area Covered by Corners
Wall Area – Window Area – Wall Area Covered by Corners = Square Ft. Flats Required

TOOLS REQUIRED

Choose the tools required for your installation—see page 7 for illustrations and appropriate use.

• Safety Glasses and other personal protective equipment • Staple Gun or Hammer • Wheelbarrow & Hoe • Hock & Trowel • Mason's Trowel • Margin Trowel • Masonry, Circular, Table, Wet Saw or Grinder with Carborundum or Diamond Blade • Wide-Mouth Nippers or Hatchet • Dust Mask(1) • Level • Metal Jointing Tool or Wood Stick • Grout Bag • Whisk Broom

SUNDRY MATERIAL REQUIREMENTS

A. Mortar Components

1. Premixed: Type N or Type S mortar, meeting ASTM C270
2. Mortar mixed: as per Table #2 on page 3.
3. Mortar color: iron oxide color (if desired).
4. Water: Potable water

NOTE: Mortar must comply with IBC Section 2103.8, IRC Section R607.1, BNBC Section 2104.7, SBC Section 2104.7.1 or UBC Table 21-A as applicable.

NOTE: Additives should not be used unless approved by building official. Additives should meet the requirements of ASTM C 270 or CSA A179.

B. Water-Resistive Barrier

Depending on local building code requirements, barrier shall meet the requirements of ICC Acceptance Criteria 38 "Acceptance Criteria for Water Resistive Barriers."

Note: Water-resistive barrier must be used on all exterior and interior mortar applications. Water-resistive barrier is not required for application over masonry or concrete.

C. Flashing

1. To maintain the weather-resistance of the exterior wall on which stone products are installed, corrosion-resistant flashing, weep screed and a means of drainage shall be installed at all penetrations and terminations of the stone cladding. Flashing type and locations shall be in accordance with the requirements of the applicable building code.
2. For additional recommendations regarding flashing, refer to the following trade associations, standards, organizations and resources:
   a. ASTM E 2112
   b. Asphalt Roofing Manufacturers Association (ARMA)
   c. Brick Institute of America (BIA)
   d. The American Plywood Association (APA)
   e. Local building department
   f. Architect or engineer
   g. Masonry Veneer Manufacturers Association (MVMA) installation guide for adhered concrete masonry veneer, available at www.masonryveneer.org

D. Metal Lath

1. Minimum 2.5-lb. galvanized self-furring expanded metal lath (diamond mesh) meeting the requirements of ASTM C 847, or min. 18-gauge galvanized self-furring woven wire mesh meeting the requirements of ASTM C 1032.
2. For metal buildings and open stud construction—minimum 3.4-lb. ⅜" rib, paper-backed, expanded galvanized metal lath.
3. Or other code accepted mesh or lath.

E. Fasteners

1. Galvanized nails, staples, concrete nails.
2. Corrosion-resistant, self-drilling, self-tapping pancake-head screw with 7/16" head, of 1¼" length or suitable to obtain ⅜" penetration beyond inside surface of metal. (Used for installing to metal surfaces such as metal studs or metal building siding.)

F. Masonry Sealer

1. Silane-based breather-type sealer (if required). See "Sealers" in General Information section (page 6).

SURFACE PREPARATION FOR MORTAR INSTALLATIONS

Using Table I, determine the correct surface preparation for your installation.

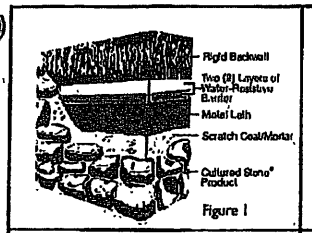


Figure 1

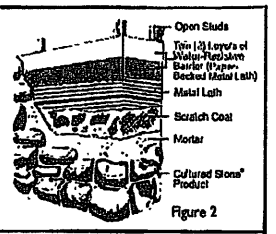


Figure 2

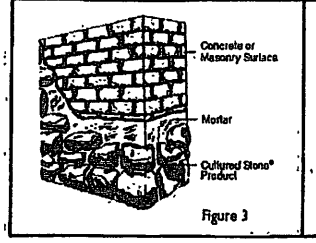


Figure 3

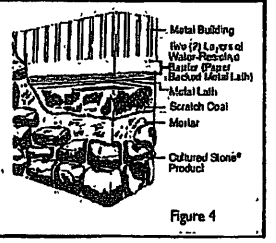


Figure 4

Table I

WALL SURFACE	INTERIOR & EXTERIOR PREPARATION REQUIRED
Rigid Backwall Wallboard Plywood Paneling OSB Concrete Board Polystyrene Insulation Board installed over a Rigid Backwall	Cover sheathing with a minimum of One (1) layer of breather-type water resistive barrier, lap joints minimum 6" at vertical joints and minimum 2" at horizontal joints in shingle fashion. Then, in accordance with local building code, lap and install lath or mesh using galvanized nails or staples 6" on center vertically, penetrating studs a minimum of 1". Continuously wrap water-resistive barrier and metal lath a minimum of 16" to next framing member around all outside and inside corners (Fig. 1). Apply ⅜" to ½" scratch coat.
Clean & Untreated Concrete Masonry Stucco*	Examine newly poured concrete closely to ensure that its finished surface contains no release agents (form oil). If it does contain form oil, etch surface with muriatic acid, rinse thoroughly and/or scrub with a wire brush, beadblast or sandblast (Fig. 3) if no further preparation needed
Dirty, Painted or Sealed Concrete, Masonry or Stucco	Sandblast, beadblast or waterblast to original surface (remove crumbling dust by washing) or securely attach lath.
Metal Buildings	Install primary water-resistive barrier. Lap and install 3.4-lb. ⅜" rib, paper-backed, expanded metal lath to metal cladding supports of 20 ga to 12 ga. using corrosion resistant, self-drilling, self-tapping panel-head screw with ⅝" head, of 1¼" length or suitable to obtain ¾" penetration beyond inside surface metal. Screws are to be installed on center equal to 1 screw/sq. ft. and shall not exceed 6" on center in one direction. Apply ⅜" to ½" scratch coat and allow to dry 48 hours (Fig. 4).
Insulation Board or Open Studs Polystyrene Foam Board Please see Installation Over Thick Foam note page 7	Install primary water-resistive barrier. Lap and install 3.4 lb ⅜" rib, paper-backed, expanded metal lath to studs using nails which penetrate a minimum of 1" at 4" on center. Apply ⅜" to ½" scratch coat and allow to dry 48 hours (Fig. 2).

*Stucco cement plaster meeting requirements of ASTM C926, or other building code approved stucco. EIFS systems are not an approved backing for Cultured Stone®.

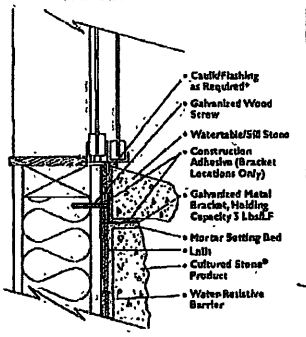
WEATHER RESISTANT BARRIER/WATER RESISTIVE BARRIER (WRB)

When installing manufactured stone veneer in an exterior application requiring a WRB, two separate layers of WRB shall be used. Each layer of WRB should meet the requirements for Water Resistive Barrier (Grade D) as defined by ICC Acceptance Criteria AC-38. Installation of the WRB should follow instructions provided by specific manufacturer. When installing manufactured stone veneer in an interior application, a single layer of WRB is recommended.

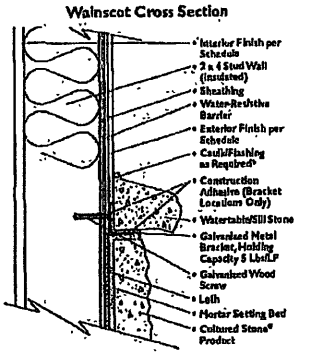
WATERTABLE/SILL INSTALLATIONS

Watertables/sills provide a transition piece between a stone wainscot and other exterior finishes and for water runoff. They can also be used as a windowsill. Install using galvanized metal support brackets (Simpson Strong Tie A-21 or other galvanized right angle bracket with holding capacity minimum 5 lbs./LF) fastened with galvanized nails or screws penetrating studs 1" at a minimum of 16" on center. Two brackets per sill is preferred if blocking is present. Use construction adhesive to bond stone at bracket locations. Caulk and flash as required at Watertable/Sill locations using an approved corrosion-resistive flashing that extends to the surface of exterior wall finish and is installed to prevent water from re-entering the exterior wall envelope.

Windowsill Cross Section



Wainscot Cross Section



*Failure to properly caulk/flash as described in these installation directions may result in water damage to the structure

INSTALLING STONE AT GROUND LEVEL

Keep the finished edge of the Cultured Stone® product a minimum of 4" above grade if earth or 2" above pavement. Use a 2" x 4" leveling strip (straightedge) or weep screed/flashing. Framed (wood or metal) applications are required by code in many jurisdictions to have weep screed or a weeped casing bead, at the base of the wall or foundation transition. This will:

- Provide drainage as required by applicable building code.
- Avoid possible staining of the stone by soils containing alkali or other minerals.

PREPARE YOUR WORK AREA

Spread Cultured Stone® wall veneer out at the job site so you have a good variety of sizes, shapes and colors to choose from. Plan for some variety and contrast in the overall design. Use small stones next to large ones, heavy-textured pieces next to smooth, thick stones next to thinner ones. Mixing Cultured Stone® wall veneer from different boxes during application will allow you to achieve a desirable balance of stones on your finished project.

MORTAR

NOTE: Weather Conditions

If stone is being applied in hot or dry weather, the back of each piece should be moistened with a fine spray of water or a wet brush to adequately prevent excessive absorption of moisture from the mortar. If being installed over concrete, masonry or scratch coat substrate, the substrate surface area should also be dampened before applying mortar. Surfaces should appear damp but free of surface water.

Applications should be protected from temperatures below 40°F as mortar will not cure properly under such conditions. Do not use antifreeze compounds to lower the freezing point of mortar. See International Building Code Section 2104.3 for cold weather construction requirements.

A. Mixing Mortar/Grout

Using Premixed Type N or Type S mortar or components from Table 2, mix to a firm, moist consistency. Mortar that is too dry and crumbly will not provide proper bond. Mortar that is too wet will be weak and messy.

Table 2 – Proportions for Mortar					
Parts By Volume					
Mortar type	Portland Cement or Blended Cement	Masonry Cement Type N	Masonry Cement Type S	Hydrated Lime or Lime Putty	Aggregate
N	1			1	4½ to 6
N		1			2¼ to 3
S			1		2¼ to 3

B. Mortar Color

Tinting mortar complements the color of the stone being installed. Example: Use tan mortar with earth-tone stones. This will greatly enhance the appearance of the finished installation. Regular mortars can be tinted to complement your Cultured Stone® product using iron oxide pigments available from your dealer.

C. Applying Mortar to Prepared Surface Area

Using a plasterer's or mason's trowel (Fig. 5 and 6), apply mortar ½" to ¾" thick to prepared surface area. Do not spread more than a workable area (5 to 10 sq. ft.) so that mortar will not "set up" before stone is applied.

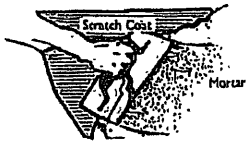


Figure 5 Apply mortar using a plasterer's trowel.

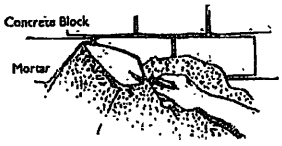


Figure 6 Apply mortar using a mason's trowel

APPLYING CULTURED STONE® PRODUCTS

See page 4 for additional instructions concerning Pro-Fit® Ledgestone, Pro-Fit® Alpine Ledgestone and European Castle Stone.

A. Starting Point

Apply mortar and stone working from the bottom up, or most stones can also be applied from the top down. Working from the top down may help avoid splashing previously applied stone with dripping mortar. Ledgestone types should be installed from the bottom up.

B. Joint Width

In order to obtain the most natural look, joints should be as narrow as possible. The average should not exceed ½" in width. An attractive look can also be achieved by fitting stones tightly together if desired. If using tight fit/drystack method, it is important to make sure scratch coat/backing has been covered completely by the setting bed of mortar. This will conceal the scratch coat/backing and prevent pockets from forming behind stones that could trap water.

C. Setting the Stones

Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the stone's edges. Apply pressure to the stone to ensure a good bond. **Ensure complete coverage between the mortar bed and back surface of the stone.** Mortar may also be applied to the entire back of the stone (Fig. 7). When stone is installed correctly, lath will not be visible. The mortar setting bed shall be between ⅜" minimum and 1⅛" maximum.

Figure 7
Mortar applied to the entire back of the stone.

Care must be taken to avoid smearing mortar on surface of stone. Accidental smears or mortar droppings should be removed using a whisk broom only after mortar has become crumbly.

D. Install Corner Pieces First

If your application requires corner pieces, apply these first. Notice that the corner pieces have a long and a short leg. Alternate these in opposite directions (Fig. 8).

Figure 8
Apply corners—alternating long and short legs in the opposite directions

E. Install Flat Pieces

After the corner pieces are in place, flat pieces are applied working toward the wall center (Fig. 9).

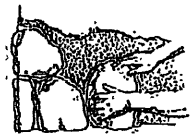


Figure 9
Apply flat pieces.

F. Keep Your Mortar Joints Consistent

Place the individual stones close together, creating uniform joints between them. Cut and trim as required to achieve consistent width in the mortar joints. Then trim and fit small pieces into any remaining voids (Fig. 10).

Figure 10
Position large pieces first, then trim and fit in smaller pieces

G. Cutting and Trimming

Stones can be cut and shaped for fit. Use wide-mouth nippers or a hatchet (Fig. 11 and 12). (Refer to page 7–Tools Required.) Some broken stones may be found in the box. These also may be used in filling gaps between large stones. For best finished appearance, coat cut or broken edges with mortar. If possible, position cut edges up when they are above eye level, down when below eye level. **SAFETY GLASSES AND A DUST MASK(!) SHOULD ALWAYS BE WORN WHEN CUTTING ANY CULTURED STONE® PRODUCTS.**

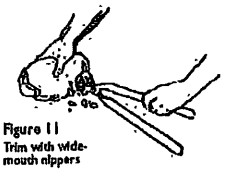


Figure 11
Trim with wide-mouth nippers

Figure 12
Trim with a hatchet.

NOTES:

Level and Plumb Joint Lines

When applying Cobblefield® manufactured stone veneer, European Castle Stone, Limestone, Rockface, Coral or Ledgestone, endeavor to maintain level and plumb joint lines. Also, long rectangular pieces will look most natural if applied horizontally.

River Rock and Stream Stone

When applying River Rock or Stream Stone, plan the placement of stones to minimize trimming and cutting to maintain the natural look of the rounded shapes.

Ledgestone Types

When applying ledgestone types, keep joints as small as possible to maintain a natural look, and install from the bottom up. Strike joints deeply, being careful not to expose the back edge of stones or scratch coat/backing. See page 4 for additional instructions regarding Pro-Fit® Ledgestone, Pro-Fit® Alpine Ledgestone and European Castle Stone.

GROUTING AND FINISHING JOINTS

A. Grouting Joints

If additional mortar is required, use a grout bag to fill in joints (Fig. 13). Care must be taken to avoid smearing mortar on surface of stone. Accidental smears or mortar droppings should be removed only after mortar has become crumbly using a whisk broom or dry bristle brush. Never use a wet brush or wire brush.

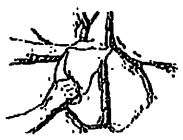


Figure 13
Grout Joints

B. Finishing Joints

When the mortar joints have become firm or "thumb-print" dry (setting time will vary depending on wall surface and climatic conditions), they should be pointed up with a wood stick or metal jointing tool. Rake out excess mortar, compact and seal edges around stones (Fig. 14). Careful attention to proper and even jointing will result in a professional looking finish.

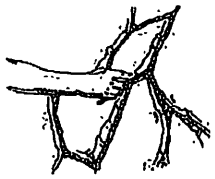


Figure 14
Finishing the Job.

C. Cleaning Finished Job

At the end of the work day, or when mortar is sufficiently set up, the finished job should be broomed or brushed to remove loose mortar and to clean the face of the stone. **A wet brush or sponge should never be used to treat the mortar joints** as this will cause staining that will be difficult, or impossible, to remove. **Do not use acid or acid-based products.**

ADDITIONAL INSTRUCTIONS FOR PRO-FIT® LEDGESTONE, PRO-FIT® ALPINE LEDGESTONE AND EUROPEAN CASTLE STONE

Fit the Joints Tightly

Install all these products with tight-fitted joints. Generally, components should be placed butting each other and aligned for level and plumb. When installing, the backs of all these components must be wet. They should be noticeably damp, but free from surface water. Mortar must be tinted to match the color of the stone you are installing to help conceal the joint lines.

A. Starting Point

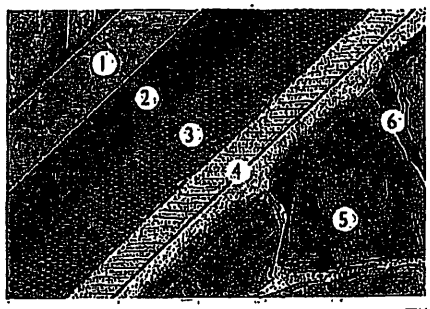
Products are applied starting from the bottom and working up. Start each ProFit® Ledgestone course level and continue horizontally completing each course before starting the next. European Castle Stone is done in a similar sequence to achieve a random ashlar pattern. If required, cut the appropriate size component to fit at the end or top of the finish area (Fig. 18). Frequently check the installation for level and alignment.

B. Install Corner Pieces First

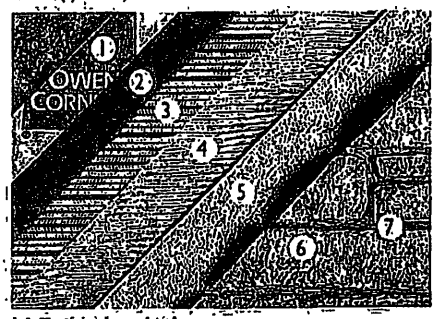
If your application requires corner pieces, start by installing a corner piece first, followed by the adjoining flat pieces. Notice that the corner pieces have a long and short leg. Alternate these in opposite directions.

TYPICAL INSTALLATIONS:

Wood Frame:

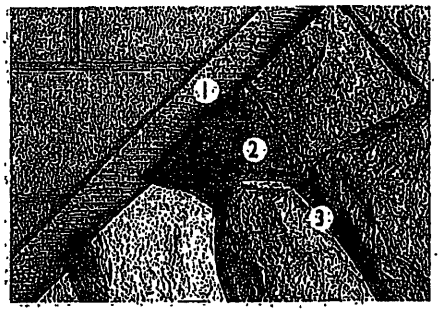


In sequence: (1) sheathing, (2) two layers of water-resistive barrier, (3) galvanized metal lath, (4) mortar scratch coat/setting bed (5) Cultured Stone® manufactured stone veneer, (6) mortar joint.



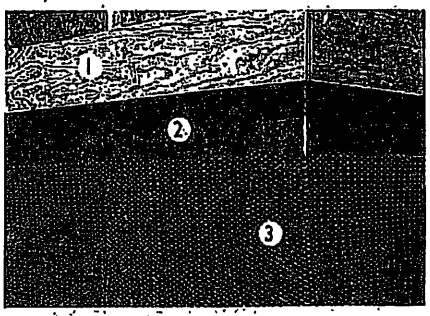
Rigid Foam Insulation:

In sequence: (1) rigid foam insulation, (2) two layers of water-resistive barrier, (3) galvanized metal lath, (4) scratch coat, (5) mortar setting bed, (6) Cultured Stone® manufactured stone veneer, (7) mortar joint.



Masonry or Concrete:

In sequence: (1) mortar applied directly to untreated, unpainted masonry, concrete or stucco, (2) Cultured Stone® manufactured stone veneer, (3) mortar joint.



Corner Preparation:

Water-resistive barrier and galvanized metal lath must continuously lap a minimum of 16" beyond outside and inside corners. Lap materials 4" on horizontal and vertical joints. (1) Wall substrate, (2) two layers of water-resistive barrier, (3) metal lath.

C. Setting the Stones

Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the mortar groove at the back edge of component. Apply pressure to the component to ensure a good bond. **Ensure complete coverage between the mortar bed and back surface of stone.** Mortar may also be applied to the entire back of the stone. Check for level and plumb.

D. Install Flat Pieces

After the first corner piece is in place, the adjoining flat pieces of each course or pattern are applied. Using a trowel, strike off the excess mortar around the edges of the component prior to placing the next component. This will allow the next adjacent component to fit tightly (see Fig. 15). **Choose the correct length component to ensure that vertical joints do not line up.**

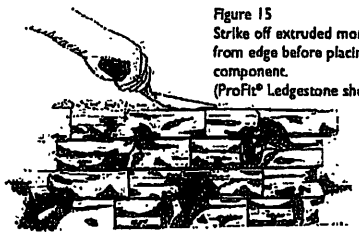


Figure 15
Strike off extruded mortar from edge before placing next component.
(ProFit® Ledgestone shown)

E. Cutting and Trimming

Vertical or horizontal cuts can be made using a table saw, circular saw or small grinder equipped with a dry cutting diamond or carborundum blade.

CUTTING SHOULD BE DONE OUTSIDE AS SOME DUST WILL OCCUR. SAFETY GLASSES AND A DUST MASK(1) SHOULD ALWAYS BE WORN WHEN CUTTING ANY CULTURED STONE® PRODUCTS.
Stones can also be cut and shaped using wide-mouth nippers or a hatchet.

Additional Information on Cutting and Fitting

Finished Edges—Place finished edges at exposed areas.
Cut Edges—Place cut edges within courses.

Finishing Joints

The design simplicity of Pro-Fit® Ledgestone, Pro-Fit® Alpine Ledgestone and European Castle Stone allows for easy installation of components and provides a finished, tightfit joint between the stones. This reduces the time required for cutting, grouting and jointing.

Surface Cleaning

Care must be taken to avoid smearing mortar on the surface of components. Accidental smears or mortar droppings should be removed with a whisk broom or dry bristle brush only after mortar has become crumbly. **Do not use a wet brush, sponge or a wire brush. Do not use acid or acid-based products, power-washing, sandblasting or wire-brush cleaning.**

INSTALLING FINISHING TOUCHES

Hearthstone Installation Instructions

Hearthstones are not recommended or warranted for exterior use or as a surface area subject to foot traffic. TERRA CRAFT® Pavers are available from your dealer for use as a hearthstone or for patios and walkways.

Consult surface preparation table 1 for requirements prior to installing Hearthstone.

A. Place Mortar

Place mortar ¾" deep in 3-inch wide strips 1 inch apart on prepared surface (Fig. 16).

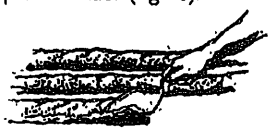


Figure 16
Place mortar for Hearthstone installation.

B. Install Hearthstones

Place the first Hearthstone onto the mortar bed and level (Fig. 17). Place adjacent Hearthstones, aligning and leveling with the first piece.

Figure 17
Place Hearthstone.

If joints need additional mortar, fill joints using a grout bag. Tool and finish joints following previous instructions under "Grouting and Finishing Joints." Ensure Hearthstones are set in a complete bed of mortar.

C. Cutting and Trimming Hearthstones

Hearthstones can be cut as required using a circular saw fitted with a carborundum or diamond blade or using a mason's brick or tile saw. Place finished edges at exposed areas.
SAFETY GLASSES AND A DUST MASK(1) SHOULD ALWAYS BE WORN WHEN CUTTING ANY CULTURED STONE® PRODUCTS.

NOTES: Hearthstone Installation UL Listed

Cultured Stone® manufactured stone veneer and hearth products are made from non-combustible materials (UL Listing #209T). They are listed by Underwriters Laboratories, Inc., for use as floor protectors and wall shields with stoves and on fireplace hearths. To comply with UL Listing, mortar joints must not exceed ½" in width and the mortar must be even with the top of the hearth surface.

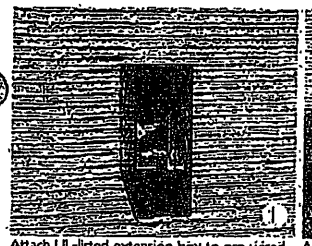
Raised Hearth

Do not cantilever or extend Hearthstones more than 1½" beyond direct support. When grouting the extended portion of a cantilevered Hearthstone, bring the grout to the front edge. Push a long galvanized nail horizontally into the grout to add support, then cover the nail with mortar.

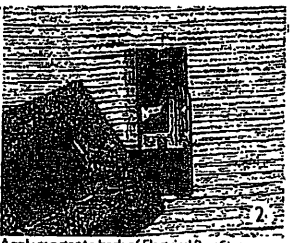
Sealing Fireplaces/Hearths

If desired, sealing the Cultured Stone® facing or hearth of a fireplace installation will assist in the removal of smoke and soot stains should they occur. See "Sealers" in General Information section for more information (page 6).

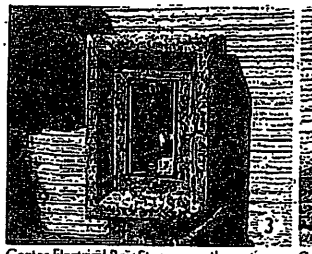
Cultured Stone® Electrical Box Stones Installation Instructions



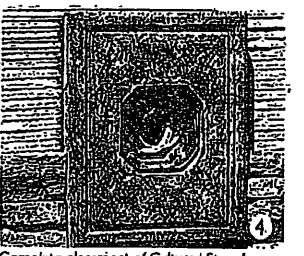
Attach UL-listed extension box to pre-wired and mounted electrical box.



Apply mortar to back of Electrical Box Stone or prepared substrate.



Center Electrical Box Stone over the extension box. Level and plumb. Use removable shims if required.



Complete placement of Cultured Stone® veneer or other exterior material around Electrical Box Stone.

NOTES: Electrical Box Stones Installation

- Electrical Box Stones must be installed in accordance with Cultured Stone® Installation Instructions.
- Extension box, light fixture or receptacle plate must be attached in accordance with manufacturer's instructions and local building codes.

Tuscan Lintel Installation Instructions

Method One

On installations where the top of the opening provides no support for the bottom edge of the Tuscan Lintel: Install metal support brackets as per Cultured Stone® Installation Instructions for Watertables/Sills. Then install Lintel stones in a full setting bed of mortar in accordance with Cultured Stone® Installation Instructions.

Method Two

On installations where the bottom edge of the Tuscan Lintel will be supported by a window or door frame's molding or profile: Install lintel stones in a full setting bed of mortar in accordance with Cultured Stone® Installation Instructions.

Make sure you do not cause deflection to window with weight of Lintel. If there is any question, use method one.

GENERAL INFORMATION

Cleaning

Dirt, etc., may be removed by using a strong solution of granulated soap or detergent and water with a bristle brush. **Do not use a wire brush** as it will cause damage to the surface. Rinse immediately with fresh water. For help with serious cleaning problems, contact your local dealer. **Do not attempt to clean using acid or acid-containing products, power-washing, sandblasting or wire-brush cleaning.**

Salt and De-Icing Chemicals

Because all concrete and masonry are vulnerable to damage by salt, Cultured Stone® products are not warranted against damage incurred from salt or other chemicals used to remove snow or ice. Do not use de-icing chemicals on areas immediately adjacent to a Cultured Stone® manufactured stone veneer application.

Scuffing

Scuffing occurs on all natural stone. Occasionally some scuffing will occur on the surface of Cultured Stone® products. This can enhance the natural appearance of your Cultured Stone® manufactured stone veneer installation. Some scuff marks can be removed by cleaning as described above.

Efflorescence

Efflorescence is a water-soluble salt that is deposited on the surface of stucco, concrete, brick and other masonry products by the evaporation of water from the wall. On rare occasions efflorescence will occur on Cultured Stone® products. To remove efflorescence, allow the stone to dry thoroughly, then scrub vigorously with a stiff bristle brush and clean water. Rinse thoroughly—do not use a wire brush. For more difficult efflorescence problems, scrub thoroughly with a solution of 1 part white household vinegar to 5 parts water. Rinse thoroughly. For unusually difficult cleaning problems, contact your local Cultured Stone® dealer.

Sealers

Sealers are not necessary on Cultured Stone® products. However, some customers use sealers to help prevent staining in applications prone to smoke, soot, dirt or water splashing. If you choose to use a sealer, make sure it is a silane-based, breathable sealer. Take note that sealers may darken the color of the stone. A sealer may also slow the natural movement of moisture out of the stone and increase the possibility of efflorescence and/or spalling. For information regarding actual performance or application of sealers, contact the manufacturer of the sealer directly.

Use of Cultured Stone® Below Water Levels

Cultured Stone® veneer is a lightweight concrete material and will not deteriorate from exposure to fresh liquid water. The use of Cultured Stone® veneer below water level, in which the water is chlorinated, treated with chemicals or dirty will likely cause discoloration as it would on any concrete, natural stone or other materials. Pool chemicals which contain acid, such as muriatic acid, may cause damage to Cultured Stone® products, which would not be covered by the Cultured Stone® 50 Year Limited Warranty. Cultured Stone® veneer, concrete and many natural stone materials are subject to potential damage from adverse freeze thaw conditions. For that reason, water should be drained below susceptible materials prior to freezing temperatures. Pressure and abrasion from constant fast flowing water may cause some surface deterioration as it would on other concrete materials. The surfaces of concrete and many other materials may be affected by exposure to extensive salt-water conditions. Cultured Stone® veneer should not be considered a waterproof material.

INCORPORATE GOOD BUILDING PRACTICES

Building Code Requirements

Building code requirements vary from area to area. Check with local authorities for building code requirements in your area. Carefully read all Installation Instructions before proceeding with your Cultured Stone® manufactured stone veneer application.

Exterior Applications

Make sure that the application of Cultured Stone® products and the structure they are being applied to incorporate good building practices. Rigid, corrosion-resistant flashing shall be installed at all wall penetrations. Flashing type and locations shall be in accordance with the requirements of the applicable

building code. On exterior applications, the incorrect installation or absence of flashing, cant strips, gutters and downspouts may result in diversion of water run-off onto finished surface areas. Masonry and other building products subjected to these conditions may develop staining and, when combined with severe freeze-thaw conditions, may eventually cause damage. The application of Cultured Stone® products under these conditions is not recommended.

Rainscreen Statement

Some building codes require a rainscreen behind cladding materials, including manufactured stone veneer. If you are installing manufactured stone/brick veneer in one of these jurisdictions, or are concerned about extreme weather conditions, it is recommended that you choose a rainscreen system that can achieve the following:

- The system should create a space with a minimum depth of 3/16" (10mm) and maximum depth of ¾" (19mm).
- The materials should be corrosion and rot resistant.
- Unless otherwise designed to manage moisture vapor, the system should be vapor open.
- If rainscreen space is created with a material other than solid strapping/ furring attached directly to framing, the following must be considered. Lath fasteners must be capable of supporting the weight of the finished wall cladding system considering the unsupported/cantilevered portion of fastener that is equal to the thickness of the rainscreen materials.

Overhead Application

Overhead, horizontal or sloped applications are not included in our building code evaluation reports or acceptances. These applications often require special approval/inspections by local building code inspectors. Contact your architect or engineer for assistance designing these installations.

Installation Over Thick Foam

Installation over foam board thicker than ½" may require special fasteners. Consult your architect or engineer for assistance designing a thick foam installation.

Capping Off the Exposed Top of Exterior Walls

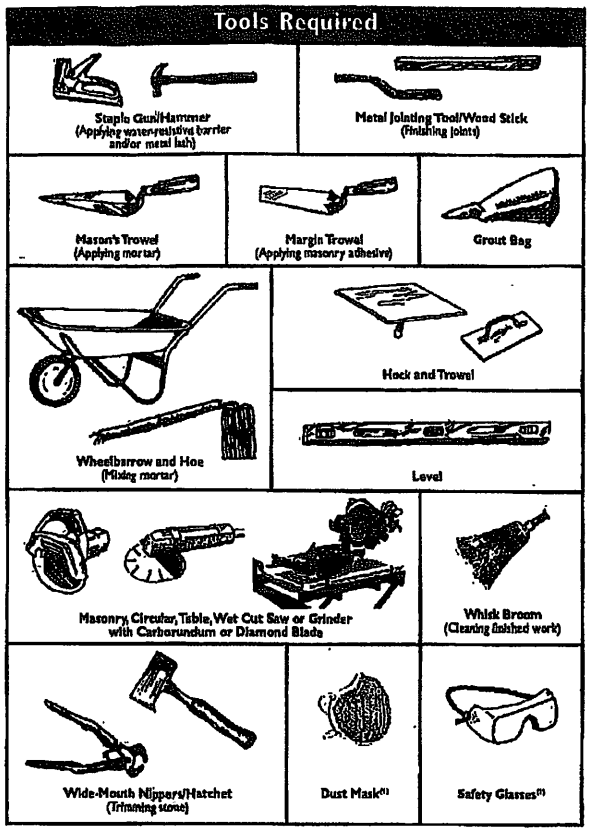
To achieve a finished architectural look on horizontal or sloping top areas of exterior walls, piers, retaining walls or other surfaces, Cultured Stone® Capstones or a poured-in-place concrete cap must be used to provide adequate run-off protection to the wall areas. Caps should extend approximately 1"–2" beyond the finished stone surface. **Cultured Stone® corner pieces, flat pieces, or hearthstones should not be used to cap walls.**

Retaining Walls

All retaining walls must be waterproofed at the fill side. Wall construction should incorporate proper use of granular backfill and provisions for good drainage. A continuous longitudinal drain along the back of the wall set in drain rock is recommended.

Chimney Cap

All chimney chases must be capped with a one-piece cap that extends 1"–2" beyond the finished stone surface to prevent water from entering the wall system. Chimney or chase construction should incorporate proper flashing.



Cultured Stone® 50-Year Limited Warranty

Cultured Stone® products are covered for a period of 50 years from the date of purchase when used on a structure which conforms to local building codes and when installed in accordance with the manufacturer's instructions. Cultured Stone® will repair or provide, free of charge, new materials to replace any determined to be defective. This warranty is limited to the original purchaser and may not be transferred to any subsequent owner.

This warranty does not cover damage resulting from:

- Settlement of the building or other wall movement
- Contact with chemicals or paint
- Discoloration due to airborne contaminants
- Staining or oxidation

This warranty covers only manufacturing defects in Cultured Stone® manufactured stone products. Cultured Stone® is not responsible for labor costs incurred in removal and replacement of defective products. Hearthstones are not warranted for use on the ground or as a surface area subject to foot traffic.

CODE COMPLIANCE EVALUATION AND LISTINGS

ICC-ES ESR-1364. Tested or listed by Underwriters Laboratories, Inc., City of Los Angeles RR23744, HUD Materials Release No.1316, Texas Dept. of Insurance Product Evaluation EC-21.

[1] **CAUTION:** Contains Crystalline Silica. Dusts from cutting or sawing may create possible cancer hazard. Dusts of this product may cause irritation of the nose, throat and respiratory tract. Avoid prolonged or repeated inhalation of dusts from this product. A properly fitted NIOSH approved N-95 series disposable particulate filtering facepiece respirator (formerly referred to as "dust masks") should be used when mechanically altering this product (e.g., sawing, cutting, drilling, or similar dust generating processes). Wear long-sleeved shirt, long pants, gloves and safety glasses with side shields when handling and installing material. Wash hands and face with soap and warm water immediately after handling this product.

AUTHORIZED DEALER

For additional information on
Owens Corning Cultured Stone® products
visit **www.culturedstone.com**
or call
1-800-255-1727

CULTURED STONE

The Preferred Name In Stone™

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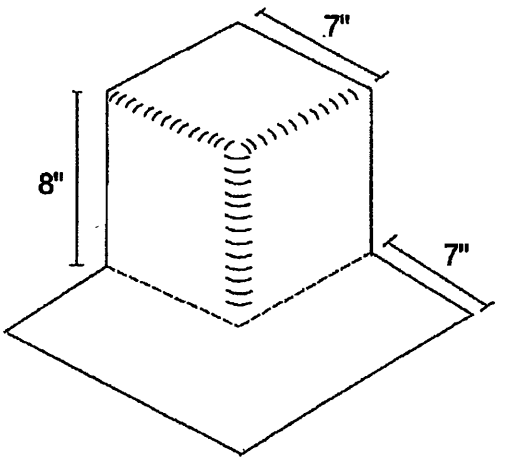
POLYGUARD PREFORMED OUTSIDE CORNER



DESCRIPTION:

The ***POLYGUARD PREFORMED FLASHING CORNER*** is a 40 mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner.

POLYGUARD LIQUID ADHESIVE is used to prepare surfaces for ***POLYGUARD PREFORMED CORNERS.***

USES:

The ***PREFORMED FLASHING CORNER*** provides maximum protection against moisture infiltration at outer corners. It bridges the flashing where it terminates, forming a continuous water deterrent seal. ***PREFORMED CORNERS*** can be used wherever a continuous water seal around outer corners is desired.

ADVANTAGES:

At present, flashing around corners requires a series of cuts, folds, flaps and patching with mastic. This is a time consuming, difficult procedure which often results in a less than desirable corner condition.

POLYGUARD PREFORMED CORNERS offer an easy and practical method of field installation, eliminating as much as 10 minutes *(per corner)* of expensive field labor time. But most important, the design provides maximum protection against water penetration at outside corner conditions.

PRODUCTS/HANDLING:

POLYGUARD THRU WALL FLASHING SYSTEMS components should be unloaded and stored in such a manner that prevents injury to the materials.

EXECUTION:

SURFACE PREPARATION: Clean all surfaces of dust, dirt and foreign matter. Eliminate sharp protrusions, which may puncture membrane. Surfaces should be dry prior to application of ***POLYGUARD 650 LT LIQUID ADHESIVE*** and ***POLYGUARD PREFORMED CORNERS.***

APPLICATION OF CORNER: Remove silicone release liner and apply to properly prepared surface. Then apply ***THRU WALL FLASHING MEMBRANE*** over lapping 2" onto the ***PREFORMED CORNER*** or ***END DAM.*** All vertical terminations must be sealed immediately with a tooled bead of ***POLYGUARD 650 MASTIC.***

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This Information is based on our best knowledge, but POLYGUARD cannot guarantee the results to be obtained.

POLYGUARD PRODUCTS, INC • ENNIS, TEXAS 75120-0755
PH: 214-515-5000 • 800-541-4994 • FAX: 972-875-9425
Web Site: www.polyguardproducts.com

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LIMITATIONS:

POLYGUARD THRU WALL FLASHING COMPONENTS are recommended for concealed applications behind brick, marble, granite, siding or other exterior wall covering system. ***POLYGUARD MEMBRANES*** should be covered within 30 days to prevent prolonged exposure to sunlight.

PRECAUTIONS:

POLYGUARD LIQUID ADHESIVES are industrial coatings and would be harmful or fatal if swallowed. Marked as a red label flash point product, prohibit flames, sparks, welding and smoking during application. Refer to product label and Material Safety Data Sheets for handling, use and storage.

Solvents could be irritating to the eyes. In case of contact with eyes, flush with water and contact physician.

Avoid prolonged contact with skin and breathing of vapor or spray mist from ***LIQUID ADHESIVE***. If in confined areas, use adequate forced ventilation, fresh air masks, explosion proof equipment, and clean clothing. Close container after each use. **Keep out of reach of children.**

This material is offered for sale by ***POLYGUARD PRODUCTS, INC.*** only for the expressed purposes as described in this literature. Any use of the products described in this literature for purposes other than taught therein by ***POLYGUARD PRODUCTS, INC.*** shall be the responsibility of the purchaser and ***POLYGUARD PRODUCT, INC.*** does not warrant nor will be responsible for any misuse of these products. ***POLYGUARD PRODUCTS, INC.*** will replace F.O.B. Ennis, Texas, material not meeting our manufacturer's specifications one year from date of sale. ***POLYGUARD*** products as described herein are for industrial use only. The application procedures should be performed by workmen who are skilled in the application of materials described herein in accordance with manufacturer specifications.

MATERIAL SAFETY DATA:

All Material Safety Data Sheets and precautionary labels should be read and understood by all user supervisory personnel and employees before using. Consult ***POLYGUARD PRODUCTS, INC.*** Material Safety Data Sheets and OSHA regulations for additional safety and health information for the products described herein. Purchaser is responsible for complying with all applicable federal, state or local laws and regulations covering use of the product including waste disposal.

This is not a Material Safety Data Sheet and is not to be used as such. ***POLYGUARD*** has prepared separate Material Safety Data Sheets on each product.

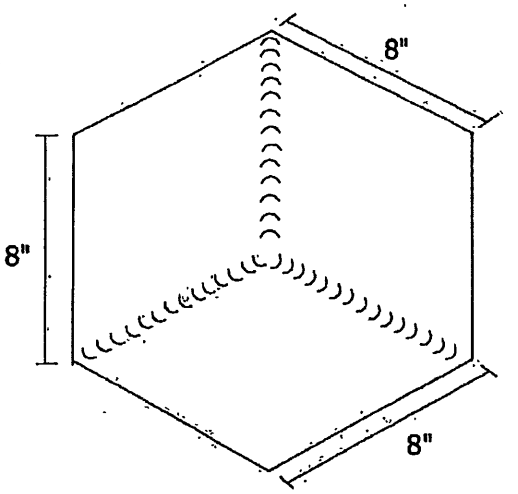
TECHNICAL SERVICE AND AVAILABILITY:

Technical assistance, information and ***POLYGUARD*** products are available through a nationwide network of distributors and architectural representatives, or contact ***POLYGUARD PRODUCTS, INC.***

NOTE ON ISO 9000

POLYGUARD PREFORMED OUTSIDE CORNERS are not covered by ***POLYGUARD'S*** ISO 9001 quality system.

POLYGUARD PREFORMED INSIDE CORNER AND END DAMS



DESCRIPTION:

The ***POLYGUARD PREFORMED INSIDE FLASHING CORNER AND END DAMS*** are a 40 mil combination of rubberized asphalt bonded to a cross laminated polyethylene film. The adhesive surface is covered with a release liner.

POLYGUARD LIQUID ADHESIVE is used to prepare surfaces for ***POLYGUARD PREFORMED INSIDE CORNERS AND END DAMS.***

AVAILABLE SIZES:

3" x 3" x 3"
6" x 6" x 6"
8" x 8" x 8" (also used as inside corners)

USES:

The ***PREFORMED FLASHING CORNERS AND END DAMS*** provides maximum protection against moisture infiltration at inner corners as well as any vulnerable location such as near the jamb lines above and below wall openings. It bridges the flashing where it terminates, forming a continuous water deterrent seal.

ADVANTAGES:

At present, flashing around corners requires a series of cuts, folds, flaps and patching with mastic. This is a time consuming, difficult procedure which often results in a less than desirable corner condition.

POLYGUARD PREFORMED INSIDE CORNERS AND END DAMS offer an easy and practical method of field installation, eliminating as much as 10 minutes *(per corner)* of expensive field labor time. But most important, the design provides maximum protection against water penetration at outside corner conditions.

PRODUCTS/HANDLING:

POLYGUARD THRU WALL FLASHING SYSTEMS components should be unloaded and stored in such a manner that prevents injury to the materials.

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This Information is based on our best knowledge, but POLYGUARD cannot guarantee the results to be obtained.

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EXECUTION:

SURFACE PREPARATION: Clean all surfaces of dust, dirt and foreign matter. Eliminate sharp protrusions, which may puncture membrane. Surfaces should be dry prior to application of ***POLYGUARD 650 LT LIQUID ADHESIVE*** and ***POLYGUARD PREFORMED CORNERS.***

APPLICATION OF INSIDE CORNER AND END DAMS: Remove silicone release liner and apply to properly prepared surface. Then apply ***THRU WALL FLASHING MEMBRANE*** as per the manufacture's recommendation overlapping 2" onto the preformed corner. All vertical terminations must be sealed immediately with a tooled bead of ***POLYGUARD 650 MASTIC.***

LIMITATIONS:

POLYGUARD THRU WALL FLASHING COMPONENTS are recommended for concealed applications behind brick, marble, granite, siding or other exterior wall covering system. ***POLYGUARD MEMBRANES*** should be covered within 30 days to prevent prolonged exposure to sunlight.

PRECAUTIONS:

POLYGUARD LIQUID ADHESIVES are industrial coatings and would be harmful or fatal if swallowed. Marked as a red label flash point product, prohibit flames, sparks, welding and smoking during application. Refer to product label and Material Safety Data Sheets for handling, use and storage.

Solvents could be irritating to the eyes. In case of contact with eyes, flush with water and contact physician.

Avoid prolonged contact with skin and breathing of vapor or spray mist from ***LIQUID ADHESIVE.*** If in confined areas, use adequate forced ventilation, fresh air masks, explosion proof equipment, and clean clothing. Close container after each use. Keep out of reach of children.

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TECHNICAL SERVICE AND AVAILABILITY:

Technical assistance, information and ***POLYGUARD*** products are available through a nationwide network of distributors and architectural representatives, or contact ***POLYGUARD PRODUCTS, INC.***

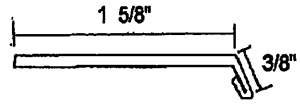
NOTE ON ISO 9000

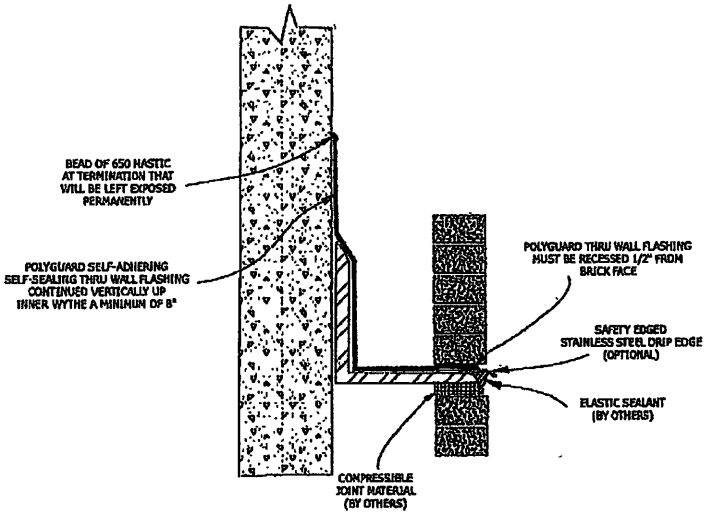
POLYGUARD PREFORMED INSIDE CORNERS AND END DAMS are not covered by ***POLYGUARD'S*** ISO 9001 quality system.

SELF-ADHERING FLASHING AND STAINLESS STEEL DRIP EDGE

- ***Preformed Stainless Steel Drip Edges*** can be used in conjunction with ***Polyguard Thru Wall Flashings.*** The ***Drip Edge*** is 28 gauge (15 mils thick), 1 5/8" inches wide with a 3/8" inch bend at one end made of Type 304 grade, dull finish stainless steel which complies to ASTM A-167. They are supplied in 8 foot pieces.

- The ***Drip Edge*** is set along the edge of the shelf angle. Apply the ***Thru Wall Flashing*** to ***Drip Edge*** leaving approximately 1 inch from drip edge.





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As of 9/1/2003 Polyguard Products' quality system has been certified to American, Dutch and German quality system requirements:
- AMERICAN NATIONAL STANDARDS INSTITUTE
- DUTCH COUNCIL FOR CERTIFICATION
- DEUTSCHER AKKREDITIERUNGS RAT

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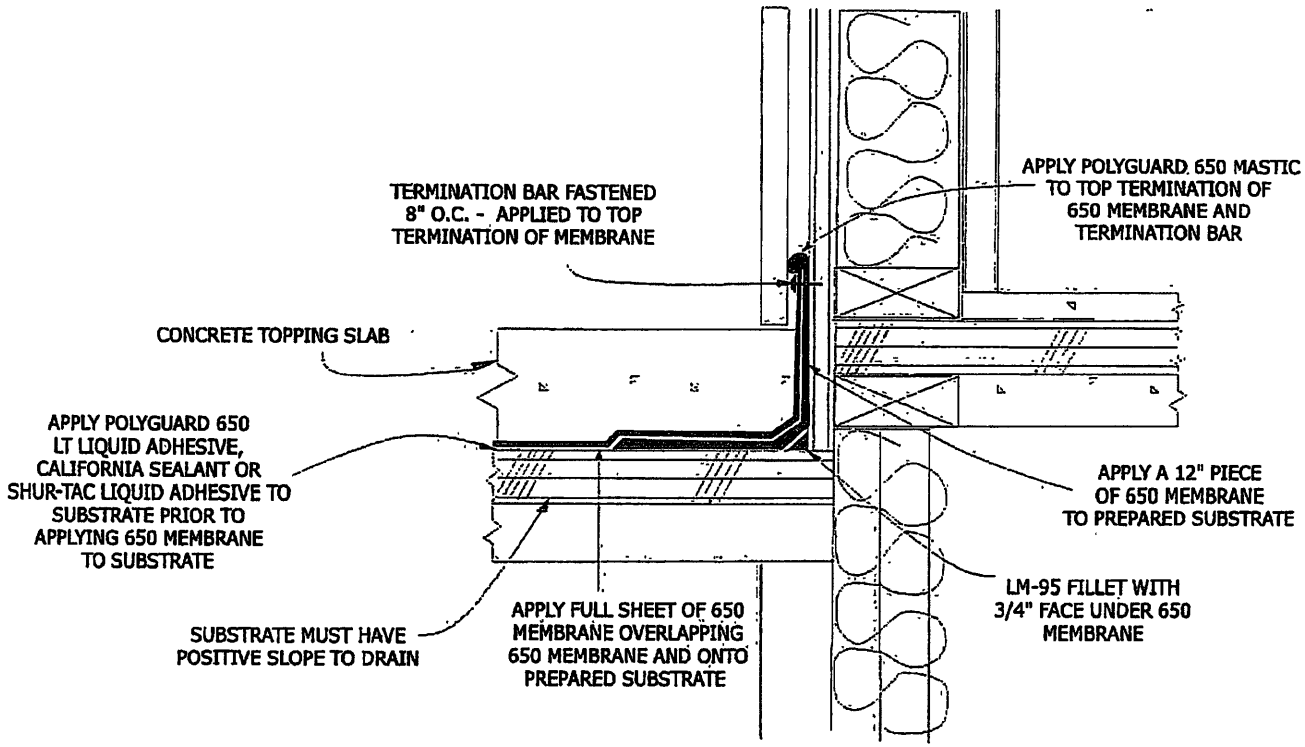

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SECTION @ WALL FLASHING AT BALCONY

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(NOT TO SCALE)

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Polyguard

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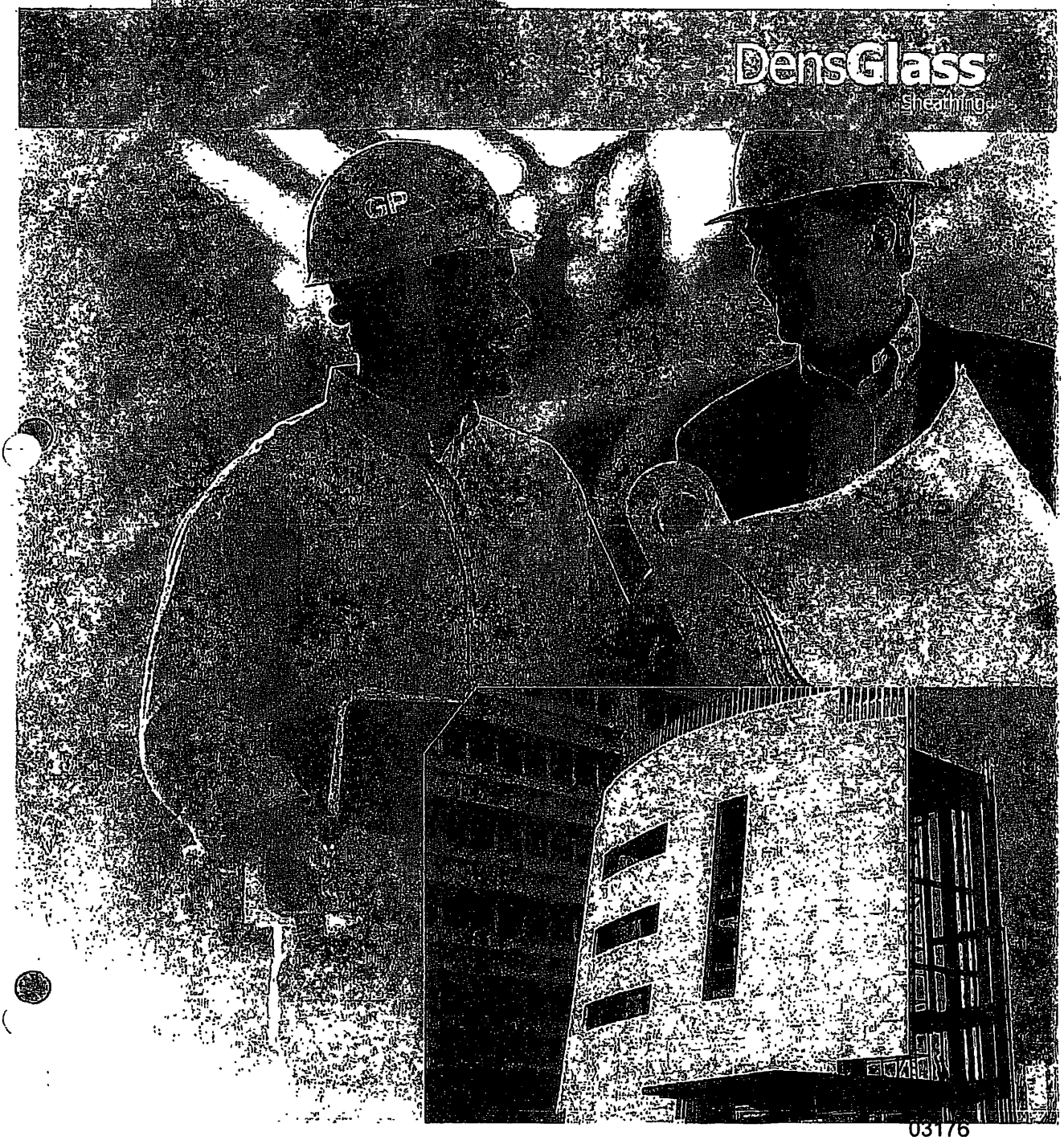

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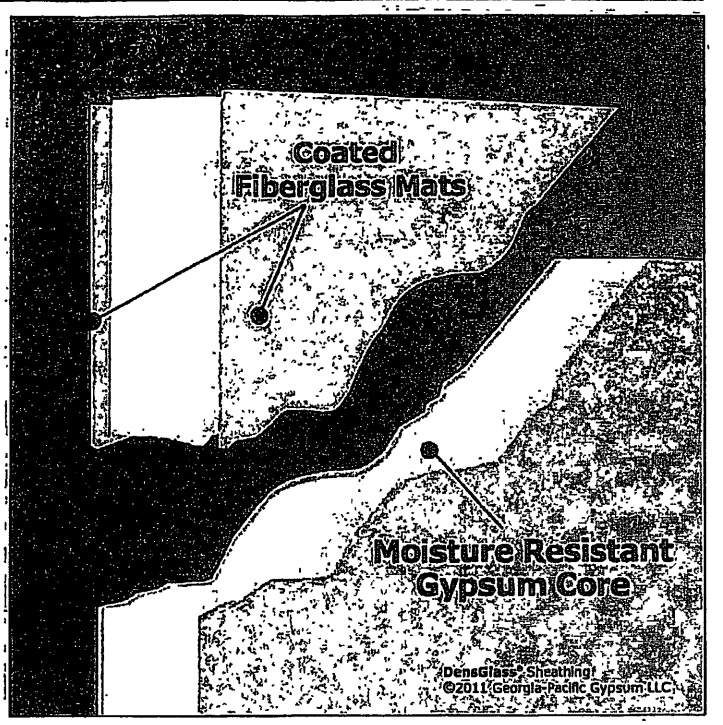
Product Overview



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DensGlass® Sheathing has fiberglass mats for superior mold and moisture resistance compared to paper-faced sheathings.

- *Fiberglass mats eliminate a potential food source for mold and may reduce remediation and scheduling delays associated with paper-faced drywall.*
- *Replaces traditional paper-faced sheathing.*
- *Backed with a limited warranty against delamination and deterioration for up to 12 months of exposure to normal weather conditions.**

**For complete warranty details, visit www.gpgypsum.com*

When tested, as manufactured, in accordance with ASTM D 3273, DensGlass Sheathing has scored a 10, the highest level of performance for mold resistance under the ASTM D 3273 test method.

The score of 10, in the ASTM D 3273 test, indicates no mold growth in a 4-week controlled laboratory test. The mold-resistance of any building product when used in actual job site conditions may not produce the same results as were achieved in the controlled, laboratory setting. No material can be considered mold proof. When properly used with good design, handling and construction practices, Dens® Brand gypsum products provide increased mold resistance compared to standard paper-faced wallboard. For additional information, go to www.gp.com/safetyinfo.

Available Sizes/Dimensions

DensGlass Sheathing is available in 1/2" (12.7 mm) thickness and DensGlass® Fireguard® Sheathing is available in 5/8" (15.9 mm) thickness. DensGlass Sheathing is manufactured in a 4' (1219 mm) width and 8' (2438 mm), 9' (2743 mm) and 10' (3048 mm) lengths. Other lengths are available upon request.

DensGlass® Sheathing is the preferred substrate under brick, stone, stucco, siding and Exterior Insulation and Finishing Systems (EIFS) because of its exemplary track record. DensGlass Sheathing should be specified for any project where flexibility and easy sheathing installation are paramount without the headaches and expense of delamination, deterioration, sagging and warping. Look for the distinctive GOLD color to ensure you're using genuine DensGlass Sheathing.

Mold Resistance

In independent testing, DensGlass Sheathing, with its fiberglass mat design, has achieved a score of 10, the highest level of performance for mold resistance under ASTM D 3273.

Strength

Fiberglass mats penetrate into the panel to make an integrated unit that offers superb strength; outstanding resistance to delamination, deterioration, warping and job site damage; and an excellent bonding surface for EIFS. The flexural strength of DensGlass Sheathing is approximately the same in both directions. This means DensGlass Sheathing can be installed either vertically or horizontally without sacrificing wall strength between studs. DensGlass panels also protect and help stabilize structural framing.

Stability

DensGlass Sheathing is extremely resistant to rippling, buckling and sagging, even under humid conditions—which makes it particularly suitable for soffits. In actual tests, DensGlass panels exceeded ASTM C 1396 and ASTM C 79 standards for humidified deflection by a factor of five times over the standard for paper-faced gypsum sheathing.

Fire Resistance

DensGlass Sheathing is noncombustible as described and tested in accordance with ASTM E 136. Tests of 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing conducted in accordance with ASTM E 119/CAN-ULC S-101 qualify the product for a variety of UL listings and other designs in the GA-600 Fire Resistance Design Manual.

Superior Weather Protection

DensGlass Sheathing integrates a water-resistant, treated core with a fiberglass mat face and back to provide superb protection from the elements.

A water-resistive barrier is not required over DensGlass Sheathing to provide for the protection of the gypsum sheathing itself. Consult with the local building code, design professional, owner or cladding manufacturer for water-resistive barrier requirements. DensGlass Sheathing is the ideal substrate for a wide variety of air and water-resistive barriers including building wraps, liquid applied coatings and self-adhering membranes. See page 10 for details.

Easy to Handle

DensGlass Sheathing is lightweight and easy to handle. It can be cut and fastened with standard drywall tools and fasteners. The product is much easier to work with than wood substrate, cement board or fiber cement sheathing, which tend to be heavy and bulky.

Outstanding Warranty

DensGlass Sheathing is covered by a 12-month limited warranty for exposure to normal weather conditions, a five-year limited warranty against manufacturing defects and a 12-year limited warranty when used as a substrate for architecturally specified EIFS. For a copy of the limited warranty, visit our website at www.gpgypsum.com.

Standards and Code Compliance

DensGlass Sheathing is manufactured to meet ASTM C 1177. Application standards where applicable are in accordance with Gypsum Association Publication GA-253 for gypsum sheathing or ASTM C 1280.

Evaluated by:

- CCMC-12064-R
- N.Y. City MEA 244-88-M
- Florida Product Approval Code FL 2524

The data relating to fire- and sound-tested assemblies is based on the characteristics, properties and performance of materials and systems obtained under controlled test conditions as set forth under the appropriate ASTM standard, such as E 119 (fire), E 90 (sound) or E 72 (structural).

Georgia-Pacific Gypsum Products and LEED®

Our definition at Georgia-Pacific of sustainability is meeting the needs of society today without jeopardizing our ability to do so in the future. The Georgia-Pacific Gypsum manufacturing process is influenced by our concern for the environment, our commitment to the responsible use of natural resources and doing the right thing.

In the coming years, we will continue to focus on:

- Improving energy efficiency at our manufacturing plants, with innovative technologies, that will also result in reduced greenhouse gas emissions.
- Opportunities to reduce water use, and to reuse water more effectively.
- Finding cost effective ways to further reduce air emissions.

By using recycled materials for nearly 50 years, we have found innovative ways to recover and reuse materials that otherwise would end up in landfills. We recover and reuse the wallboard that does not meet our standards, and are developing beneficial applications for the very small amount of material left over at the end of each production cycle.

Green building codes, programs and standards are establishing themselves all across the country. They all promote the use of products that contribute to both the building science performance of the structure and to minimize the environmental and human health impacts of the products used in construction and over the life of the building or home. Because we are embracing sustainable practices in the manufacture of our products, architects and owners can feel good about the structures they build with our products. It is all a part of being mindful of the environment, and the social and economic impact of our products from start to finish.

Many of our products may contribute to LEED credits. To find out more, please reference the Sustainable Materials Data Sheets (SMDS) at www.gpgypsum.com for recycled content, regional materials, low emitting materials and other potential categories for LEED credit contributions. For general information on sustainability, click the "Sustainability" tab on the website.

Architectural Specifications

Georgia-Pacific Gypsum's 3-part guide specifications are downloadable, as rewritable Microsoft® Word documents, in both CSI and ARCOM MasterSpec® formats. Please visit www.gpgypsum.com for details. Downloadable specifications are also available online from Building Systems Design, Inc. at www.bsdsoftlink.com, and ARCOM Product Masterspec at http://www.arcomnet.com/users/masterspec_sections_manufacturers.php. Georgia-Pacific Gypsum specifications and 3-D Revit® compatible models can also be generated in the Georgia-Pacific Design Studio at www.gpdesignstudio.com.

Physical Properties

Product Comparison	1/2" (12.7 mm) Regular Gypsum Sheathing (Paper-faced)	1/2" (12.7 mm) DensGlass® Sheathing	5/8" (15.9 mm) Gypsum Sheathing, Type X (Paper-faced)	5/8" (15.9 mm) DensGlass® Fireguard®
Width, Nominal	4' (1219 mm)	4' (1219 mm)	4' (1219 mm)	4' (1219 mm)
Length, Standard	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)	8', 9', 10' (2438, 2743, 3048 mm) ± 1/4" (6 mm)
Weight[1] nominal, lbs./sq. ft. (Kg/m²)	1.7 (9)	1.9 (9)	2.2 (11)	2.5 (12)
Bending Radius	n/a	6' (1829 mm)[2]	n/a	8' (2438 mm)[2]
Racking Strength,[3] lbs./ft. (dry) (N/m) (Ultimate – not design value)	540[1] (7878)	>540 (>7878)	654[1] (9544)	>654 (>9544)
Flexural Strength,[3] parallel, lbf. (N) (4' weak direction)	40[2] (178)	≥80[2] (356)	50[2] (227)	≥100 (445)
Compressive Strength	min. 350 psi[1] (2400 kPa)	min. 500 psi (3445 kPa)	min. 400 psi[1] (2750 kPa)	min. 500 psi (3445 kPa)
Humidified Deflection,[3,4] inches	10/8" (32 mm)	2/8" (6 mm)	5/8" (15.9 mm)	1/8" (3 mm)
Permeance,[4] Perms (ng/Pa•s•m²)	27 [1600][1]	>23 [1300]	25 [1400][1]	>17 [970]
R Value[5], ft²•°F•hr/BTU (m²•K/W)	.45 (0.079)[1]	.56 (0.099)	.56 (0.099)[1]	.67 (0.118)
Combustibility[8]	Combustible	Noncombustible	Combustible	Noncombustible
Linear Expansion with Change Moisture in/in/%RH (mm/mm %RH)	7.5 x 10⁻⁶	6.25 x 10⁻⁶	7.5 x 10⁻⁶	6.25 x 10⁻⁶
Surface burning characteristics (per ASTM E 84 or CAN/ULC-S102): flame spread/smoke developed	15/0[1]	0/0	15/0[1]	0/0
Coefficient of Thermal Expansion in/in/°F (mm/mm/°C)	10 x 10⁻⁶ (18 x 10⁻⁶)	8.5 x 10⁻⁶ (15.3 x 10⁻⁶)	10 x 10⁻⁶ (18 x 10⁻⁶)	8.5 x 10⁻⁶ (15.3 x 10⁻⁶)

1. Gypsum Association – GA-253, GA-235
2. Specified values per ASTM C 1396
3. Tested in accordance with ASTM C 473
4. Tested in accordance with ASTM E 96 (dry cup method)
5. Tested in accordance with ASTM C 518 (heat flow meter)
6. Specified values per ASTM C 1177
7. Double fasteners on ends as needed
8. Tested in accordance with ASTM E 72
9. As defined and tested in accordance with ASTM E 136

Installation Recommendations

- DensGlass® Sheathing must be installed in accordance with the instructions in this brochure, Gypsum Association document GA-253 or ASTM C 1280. DensGlass Sheathing can be attached parallel or perpendicular to wood or metal framing. Use appropriate board orientation for specific fire assemblies and shear wall applications within this document, other reference documents or as required by designing authority. The framing width shall not be less than 1-1/2" (38 mm) wide for wood framing and 1-1/4" (32 mm) for steel framing. Framing members shall not vary more than 1/8" (3 mm) from the plane of the faces of adjacent framing.
- Fasteners should be driven flush with the panel surface (not countersunk) and into the framing system. Locate fasteners at least 3/8" (9 mm) from the ends and edges of the sheathing. Nails or screws, as listed in the fastener chart, may be used to attach DensGlass Sheathing to framing. When a pneumatic fastening system into metal is specified to attach DensGlass Sheathing, consult with manufacturer for application specifications and shear resistance data. DensGlass Sheathing is not to be used as a base for nailing or other fastening.
- Install DensGlass Sheathing with end joints staggered on horizontal applications. Ends and edges of the sheathing should fit tightly. DensGlass Sheathing panels shall not be less than 8" (203 mm) from the finish grade in fully weather- and water-protected siding systems, and not less than 12" (305 mm) from the ground for properly drained and ventilated crawl spaces. Consult with the design authority for control joint recommendations.

Wall Applications

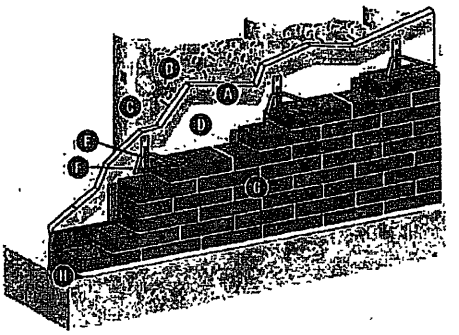
Installing Cladding over DensGlass® Sheathing

Most conventional exterior sidings and wall coverings—including wood, vinyl, composition, metal, stone, brick, wood shingles, shakes and plywood panels—may be applied over DensGlass Sheathing Consult your local building codes for water resistive barriers (WRB) requirements.

A. DensGlass Sheathing
B. Insulation
C. Framing
D. Water-Resistive Barrier
E. Masonry Tie
F. 2" (50mm) Max. Air Space
G. Brick Masonry or Stone Veneer
H. Flashing and Weeps
I. Wood Shingles or Shakes
J. Plywood Siding
K. Vinyl Siding
L. Fiber Cement Siding
M. Metal Siding

Brick Cavity Wall

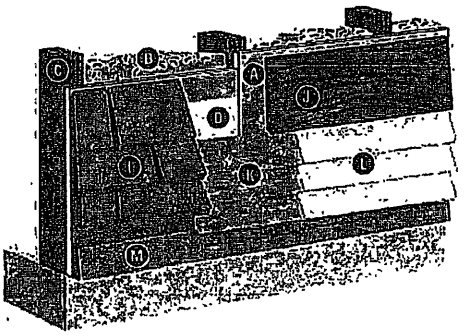
Masonry or stone veneer can be applied over DensGlass Sheathing just as it would be over any other type of sheathing. Attach the masonry ties securely through the panels and into the steel or wood framing. Space the ties as required by masonry courses. Apply water-resistive barrier as required by building code or design authority.



Shingles, Shakes, Vinyl, Metal, Wood, Fiber Cement Siding

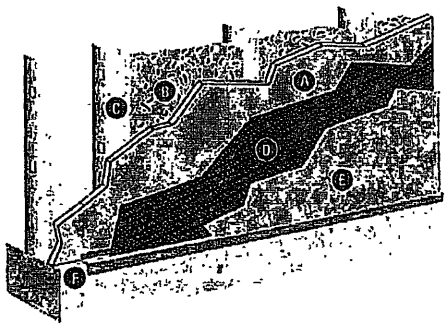
DensGlass Sheathing can be used in applications such as under wood shakes or shingles, plywood panel siding or other horizontal siding applications. All siding must be attached through the DensGlass Sheathing and into the steel or wood framing. Apply water-resistive barrier as required by building code or design authority.

Illustrations not intended for design or specification purposes.



Wall Applications continued

A. DensGlass® Sheathing
B. Insulation
C. Framing
D. Paper-Backed Metal Lath
E. Conventional Stucco
F. Minimum 1/4" (6 mm) Gap



Conventional Stucco

Stucco systems may be applied over DensGlass Sheathing using paper-backed metal lath. Paper-backed metal lath must be mechanically attached through the DensGlass Sheathing into the steel or wood framing. Install stucco system in accordance with the manufacturer's instructions, the Portland Cement Association guidelines and local building code requirements.

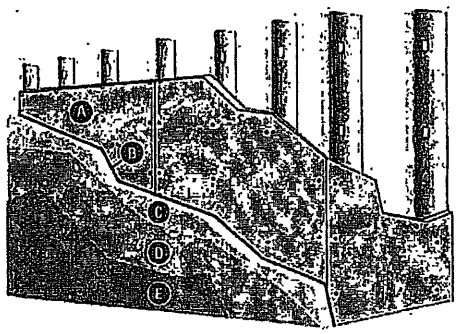
Exterior Insulation and Finish Systems (EIFS)

DensGlass Sheathing is an ideal substrate for adhesive or mechanical application of expanded polystyrene (EPS) or extruded polystyrene insulation in EIFS applications and is recommended for all climate zones.

DensGlass Sheathing is designated as the preferred gypsum substrate for EIFS by EIMA, the EIFS industry members association, in the EIFS Durability Specifications Guideline. DensGlass panels are treated with a primer coating in our exclusive GOLD color. This coating, developed especially for DensGlass Sheathing, has several important advantages for EIFS applications:

- Eliminates the need for sealer/primer with adhesively applied EIFS.
- Strengthens the bond between panel and surfacing product.
- Makes the panel more resistant to surface water. The result: labor cost and callbacks go down while customer satisfaction on each project goes up.
- 12-year limited warranty when used in an architecturally specified EIFS application.
- Maximum framing spacing 16" (406 mm) o.c. for 1/2" (12.7 mm) and 24" (610 mm) o.c. for 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing.

A. DensGlass Sheathing
B. Adhesive or Mechanically Attached
C. Polystyrene Insulation
D. Reinforcing Mesh Embedded in Base Coat
E. Finish Coat



High Velocity Hurricane Zone (HVHZ)

The ability to withstand the destructive winds and the impact of various objects during a hurricane in a coastal area is key to the survival of any exterior cladding system. DensGlass Sheathing from Georgia-Pacific Gypsum helps BASF, Sto Corp, Dryvit, Parex Lahabra, Inc., Fiberweb, Inc. and Wellbilt International's systems pass the strict Miami-Dade County and Florida Building Code requirements for High Velocity Hurricane Zones (HVHZ). The systems were tested independently to determine the performance against specific criteria for impact resistance, air and water infiltration resistance and wind load resistance. For more information, please visit www.gpgypsum.com or contact the system manufacturer.

Fastening and Framing

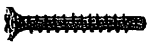
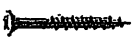
Thickness	Framing Spacing	Panel Orientation	Fastener Spacing – Wood Framing[4]	Fastener Spacing – Metal Framing[4]
1/2" (12.7 mm)	24" (610 mm) o.c. max[1,3]	Parallel[3] or Perpendicular	8" (203 mm) o.c. field[2] & perimeter	8" (203 mm) o.c. along framing
5/8" (15.9 mm)	24" (610 mm) o.c. max[3]	Parallel[3] or Perpendicular	8" (203 mm) o.c. field[2] & perimeter	8" (203 mm) o.c. along framing

1. Only for mechanically attached claddings. When specified behind EIFS, maximum framing spacing for 1/2" (12.7 mm) DensGlass® Sheathing is 16" (406 mm) o.c.

2. Fastener spacing around the perimeter of the wall and along intermediate vertical framing members. To meet the racking shear strength listed in the physical properties table, fastener spacing is 4" (102 mm) o.c. around the perimeter of each panel and 8" (203 mm) o.c. along vertical framing members.

3. For racking strength resistance, apply panel edges parallel with framing spaced a maximum of 16" (406 mm) o.c. for both 1/2" (12.7 mm) and 5/8" (15.9 mm) DensGlass Sheathing.

4. Fire-rated assemblies may require additional fasteners, see specific assembly details.

Fastener*	Length 1/2" Thick	Length 5/8" Thick	Description	Application
	1" (25 mm)	1-1/4" (32 mm)	Bugle head fine thread, rust-resistant drill point drywall screw	DensGlass Sheathing to heavy-gauge steel
	1" (25 mm)	1-1/4" (32 mm)	Bugle head fine thread, rust-resistant sharp point drywall screw	DensGlass Sheathing to light-gauge metal framing furring
	1-1/4" (32 mm)	1-5/8" (41 mm)	Bugle head, rust-resistant, coarse thread sharp point screw	DensGlass Sheathing to wood framing
	1-1/4" (32 mm)	1-1/4" (32 mm) metal 1-5/8" (41 mm) wood	Wafer head, rust-resistant screws, drill or sharp point	DensGlass Sheathing to heavy-gauge or light-gauge, metal or wood, respectively
	1-1/2" (38 mm)	1-3/4" (45 mm)	11-gauge, galvanized nail	DensGlass Sheathing to wood framing or equivalent

**For screws, meet or exceed ASTM C 1002 or C954. Contact fastener manufacturer for correct amount of corrosion resistance.*

Negative Uniform Wind Load

5/8" (15.9 mm) DensGlass® Fireguard® Sheathing Horizontally Applied

Stud Spacing, In./O.C. (mm)	Screws, In./O.C. (mm)	Ultimate load, PSF* (kPa)
16 (406)	8 (203)	127 (6.08)
16 (406)	6 (152)	142 (6.80)
16 (406)	4 (102)	192 (9.19)
12 (305)	8 (203)	157 (7.51)
12 (305)	6 (152)	204 (9.77)
12 (305)	4 (102)	270 (12.93)
8 (203)	8 (203)	208 (9.96)
8 (203)	6 (152)	354 (16.95)
8 (203)	4 (102)	410 (19.63)

NOTE: Apply DensGlass Sheathing to appropriately engineered framing system. Tested applied to 6" (152 mm) x 1-5/8" (41 mm) 18-gauge (43 mils) steel studs using #6 1-1/4" (32 mm) bugle head screws. Other stud sizes may be suitable.

Source: Tested in accordance with ASTM E 330 by Hurricane Test Laboratory. For a copy of report #G408-1001-07, contact Georgia-Pacific Gypsum Technical Hotline at 1-800-225-6119.

**Maximum load capacity (not design load) of the 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied horizontally. Apply appropriate safety factor from the design method used to calculate design load. For example, a safety factor of 3 applied to an ultimate load of 127psf (6.08 kPa) results in a design load of 42 psf (2.01 kPa).*

1/2" (12.7 mm) and 5/8" (15.9 mm) DensGlass Fireguard Sheathing Vertically or Horizontally Applied

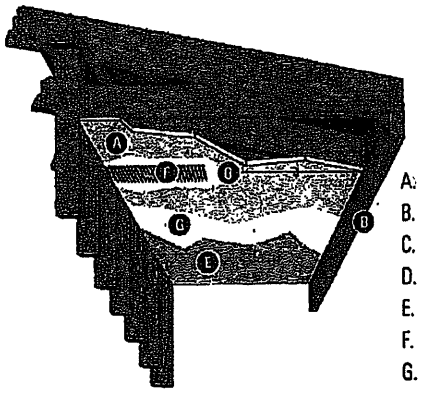
Thickness Inches (mm)	Board Orientation	Stud Spacing In. o.c. (mm)	Ultimate Load Psf (kPa)
1/2" (12.7)	Vertical	16 (406)	65 (3.11)
1/2" (12.7)	Horizontal	16 (406)	70 (3.35)
5/8" (15.9)	Vertical	24 (610)	68 (3.26)
5/8" (15.9)	Horizontal	24 (610)	85 (4.07)
5/8" (15.9)	Vertical	16 (406)	92 (4.40)

Source: TPI Report #09-047; wind load per ASTM E330 (bugle head screws 8" (203 mm) o.c.).

Soffit Applications, Fastening, Framing and Finishing

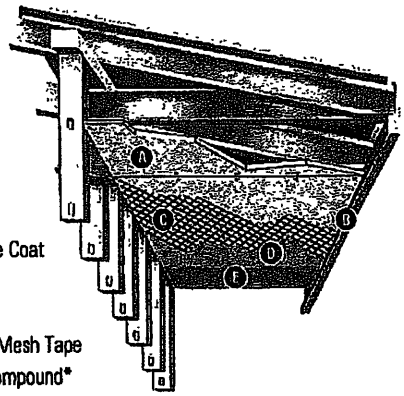
Method #1

Painted Ceilings and Soffits Finished Joints



Method #2

Exterior Ceilings and Soffits



A: DensGlass® Sheathing
B. Drip Edge
C. Reinforcing Mesh/Base Coat
D. Base Coat
E. Finish Coat
F. 2" (51 mm) Fiberglass Mesh Tape
G. ToughRock® Setting Compound*

**Sandable setting compounds are not recommended.*

Thickness	Framing Spacing	Orientation	Screw Spacing
1/2" (12.7 mm)	16" (406 mm) o.c. max	Parallel or Perpendicular	8" (203 mm) o.c. along framing
1/2" (12.7 mm)	24" (610 mm) o.c. max	Perpendicular 24" o.c. framing	8" (203 mm) o.c. along framing
5/8" (15.9 mm)	24" (610 mm) o.c. max	Parallel or Perpendicular	8" (203 mm) o.c. along framing

Method #1

Embed 2" (51 mm) wide fiberglass mesh tape in ToughRock® 90 Setting Type joint compound, or equivalent, over all joints. Once dry, apply a skim coat of ToughRock 90 setting compound, or equivalent, over the panels to achieve a uniform, smooth finish over the entire area. Prime with exterior-grade primer and finish with two coats of exterior-grade paint.

Method #2

Apply a synthetic-type Direct Applied Finish System in accordance with the coating manufacturer's recommendation.

Special conditions for both methods:

1. Control joints are recommended a maximum of 30 feet (9144 mm) or closer as specified by the design authority.
2. The roof must be dried in or protection from the elements must be provided prior to installing DensGlass Sheathing in horizontal applications to prevent moisture from ponding or settling on top of the sheathing panel or within the finished soffit.
3. Sandable setting compounds are not acceptable for use over DensGlass Sheathing in exterior soffit applications.
4. Georgia-Pacific Gypsum's ToughRock 90 setting compound is not available in all markets. It is permissible to use setting-type joint compounds from other manufacturers that are equivalent to ToughRock 90 setting compound.

Air- and Water-Resistive Barriers

The need for moisture control, greater energy savings, comfort and improved environment is driving the use of air- and water-resistive barriers. Manufacturers, building codes and standards organizations are improving the ways moisture is controlled in buildings. DensGlass® Sheathing has been widely accepted for years as the preferred substrate with these systems and provides superior performance over other sheathings. The ultimate in wall performance and peace of mind is starting with the best substrate–DensGlass Sheathing.

DensGlass Sheathing is a superior substrate for a wide variety of air- and water-resistive systems which include:

- #15 asphalt felt, ASTM D 226, type 1 or equivalent
- Synthetic wraps such as Tyvek®, Typar® MetroWrap®, ASTM E 1677 or equivalent
- Liquid- or fluid-applied air or vapor barriers such as Tremco ExoAir® 120, Grace Perm-A-Barrier® VP, Henry Air-Bloc® 32 or Carlisle Barriseal®
- Water barrier systems such as Sto Guard® as manufactured by Sto Corp., Dryvit's Backstop® NT, Prosoco R-GUARD® or equivalent
- Asphalt-based coatings
- Self-adhering membranes such as Carlisle CCW, Grace Perm-A-Barrier®, Henry Air-Bloc Vapor Barriers, Protecto Wrap
- Water-resistive barrier and drainage membranes such as DELTA-DRY®

Follow manufacturer's installation recommendations for use with DensGlass panels, local building code requirements and design authority's specifications.

In areas that do not prescribe to current code requirements but still require long-term joint protection, either of the following two methods may be specified in lieu of an air- and water-resistive barrier system: **Method 1)** Apply minimum 3/8" (9 mm) bead of sealant to joints and trowel to provide a layer approximately 2" (51 mm) wide by 1/16" (2 mm) thick spanning the joint. Use backer rod for openings larger than 1/8" (3 mm). **Method 2)** Apply glass mesh joint tape to all joints, overlapping at intersections by the width of the tape. Apply approximately 3/8" (9 mm) bead of caulk along the joint. Embed the caulk into the entire surface of the tape with a trowel. Use backer rod for openings larger than 1/8" (3 mm). Follow manufacturer's installation recommendations for use with DensGlass Sheathing, and design authority specifications.

A variety of caulk and polymer-based "fill" materials may be specified, including GE, Dow Corning, Tremco, Sto, Dryvit, BASF and Proseco. Please contact the caulk manufacturer for its recommended caulks over DensGlass Sheathing.

Note: It is not required to provide a water-resistive barrier over DensGlass Sheathing for the protection of the gypsum sheathing itself during the 12-month weather exposure limited warranty. Consult with local building code, design professional, owner or cladding manufacturer for water-resistive barrier requirements and compatibility with the wall cladding.

Protection of Penetrations

All penetrations should be protected to prevent air and water infiltration. Follow building code, door/window manufacturer or design authority's recommendations for flashing around openings, abutments to dissimilar materials and wall terminations.

Fire-Rated Assemblies

DensGlass® Fireguard® Sheathing is UL and ULC classified as **Type DGG** and is included in numerous assembly designs investigated by UL and ULC for hourly fire resistance ratings.

In addition, 5/8" DensGlass Fireguard Sheathing is classified as "Type X" in accordance with ASTM C 1177 and may replace 5/8" gypsum sheathing specified as Type X in generic fire-rated wall assemblies. Generic systems in the GA-600 Fire Resistance Design Manual are applicable to the products of any manufacturer, including Georgia-Pacific Gypsum, provided they meet certain standards set forth in such manual, such as Type X gypsum board per applicable ASTM standard with specified thickness and size described in the design. "Type X" as used in this technical guide designates gypsum board manufactured and tested in accordance with specific ASTM standards for increased fire resistance beyond regular gypsum board. Please consult the ASTM standard for the specific product (for example, ASTM C 1177 for glass mat gypsum substrate for use as sheathing) for further information and significance of use.

The following design assemblies are for illustrative purposes only. Consult the appropriate fire resistance directory or test report for complete assembly information. For additional fire safety information concerning DensGlass Sheathing, visit www.gp.com/safetyinfo.

1-Hour Fire Rating
Design Reference: UL U305, U337, WHI 495-0702, ULC W301[1], GA WP 5515

EXTERIOR

38-34 STC Sound Trans.
Test Reference: OR 64-8

Wall Thickness: 4-7/8" (124 mm)

Weight per Sq. Ft.: 7.5 (37 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing applied vertically (U337, W301, U305) or horizontally (U305) to 2 x 4 wood studs 16" (406 mm) o.c. with 1-3/4" (45 mm) galvanized roofing nails 7" (178 mm) o.c. for all framing members. Exterior surface covered with weather exposed cladding or finish system.

Interior: 5/8" (15.9 mm) DensArmor Plus® Fireguard® interior panels or 5/8" (15.9 mm) ToughRock® Fireguard® gypsum board applied vertically (U337, U305) or horizontally (U305) to studs with 1-7/8" (48 mm) 6d coated nails 7" (178 mm) o.c. Stagger joints each side.

1-Hour Fire Rating
Design Reference: UL U309, cUL U309, WP 3510

EXTERIOR

35-39 STC Sound Trans.
Test Reference: NGC 35-39

Wall Thickness: 4-7/8" (124 mm)

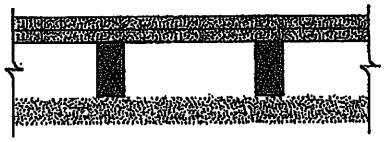
Weight per Sq. Ft.: 7.5 (37 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically or horizontally to 2 x 4 wood studs spaced 24" (610 mm) o.c. with 1-7/8" (48 mm) galvanized roofing nails 7" (178 mm) o.c.

Interior: 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board to framing with 1-7/8" (48 mm) 6d coated nails 7" (178 mm) o.c.

2-Hour Fire Rating
Design Reference: UL U301, cUL U301

EXTERIOR



40-44 STC Sound Trans.
Test Reference: NGC-2383

Wall Thickness: 6-1/8" (156 mm)

Weight per Sq. Ft.: 12.5 (61 kg/m²)

Exterior: Two layers 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically or horizontally to 2 x 4 wood studs 16" (406 mm) o.c. Base layer attached with 1-7/8" (48 mm) galvanized roofing nails 16" (406 mm) o.c. Face layer attached with 2-3/8" (60 mm) galvanized roofing nails 8" (203 mm) o.c. Stagger joints between layers and on base layer of both sides.

Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied horizontally or vertically to framing. Base layer attached with 1-7/8" (48 mm) 6d cement coated nails 6" (152 mm) o.c. Face layer attached with 2-3/8" (60 mm) 6d cement coated nails 8" (203 mm) o.c. Stagger joints between layers and on base layer of both sides. Sound tested with studs 16" (406 mm) o.c. and nails for base layer spaced 6" (152 mm) o.c.

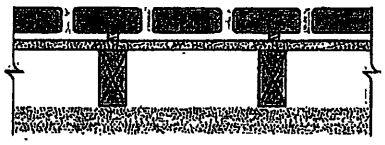
Important Note:

1. ***UL and ULC Assemblies:*** *For 5/8" ToughRock® Fireguard® gypsum boards, UL designation "Type 9" should be used for all UL and cUL assemblies, and ULC designation "Type GF-6" should be used for all ULC assemblies. Please check UL, cUL or ULC certification mark on product for confirmation prior to use.*

Fire-Rated Assemblies continued

2-Hour Fire Rating
Design Reference: UL U302, cUL U302, GA WP 8410

EXTERIOR



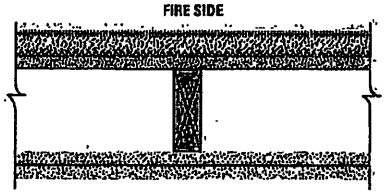
Wall Thickness: 10-1/8" (257 mm)

Exterior: One layer 1/2" (12.7 mm) DensGlass Sheathing applied vertically or horizontally to studs with 1-3/4" (45 mm) galvanized roofing nails 6" (152 mm) o.c. Face layer is 2" x 4" x 8" (51 mm x 102 mm x 203 mm) clay brick with 1" (25 mm) air space between brick and exterior sheathing. 20-gauge (30 mils) galvanized wire ties attached to each stud with 8d coated nails as described above, located at every sixth course of bricks.

Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically or horizontally to 2 x 4 wood studs 16" (406 mm) o.c. Base layer attached with 1-7/8" (48 mm) 6d coated nails 8" (203 mm) o.c. Face layer attached with 2-3/8" (60 mm) coated nails 8" (203 mm) o.c.

Generic 2-Hour Fire Rating
Design Reference: UC 12-21-67, GA WP 8420[2]

FIRE SIDE



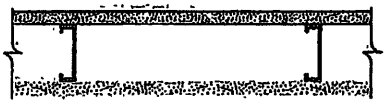
Wall Thickness: 8-5/8" (219 mm)

Exterior: Base layer 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing retardant treated 2 x 6 wood studs 16" (406 mm) o.c. with 6d coated nails, 1-7/8" (48 mm) long, 0.0915" (2 mm) shank, 1/4" (6 mm) heads, 12" (305 mm) o.c. and covered with a single layer fire resistant protective weather retarder paper stapled along each edge at 16" (406 mm) o.c. Galvanized self-furring wire mesh applied over sheathing with 8d galvanized roofing nails, 2-3/8" (60 mm) long, 0.113" (3 mm) shank; 9/32" (7 mm) heads, 6" (152 mm) o.c. Cement-stucco applied over wire mesh in two 1/2" (12.7 mm) thick coats with bonding agent applied between coats.

Interior: Base layer 5/8" (15.9 mm) DensArmor Plus® Fireguard® or 5/8" (15.9 mm) ToughRock® Fireguard® applied vertically to studs with 6d coated nails, 1-7/8" (48 mm) long, 0.0915" (2 mm) shank, 1/4" (6 mm) heads, 12" (305 mm) o.c. Face layer 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard applied horizontally to studs with 8d coated nails, 2-3/8" (60 mm) long, 0.113" (3 mm) shank, 9/32" (7 mm) heads, 8" (203 mm) o.c. at edges and 12" (305 mm) o.c. at intermediate studs.

1-Hour Fire Rating
Design Reference: UL U465, ULC W415[1], cUL U465, GA WP 1081[2]

EXTERIOR



48 STC Sound Trans.
Test Reference: RAL TL 103

Wall Thickness: 4-7/8" (124 mm)

Weight per Sq. Ft.: 6 psf (29 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to min. 3-5/8" (92 mm) corrosion resistant 25-gauge (18 mils) steel studs 24" (610 mm) o.c. with 1" (25 mm) corrosion resistant bugle head screws 8" (203 mm) o.c. at board edges and 8" (203 mm) at intermediate studs.

Interior: 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing with 1" (25 mm) Type S bugle head screws 8" (203 mm) o.c. at board edges and 12" (305 mm) at intermediate studs. Sound tested with 3" mineral fiber, 2.5 psf, in stud space.

1-Hour Fire Rating
Design Reference: UL U425, cUL U425

EXTERIOR

40-44 STC Sound Trans.
Test Reference: NGC-2835

Wall Thickness: 4-3/4" (121 mm)

Weight per Sq. Ft.: 6 psf (29 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass® Sheathing applied vertically to min. 3-1/2" (89 mm) corrosion resistant 20-gauge (30 mils) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S corrosion resistant bugle head screws 8" (203 mm) o.c.

Interior: 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing with 1" (25 mm) Type S bugle head screws 12" (305 mm) o.c. Insulation to completely fill stud cavity.

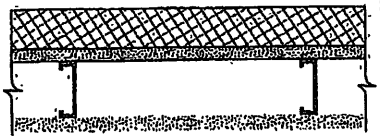
Important Notes:

1. ***UL and ULC Assemblies:*** *For 5/8" ToughRock® FireGuard® gypsum boards, UL designation "Type G" should be used for all UL and cUL assemblies, and ULC designation "Type GF-G" should be used for all ULC assemblies. Please check UL, cUL or ULC certification mark on product for confirmation prior to use.*
2. ***Proprietary GA-600 Designs:*** *Assemblies listed as proprietary in the GA-600 Fire Resistance Design Manual only list one product per manufacturer and may not include all products referenced in the illustrations above. Please consult the specified UL, cUL, ULC or other fire listing or test for a complete list of approved products.*

CAUTION: For product fire, safety and use information, go to gp.com/safetyinfo.

Fire-Rated Assemblies continued

Generic 1-Hour Fire Rating
Design Reference: SWRI 01-4409-003, GA WP 8122[2]



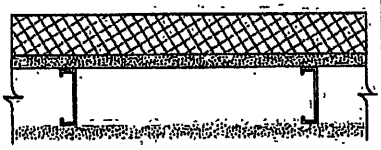
Partition Thickness. 6" – 7" (152 – 178 mm) Varies based on insulation thickness

Weight per Sq. Ft.: 7.0 (34 kg/m²)

Exterior: 5/8" (15.9 mm) DensGlass® Fireguard® Sheathing applied vertically to 3-5/8" (92 mm) 18-gauge (43 mils) steel studs 16" (406 mm) o.c. with #6 x 1-1/4" (32 mm) self-drilling, corrosion-resistant, bugle head, drywall screws 8" (203 mm) o.c. at edges and ends and 8" (203 mm) o.c. at intermediate studs. Proprietary polymer modified exterior insulation and finish system applied over sheathing. 2" (51 mm) maximum foam-plastic thickness.

Interior: 5/8" (15.9 mm) ToughRock® Fireguard® or 5/8" (15.9 mm) DensArmor Plus® Fireguard® gypsum board applied vertically to studs with #6 x 1-1/4" (32 mm) self-drilling, bugle head drywall screws 8" (203 mm) o.c. at edges and ends and 12" (305 mm) o.c. at intermediate studs.

Generic 1-Hour Fire Rating
Design Reference: SWRI 01-4409-001, GA WP 8123[2]



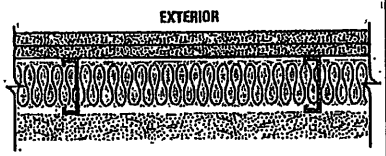
Partition Thickness: 6" – 9" (152 – 229 mm) Varies based on insulation thickness

Weight per Sq. Ft.: 7.0 (34 kg/m²)

Exterior. 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to 3-5/8" (92 mm) 18-gauge (43 mils) steel studs 24" (610 mm) o.c. with #6 x 1-1/4" (32 mm) self-drilling, corrosion-resistant, bugle head, drywall screws 8" (203 mm) o.c. at edges and ends and 8" (203 mm) o.c. at intermediate studs. Polymer-based exterior insulation and finish system applied over sheathing. 4" (102 mm) maximum foam-on-plastic thickness.

Interior: One layer 5/8" (15.9 mm) ToughRock Fireguard or 5/8" (15.9 mm) DensArmor Plus Fireguard gypsum board applied vertically to studs with #6 x 1-1/4" (32 mm) self-drilling, bugle head drywall screws 8" (203 mm) o.c. at edges and ends and 12" (305 mm) o.c. at intermediate studs.

2-Hour Fire Rating
Design Reference: UL U425, cUL U425, WP 1716



40-44 STC Sound Trans.
Test Reference: NGC-2250

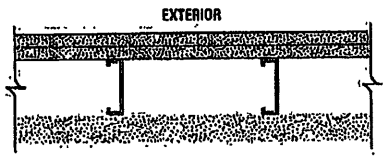
Wall Thickness: 6" (152 mm)

Weight per Sq. Ft.: 11.0 psf (54 kg/m²)

Exterior: Two layers 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to min. 3-1/2" (89 mm) corrosion resistant 20-gauge (30 mils) steel studs 24" (610 mm) o.c. Base layer attached with 1" (25 mm) Type S-12 corrosion resistant bugle head screws 8" (203 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S-12 corrosion resistant bugle head screws spaced 8" (203 mm) o.c. Joints staggered.

Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing. Base layer attached with 1" (25 mm) Type S-12 bugle head screws 12" (305 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S-12 bugle head screws spaced 12" (305 mm) o.c. Joints staggered. Insulation to completely fill stud cavity. (Load Bearing: 80% of design load)

2-Hour Fire Rating
Design Reference: UL U411, cUL U411



50-54 STC Sound Trans.
Test Reference: WHI 218

Wall Thickness: 5" (127 mm)

Weight per Sq. Ft.: 11.0 (54 kg/m²)

Exterior: Two layers 5/8" (15.9 mm) DensGlass Fireguard Sheathing applied vertically to min. 2-1/2" (64 mm) corrosion resistant 25-gauge (18 mils) steel studs 24" (610 mm) o.c. Base layer attached with 1" (25 mm) Type S corrosion resistant bugle head screws 16" (406 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S corrosion resistant bugle head screws spaced 8" (203 mm) o.c. Joints staggered.

Interior: Two layers 5/8" (15.9 mm) DensArmor Plus Fireguard or 5/8" (15.9 mm) ToughRock Fireguard gypsum board applied vertically to framing. Base layer attached with 1" (25 mm) Type S bugle head screws 16" (406 mm) o.c. Face layer attached with 1-5/8" (41 mm) Type S bugle head screws spaced 16" (406 mm) o.c. in the field and along vertical edges and 12" (305 mm) o.c. to the floor and ceiling runners. Joints staggered. Batt or blanket insulation optional. Sound tested with 2-1/2" fiberglass insulation.

Important Note:

2. ***Proprietary GA-600 Designs:*** *Assemblies listed as proprietary in the GA-600 Fire Resistance Design Manual only list one product per manufacturer and may not include all products referenced in the illustrations above. Please consult the specified UL, cUL, ULC or other fire listing or test for a complete list of approved products.*

Delivery, Handling and Storage

All materials shall be delivered in original bundles bearing the brand name, if any; applicable standard designation; and name of the manufacturer or supplier for whom the product is manufactured. The plastic packaging used to wrap gypsum panel products for rail and/or truck shipment is intended to provide temporary protection from moisture exposure during transit only and is not intended to provide protection during storage after delivery. Such plastic packaging shall be removed immediately upon receipt of the shipment. **WARNING:** Failure to remove protective plastic shipping covers can result in condensation which can lead to damage, including mold.

All materials should be kept dry. Gypsum panel products shall be neatly stacked flat with care taken to prevent sagging or damage to edges, ends and surfaces. Gypsum panel products and accessories shall be properly supported on risers on a level platform, and fully protected from weather, direct sunlight exposure, and condensation. Gypsum panel products shall be stacked flat rather than on edge or end. **WARNING:** Gypsum panel products stacked on edge or end can be unstable and present a serious hazard in the workplace should they accidentally topple.

Refer to *Handling Gypsum Panel Products,* GA-801, for proper storage and handling requirements.

Reference: Application and Finishing of Gypsum Panel Products, GA-216-2010, Gypsum Association.

Recommendations and Limitations for Use

The following recommendations and limitations are important to ensure the proper use and benefits of DensGlass Sheathing. Failure to strictly adhere to such recommendations and limitations may void the limited warranty provided by Georgia-Pacific Gypsum for such product. For additional details, please go to www.gpgypsum.com and select DensGlass Sheathing for warranty information.

DensGlass® Sheathing is resistant to normal weather conditions, but it is not intended for immersion in water. Cascading roof/floor water should be directed away from the sheathing until appropriate drainage is installed.

Avoid any condition that will create moisture in the air and condensation on the exterior walls during periods when the exterior temperature is lower than the interior. The use of forced air heaters creates volumes of water vapor which, when not properly vented, can condense on building materials. The use of these heaters and any resulting damage is not the responsibility of Georgia-Pacific Gypsum. Consult heater manufacturer for proper use and ventilation. Vapor barrier may also restrict ventilation.

When DensGlass Sheathing panels are used in slanted wall applications, that portion of the wall must be temporarily protected from the elements by the use of a water-resistant barrier prior to application of the cladding. Do not allow water to pond or settle on sheathing. Also, exposed wall ends such as those that may be found in parapets must be covered to prevent water from infiltrating the cavity.

Georgia-Pacific Gypsum does not warrant and is not responsible or liable for the performance of any cladding, coating, finishes, coverings or other materials or exterior systems applied over DensGlass Sheathing. The suitability and compatibility of any system is the responsibility of the system manufacturer or design authority.

Do not laminate DensGlass Sheathing to masonry surfaces, use furring strips or framing.

DensGlass Sheathing is not intended for roof applications. For roof applications, consult our DensDeck® Roof Board brochure.

DensGlass Sheathing is not intended for interior or exterior tile applications. For interior tile applications, consult our DensShield® Tile Backer brochure.

DensGlass Sheathing should not be used in lieu of plywood where required.

Do not apply DensGlass Sheathing below grade.

For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed. Openings and penetrations must be properly flashed and sealed. Failure to do so will void the warranty.

Do not use DensGlass Sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.

COMMONLY USED METRIC CONVERSIONS

Gypsum Board Thickness
- 1/4 in. – 6 mm
- 1/2 in. – 12.7 mm
- 5/8 in. – 15.9 mm
- 1 in. – 25.4 mm

Gypsum Board Width
- 2 ft. – 610 mm
- 4 ft. – 1219 mm
- 32 in. – 813 mm

Gypsum Board Length
- 4 ft. – 1219 mm
- 5 ft. – 1524 mm
- 8 ft. – 2438 mm
- 9 ft. – 2743 mm
- 10 ft. – 3048 mm
- 12 ft. – 3658 mm

Framing Spacing
- 16 in. – 406 mm
- 24 in. – 610 mm

Fastener Spacing
- 2 in. – 51 mm
- 2.5 in. – 64 mm
- 7 in. – 178 mm
- 8 in. – 203 mm
- 12 in. – 305 mm
- 16 in. – 406 mm
- 24 in. – 610 mm

Temperature
- 40°F – 5°C
- 50°F – 10°C
- 125°F – 52°C

High-Performance Gypsum Products from Georgia-Pacific

DensDeck® Roof Boards	Fiberglass mat roof board used as the ideal thermal barrier and cover board to improve resistance to wind uplift, hail, foot traffic, fire and mold in a broad range of commercial roofing applications. Look for DensDeck Prime and DensDeck DuraGuard, too.
DensGlass® Sheathing	The original and universal standard of exterior gypsum sheathing offers superior weather resistance, with a 12-month weather exposure limited warranty. Look for the familiar GOLD color.
DensGlass® Shaftliner	Specially designed panels for moisture prone vertical or horizontal shafts, interior stairwells and area separation wall assemblies. 12-month weather exposure limited warranty. GREENGUARD listed for microbial resistance.
DensArmor Plus® High-Performance Interior Panel	High performance interior panel accelerates scheduling because it can be installed before the building is dried-in. 12-month weather exposure limited warranty. GREENGUARD Indoor Air Quality Certified®. GREENGUARD Children & Schools® Certified. GREENGUARD listed for microbial resistance. Listed in CHPS™ High Performance Product Database as a low emitting product.
DensArmor Plus® Abuse-Resistant Interior Panel	Same benefits as DensArmor Plus® High-Performance Interior Panel with added resistance to scuffs, abrasions and surface indentations. Ideal for healthcare facilities and schools. GREENGUARD Indoor Air Quality Certified®. GREENGUARD Children & Schools® Certified. GREENGUARD listed for microbial resistance. Listed in CHPS™ High Performance Product Database as a low emitting product.
DensArmor Plus® Impact-Resistant Interior Panel	Even greater durability with an embedded impact-resistant mesh for the ultimate resistance in high traffic areas. Ideal for healthcare facilities, schools and correctional institutions. GREENGUARD Indoor Air Quality Certified®. GREENGUARD Children & Schools® Certified. GREENGUARD listed for microbial resistance. Listed in CHPS™ High Performance Product Database as a low emitting product.
DensShield® Tile Backer	Acrylic-coated tile backer stops moisture at the surface. Lightweight and strong, built for speed on the job site. Conforms to requirements of IBC/IRC Code. GREENGUARD listed for microbial resistance.
ToughRock® Gypsum Boards	Paper-faced line of gypsum panels for a variety of applications including interior wall and ceiling applications, abuse-resistant boards, veneer plaster base systems, and panels for use in fire-rated assemblies. Listed in CHPS™ High Performance Product Database as a low emitting product. Use Mold-Guard® treated paper gypsum boards for enhanced mold resistance.

Georgia-Pacific Gypsum

U.S.A. Georgia-Pacific Gypsum LLC
CANADA Georgia-Pacific Canada LP

SALES INFORMATION AND ORDER PLACEMENT
U.S.A. Midwest: **1-800-876-4746** West: **1-800-824-7503**
South: **1-800-327-2344** Northeast: **1-800-947-4497**

CANADA Canada Toll Free: **1-800-387-6823**
Quebec Toll Free: **1-800-361-0486**

TECHNICAL HOTLINE U.S.A. and Canada: **1-800-225-6119**

Some of our products have been certified by Scientific Certification Systems (SCS). SCS is an internationally recognized third-party evaluation, testing and certification organization. Its program spans a wide cross-section of the economy, including manufacturing and retailing, consumer products, the energy industry, and the home improvement and construction sectors. For details on specific Georgia-Pacific Gypsum products and plants, please contact our Technical Hotline at 1-800-225-6119.

www.gpgypsum.com

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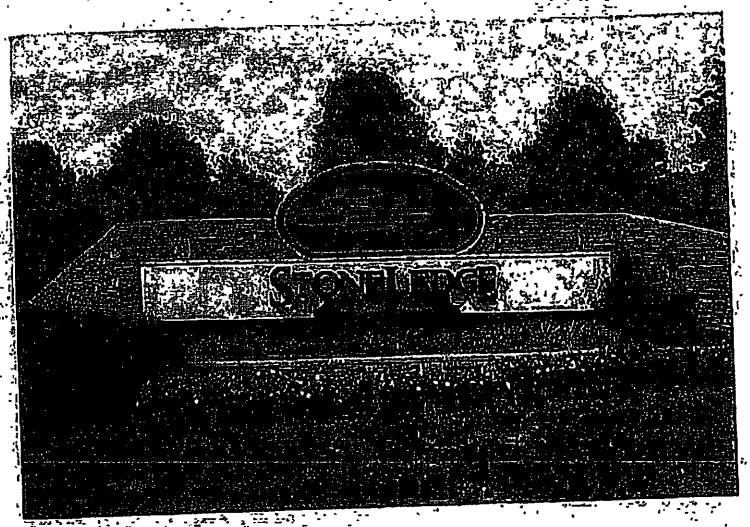
03191

Stoneledge at Lake Keowee

West Union, South Carolina

September 30, 2011

Below Grade Repair Documents



Construction Science and Engineering, inc.
218 East Main Street
Westminster, SC 29693
Phone: (864) 647-1065

PLAINTIFF'S EXHIBIT 28 10-3-13

03192

Stoneledge- Below Grade Remediation

January 30, 2012

Line	Item	Takeoff Quantity	Takeoff Units	Labor Unit Price	Matl Unit Price	Sub/Eqpt Unit Price	Labor Total	Matl Total	Sub/Eqpt Total	Line total:	Notes
Costs to Excavate and Waterproof One Typical Unit (50 LF average)											
A. Site & Building Selective Demolition							0	0	0	0	
1	Relocate & Store Condensing Units	3	ea			134	0	0	402	402	General HVAC
2	Remove & Store fence around condensing units	1	ea	50			50	0	0	50	
3	Dig up existing landscaping & store	40	MH	15			600	0	0	600	
4	Sawcut, demo, haul away sidewalk	20	MH	15			300	0	0	300	
5	Shore up front porch roof	1	est	80		45	80	45	0	125	
6	Demo front porch slab & steps on grade	1	est	500			500	0	0	500	
7	Remove 2' high strip of cultured stone	100	sfca	2			200	0	0	200	
							0	0	0	0	
B. Excavation:							0	0	0	0	
1	Excavate foundations:	153	cy			10.00	0	0	1530	1530	Fowler
2	scrape off existing waterproofing & clean	550	sfca	0.75			412.5	0	0	412.5	
							0	0	0	0	
							0	0	0	0	
C. Waterproofing & Drainage:							0	0	0	0	
1	waterproofing materials:						0	0	0	0	
	a. Polyguard 650 liquid adhesive	6	gal		23		0	138	0	138	Newsouth Supply
	b. Polyguard 650 membrane	550	sf		0.6		0	330	0	330	Newsouth Supply
	c. Termination bar at top of wall	50	lf		1.6		0	80	0	80	Newsouth Supply
	d. Polyguard sheet flow drain at footer	200	sf		2.36		0	472	0	472	Newsouth Supply
	e. 6" foundation drain w/ filter fabric	50	lf		1.3		0	65	0	65	Newsouth Supply
	f. Polyguard 15P sheet drain	500	sf		2.36		0	1180	0	1180	Newsouth Supply
							0	0	0	0	
2	backfill materials:						0	0	0	0	
	a. #57 washed stone	240	tons		20		0	4800	0	4800	Fowler
	b. Filter fabric	600	sfca		0.08		0	48	0	48	Newsouth Supply

03193

Line	Item	Takeoff Quantity	Takeoff Units	Labor Unit Price	Matl Unit Price	Sub/Eqpt Unit Price	Labor Total	Matl Total	Sub/Eqpt Total	Line total:	Notes
3	Waterproofing & backfill labor:						0	0	0	0	
	a. Apply primer & membrane	550	sfca	0.75			412.5	0	0	412.5	
	b. Install sheet flow drain at footing	200	sfca	1.00			200	0	0	200	
	c. Install sheet drain from footing to grade	500	sfca	1.00			500	0	0	500	
	d. Install 6" foundation drain	50	lf	4.00			200	0	0	200	
	e. Backfill with washed stone	240	tons			10.00	0	0	2400	2400	Fowler
	f. Backfill dirt	0	cy			15.00	0	0	0	0	Fowler
	g. Haul excess dirt offsite	150	cy			6.00	0	0	900	900	Fowler
							0	0	0	0	
D.	Hardscape, landscaping, finish items						0	0	0	0	
1	Form and pour concrete stoop	1	ea	480	250		480	250	0	730	
2	Form and pour sidewalks	40	sf			3	0	0	120	120	
3	Repair paving	1	ls			250	0	0	250	250	
4	backfill & spread topsoil	10	cy		18	4	0	180	40	220	Fowler
5	Install new irrigation system or repair existing	1	ls			150	0	0	150	150	
6	Install plants, shrubs, & mulch	1	ls			500	0	0	500	500	
7	Re install condensing units & concrete pads	3	ea			350	0	0	1050	1050	General HVAC
8	Re install condensing unit fence	1	ls	50	25		50	25	0	75	
9	install cultured stone	100	sfca			15	0	0	1500	1500	
10	Remediate lay down area/cleanup site	1	ls	100			100	0	0	100	
							0	0	0	0	
E.	Interior Work:						0	0	0	0	
1	Allowance for interior repairs to drywall, framing, trim, flooring, & painting	1	ls			1500	0	0	1500	1500	
							0	0	0	0	
							0	0	0	0	
General Conditions:							0	0	0	0	
1	Site Superintendent	1	wks	1500			1500	0	0	1500	
2	super's truck	1	wks		75		0	75	0	75	
3	cell phone	1	wks		55		0	55	0	55	
4	temp toilet	1	wks		20		0	20	0	20	
5	dumpster	1	pull		350		0	350	0	350	
6	seavan storage unit	1	wks		25		0	25	0	25	
7	Daily Cleanup	6	MH	14			84	0	0	84	
8	Final Cleanup	6	MH	14			84	0	0	84	
							0	0	0	0	
							0	0	0	0	
	Direct Total:						5753	8138	10342	24233	*24233*

03194

Line	Item	Takeoff Quantity	Takeoff Units	Labor Unit Price	Matl Unit Price	Sub/Eqpt Unit Price	Labor Total	Matl Total	Sub/Eqpt Total	Line total:	Notes
Indirect Costs:											
1	Sales Tax	6%	total Matl			5753				345.18	
2	Labor Burdon	45%	total labor			8138				3662.1	
3	Permit Fee	0.60%	total			[redacted]				217.182	
4	utility relocation contingency	1.00	ls			500				500	
5	Overhead and Fee	10%	total			[redacted]				3619.7	
6	Contingency	10%	total							3619.7	
Total per Average Unit:										**$ 36,197**	*36196.862*
Total number of units with basements:		**73**	ea								
Average cost per unit x total basement units:		**73**	ea			**36197**				**$ 2,642,371**	
Garage shoring or demo/rebuild allowance:		**43**	ea			**10000**				**$ 430,000**	
Total Estimate, Entire Project:										**$ 3,072,371**	

03195

03196

CSE File No. 237.01
September 30, 2011

Stoneledge at Lake Keowee HOA
c/o Mr. Robert Lyles
Lyles and Lyles, Inc.
P.O. Box 773
(342 East Bay Street)
Charleston, SC 29402 (29401)

Re: Scope of Repairs for Below Grade Repairs
Stoneledge at Lake Keowee
West Union, SC

Dear Mr. Lyles:

Pursuant to the request of The Stoneledge at Lake Keowee Homeowners Association (HOA), Construction Science & Engineering, Inc. (CSE) has performed visual surveys of below grade conditions at the subject property. The purpose of our surveys was to determine the extent of construction deficiencies and provide repair recommendations, as necessary to address water intrusion issues identified in finished basements at the subject property.

Prior to this letter, CSE consulted with the Structural Group (SG) in an effort to obtain a separate scope of work for a nontraditional below grade repair utilizing electro osmotic pulse (EOP) technology. SG provided a proposal for this work to the HOA. This letter provides an outline scope of repairs utilizing more traditional below grade repair methods. The scope provided below is based on visual surveys and destructive testing performed to date. In order for CSE to provide final opinions about the extent of construction defects at the subject property, additional destructive testing may be necessary to substantiate our initial findings at certain locations. The outline scope of repairs for below grade repairs should be provided to a qualified general contractor for purposes of preparing a cost estimate.

DESCRIPTION

General Project

The subject project is located in West Union, South Carolina on the shore of Lake Keowee. The subject project includes a total of twenty (20) buildings, which include nineteen (19)

residential townhouse structures and one (1) common use clubhouse structure. Each residential structure contains three (3) to seven (7) townhouse units. There are a total of eighty (80) townhouse units located at the subject project.

The subject project was developed in two (2) phases, Phase One and Phase Two, respectively. Phase One includes all structures located on the south and west sides of the lake (eight (8) buildings total). Phase Two includes all structures located north of the lake (eleven (11) residential buildings total). The clubhouse building is adjacent to an exterior pool area and is located in Phase Two. For descriptive purposes, the front of each unit will be considered the elevation facing the street and parking areas. Subsequently, all other elevations (i.e. left, right, and rear) will be referenced relative to the front elevation.

Townhouse Models

Three (3) different townhouse models were constructed, and are referred to as Parkside, Hampton, or Hickory in the original architectural drawings. The three (3) models vary from one another by exterior window locations and interior floor plans. All residential buildings are two (2) stories, with most units also having full walk-out basements with covered patio areas. However, a few units do not have basements. Units without basements are constructed over a shallow crawlspace. For units with basements, the interior finish level of the basement ranges from unfinished to fully finished. All units with walk-out basements have elevated balconies. A portion of each balcony is uncovered, while the remaining portion is screen enclosed. A copy of the original construction permit drawings were provided to CSE by the Oconee County (South Carolina) Building Department. Copies of the plans will be provided by CSE upon request.

Townhouse Construction

Typical construction for the residential townhouse units includes concrete slab-on-grade foundations for the basement floors. Concrete foundation walls enclose three (3) sides (front, right and left) of the basement and support the conventional wood framing above. The rear basement walls are constructed with conventional wood framing. The roofs are constructed using prefabricated metal plate connected wood trusses. Architectural grade composition shingles cover all roof areas. The exterior wall cladding includes cultured stone veneer (CSV) at the lower area of first floor and basement, cedar lapped siding over the main body of exterior walls, and accent areas of cedar shake. Oriented Strand Board (OSB) wall sheathing and/or gypsum wall sheathing products were used for exterior wall substrates. Windows are typically aluminum clad wood casement windows with insulated glazing (IG). Patio doors are painted wood, full lite (IG); outswing doors with fixed full lite (IG) panel(s) separated by wood framing and trim. Entry doors are stained wood, partial lite (IG), inswing doors of a different style, compared to the patio doors.

Garages

Most townhouse units include a detached garage located in front of the unit. Units 328 Blue Water Way and 335 Blue Water Way do not have a detached garage. The detached garages are located in close proximity to the front of the townhouse units. The detached garages accommodate a separate parking area for either one (1) or two (2) townhouse units. All detached garages are one (1) story structures. Garage roofs are constructed using either a gable or hip configuration covered with architectural grade composition shingles. The garages are wood frame construction supported by a concrete slab-on-grade foundation. The exterior walls have CSV along the base, with cedar lapped siding above.

BACKGROUND

Phase One

Phase One construction was permitted from August 2002 to June 2005. The applicable building code for this time period was the 2000 International Residential Code for One and Two Family Dwellings (2000 IRC). All repairs included in this Scope of Repairs will be required to meet the current applicable building code, which is the 2006 IRC.

Phase Two

Phase Two construction was permitted in March 2006. The applicable building code for this time period was the 2003 International Residential Code for One and Two Family Dwellings (2003 IRC). All repairs included in this Scope of Repairs will be required to meet the current applicable building code, which is the 2006 IRC.

OUTLINE SCOPE OF REPAIRS

1. Impacted Area

   A. Impacted area(s) include all exterior soil bearing walls (including end walls) that enclose interior basement spaces.
   B. Impacted area(s) also include portions of exterior soil bearing walls that occur at the main level (floor level directly above basement level). This occurs where the interior finish floor level is lower than the exterior grade level, as exemplified on the front elevation of 410 Sunset Point Drive.
   C. Impacted areas also include all exterior excavation areas required to access exterior walls for below grade repairs.
   D. Shoring locations required to support excavated soil and existing structures are considered as impacted area(s).
   E. All staging areas (to be determined) and access route(s) to repairs should be treated as impacted areas in so much that any existing element is repaired if damaged during the implementation of this repair scope.

2. Site Preparation

A. Identify, remove, disconnect and/or relocate all below grade utilities located within (or immediately adjacent to) impacted areas. This includes electrical, gas, telephone, cable, satellite TV, ethernet water and sewer.
B. Remove all landscaping materials adjacent to impacted wall areas as required. Salvage plantings as capable, and retain for future use appropriately. Note that all planting areas will be required to match the existing conditions at the conclusion of repairs.
C. Properly disconnect, remove and store exterior HVAC units located within or adjacent to impacted wall areas. All existing HVAC units will be assumed to be in proper working order at time of project commencement, unless documented otherwise by HOA and/or contractor.
D. Remove all paving adjacent to impacted wall areas as required to perform repair work.
E. Remove and store downspouts and drainage leaders as required.
F. Provide adequate protection for all adjacent windows and doors, as determined to be necessary.
G. Provide adequate protection for all existing site drainage inlets adjacent to impacted areas to maintain proper site drainage from other site areas.

3. Site Excavation

A. Verify that all utilities located within impacted area have been properly relocated and/or disconnected.
B. Provide proper shoring for all excavations as required to maintain structural integrity of existing structures (residential, garage and concrete walks) and all existing structural walls (existing structure foundations and site retaining walls) for duration of repair work. Shoring to comply with all applicable codes and standards, including OSHA standards.
C. Remove existing site drainage elements (as applicable) in impacted repair areas during excavations.
    I. Cut site drainage to allow for proper future attachment.
    II. Protect remaining, existing site drainage material from construction debris infiltration.
D. Remove existing utility lines in impacted repair areas during excavations.
    I. Cut utility lines to allow for proper future attachment.
    II. Protect remaining, existing utility material from damage and construction debris infiltration.
E. Remove existing site irrigation in impacted repair areas during excavations.
    I. Cut and cap irrigation lines to allow for proper future attachment.
    II. Salvage and store site irrigation components for future use.
    III. Protect remaining, existing site irrigation from damage and construction debris infiltration.

F. Remove top soil and planting medium material. Store separately from fill soil for reuse as planting medium material.
G. Remove remaining fill soil as required to implement remainder of repair work. Store fill soil separately from top soil.

4. Below Grade Wall Repair

A. Remove and dispose of existing wall barrier material.
B. Clean face of wall in preparation for installation of new material in accordance with manufacturer installation instructions.
C. All new materials should be continuous around corners in a manner consistent with all manufacturer installation instructions.
D. Prepare and prime exterior face of below grade concrete foundation wall with Polyguard 650 LT Liquid Adhesive in accordance with manufacturer installation instructions.
E. Install Polyguard 650 membrane system from the bottom of the foundation of footer continuous to under the through wall flashing at the bottom of the synthetic stone veneer in accordance with the manufacturer installation instructions. Refer to attached Below Grade Exterior Wall Detail(s) A12, A13 and A14.
F. Install Polyguard Total-flow Sheet Drain from 2'-0" above top of the footer, continuous over grouted cant and down footer edge per manufacturer installation instructions. Terminate Total-flow Sheet Drain at bottom of footer. Integrate with Polyguard Flow 15P Sheet Drain (2'-0" above the footer) per manufacturer installation instructions. Integrate with 6" diameter foundation drain with integrated filter fabric at base of footer in accordance manufacturer installation instructions. Refer to attached Below Grade Exterior Wall Detail(s) A12, A13 and A14.
G. Install 6" diameter foundation drain with integrated filter fabric at base of footer continuous from corner to corner of below grade wall(s). Slope to drain 1/8" per foot, minimum. Tie new foundation drain(s) into existing storm water management system.
H. Install Polyguard Flow 15P sheet drain from 2'-0" above top of footer continuous to approximately 3" below grade level per manufacturer installation instructions. Integrate with Polyguard Total-flow Drain Sheet per manufacturer installation instructions.
I. Install gravel drainage plane with filter fabric surround to cover all of the Polyguard Total-flow Sheet Drain, Polyguard Flow 15P Sheet Drain and foundation drain with integrated filter fabric. Refer to attached Below Grade Exterior Wall Detail(s) A12, A13 and A14.
J. Restore function of all impacted utilities.
K. Reinstall any disturbed site drainage components. Integrate all site drainage components (new and existing) to provide adequate site drainage away from structure.

L. Backfill excavated areas and replace layer of top soil. Provide adequate soil compaction in accordance with code requirements and/or accepted industry standards. Slope soil away from structures in accordance with building code(s).

5. Interior Finishes

A. Repair damaged interior gypsum wallboard as needed to match existing finish (i.e. damage due to water intrusion or consequential damages caused by exterior wall repairs, etc.). Repairs should include removal and replacement of damaged interior gypsum wallboard, incidental nail pops, spackling, prepping and painting exterior walls/finishes. For the purposes of this repair scope assume that twenty (20) square feet of gypsum wallboard will be replaced in half of the subject structures.
B. Repair or replace damaged flooring as needed to match existing finish (i.e. damage due to water intrusion or consequential damages caused by exterior wall repairs, etc.).

6. Exterior Finishes

A. Repair damaged synthetic stone as needed to match existing finish in accordance with all repair documents by CSE (i.e. consequential damages caused by exterior wall repairs, etc.).
B. Repair or replace damaged cedar siding as needed to match existing finish in accordance with all repair documents by CSE (i.e. consequential damages caused by exterior wall repairs, etc.).

7. Landscaping

A. Install / re-install site irrigation as required to provide site irrigation as existed prior to commencement of repairs.
B. Install / re-install plants and planting material as required to provide similar landscaping as existed prior to commencement of repairs.
C. Install paving (concrete walks, stairs, stoops, and asphalt paving) to match all paving that was removed in order to perform repairs to below grade wall(s).
D. Install / re-install any retaining wall material removed to perform below grade wall repairs to finish level prior to commencement of repairs and in accordance with all other repair documents by CSE.

8. General Notes for All Repairs

A. All materials specified in this Scope of Repairs and associated Repair Drawings should be installed according to the respective manufacturers' installation instructions.
B. Material / system substitutions may occur with prior acceptance by CSE. Any proposed substitutions should be submitted for approval to CSE with

documentation supporting that the proposed material is equivalent and will properly integrate with all surrounding material(s).

C. All work should be performed in accordance with applicable building codes and accepted industry standards.

This scope of repairs is based on a reasonable degree of engineering certainty regarding the extent of known defects at the subject property. In the event that additional relevant information becomes available, we respectively reserve the right to amend the repair recommendations provided herein. Please feel free to contact me if you have any questions or require additional assistance.

Sincerely,

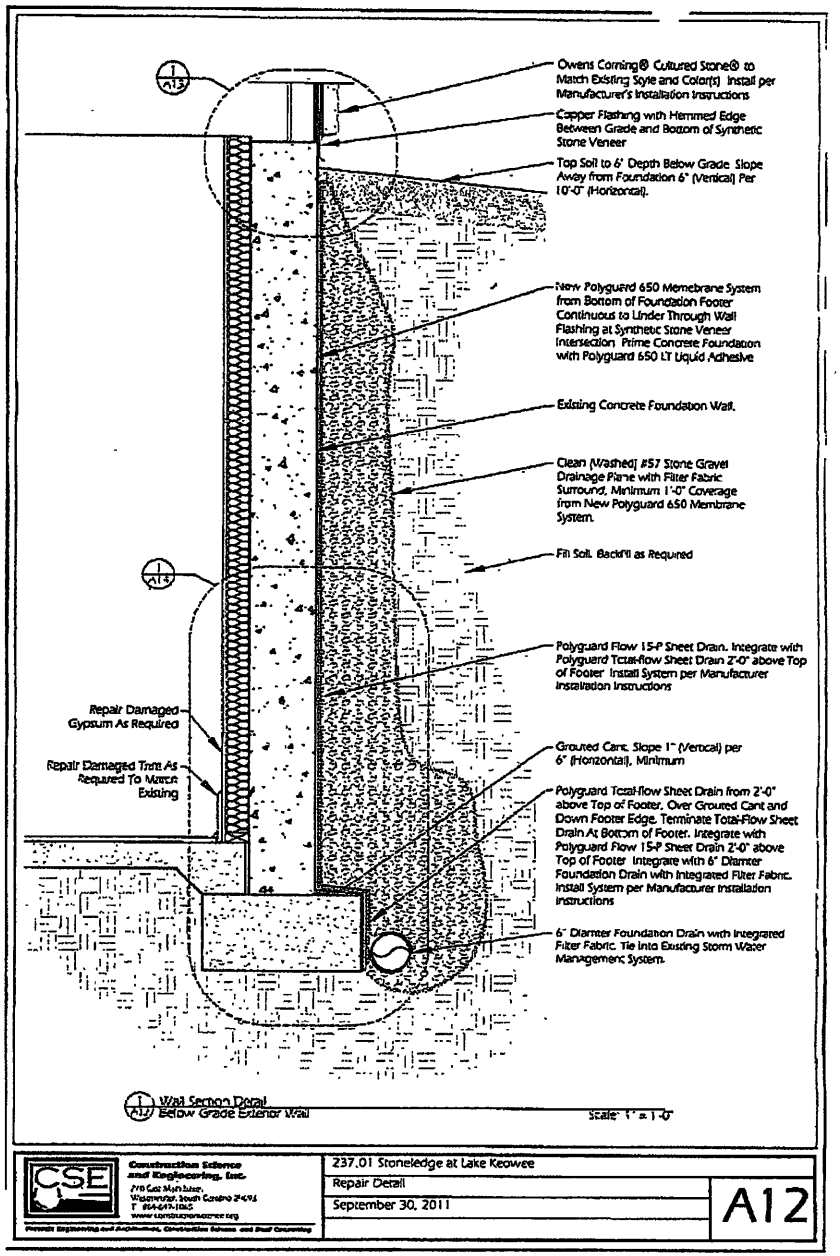
CONSTRUCTION SCIENCE AND ENGINEERING, INC.

Derek A. Hodgin, P.E.

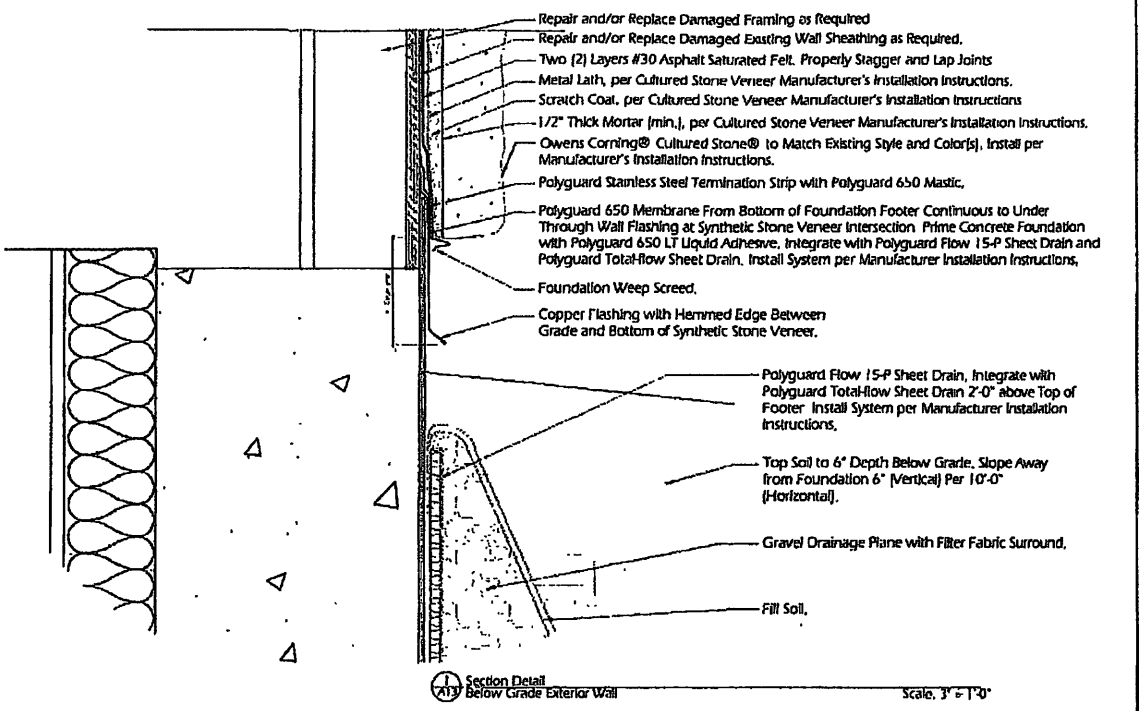
237.01 stoneledge scope of repair_below grade_2011_08_24.doc

03203

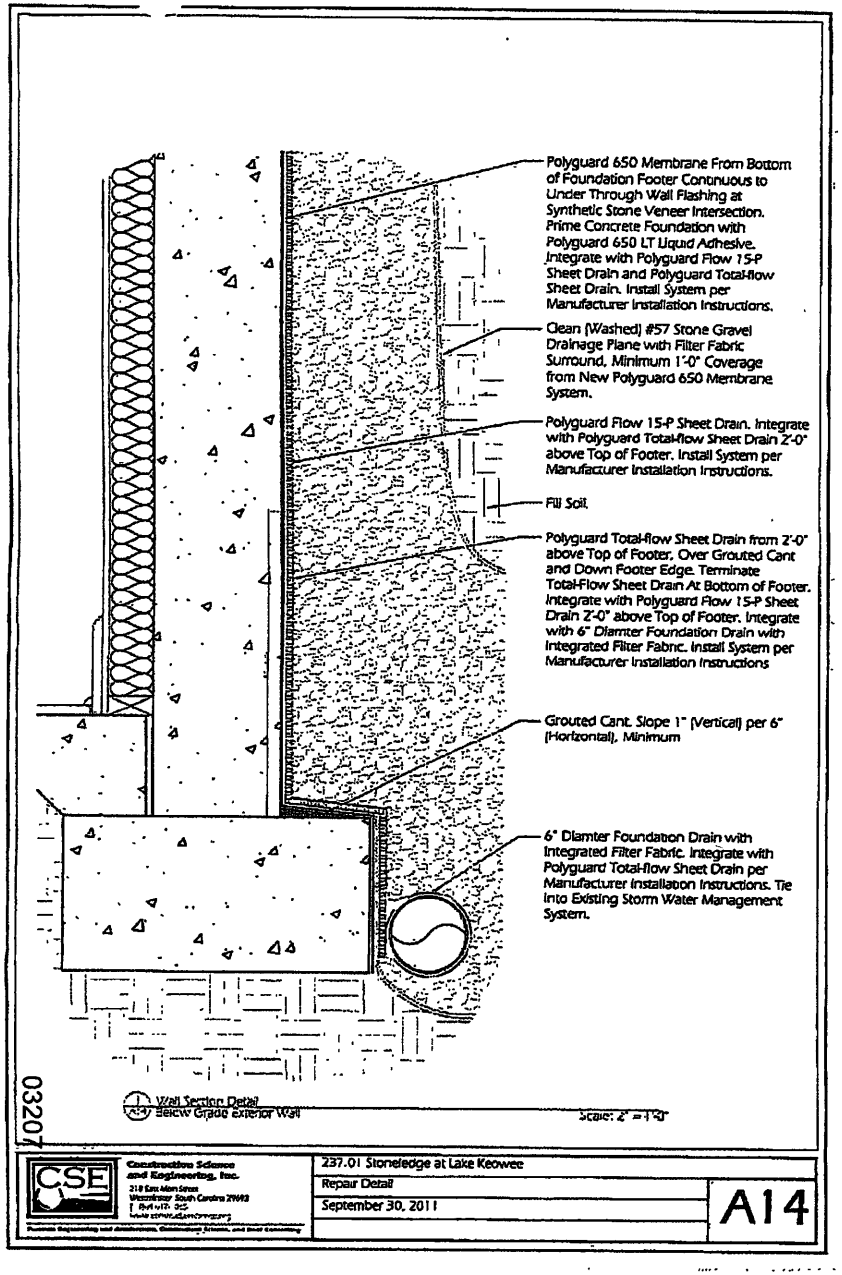
03204


Owens Corning® Cultured Stone® to Match Existing Style and Color(s) Install per Manufacturer's Installation Instructions
Copper Flashing with Hemmed Edge Between Grade and Bottom of Synthetic Stone Veneer
Top Soil to 6' Depth Below Grade Slope Away from Foundation 6" (Vertical) Per 10'-0" (Horizontal).
New Polyguard 650 Membrane System from Bottom of Foundation Footer Continuous to Under Through Wall Flashing at Synthetic Stone Veneer Intersection Prime Concrete Foundation with Polyguard 650 LT Liquid Adhesive
Existing Concrete Foundation Wall.
Clean (Washed) #57 Stone Gravel Drainage Plane with Filter Fabric Surround, Minimum 1'-0" Coverage from New Polyguard 650 Membrane System.
Fill Soil. Backfill as Required
Polyguard Flow 15-P Sheet Drain. Integrate with Polyguard Total-flow Sheet Drain 2'-0" above Top of Footer Install System per Manufacturer Installation Instructions
Repair Damaged Gypsum As Required
Repair Damaged Trim As Required To Match Existing
Grouted Cant. Slope 1" (Vertical) per 6" (Horizontal), Minimum
Polyguard Total-flow Sheet Drain from 2'-0" above Top of Footer, Over Grouted Cant and Down Footer Edge. Terminate Total-Flow Sheet Drain At Bottom of Footer. Integrate with Polyguard Flow 15-P Sheet Drain 2'-0" above Top of Footer Integrate with 6" Diameter Foundation Drain with Integrated Filter Fabric. Install System per Manufacturer Installation Instructions
6" Diameter Foundation Drain with Integrated Filter Fabric Tie Into Existing Storm Water Management System.
Wall Section Detail
Below Grade Exterior Wall
Scale: 1" = 1'-0"
CSE
Construction Science and Engineering, Inc.
237.01 Stoneledge at Lake Keowee
Repair Detail
September 30, 2011
A12

03205


Repair and/or Replace Damaged Framing as Required
Repair and/or Replace Damaged Existing Wall Sheathing as Required.
Two (2) Layers #30 Asphalt Saturated Felt. Properly Stagger and Lap Joints
Metal Lath, per Cultured Stone Veneer Manufacturer's Installation Instructions.
Scratch Coat, per Cultured Stone Veneer Manufacturer's Installation Instructions
1/2" Thick Mortar (min.), per Cultured Stone Veneer Manufacturer's Installation Instructions.
Owens Corning® Cultured Stone® to Match Existing Style and Color(s). Install per Manufacturer's Installation Instructions.
Polyguard Stainless Steel Termination Strip with Polyguard 650 Mastic.
Polyguard 650 Membrane From Bottom of Foundation Footer Continuous to Under Through Wall Flashing at Synthetic Stone Veneer Intersection Prime Concrete Foundation with Polyguard 650 LT Liquid Adhesive, Integrate with Polyguard Flow 15-P Sheet Drain and Polyguard Total-flow Sheet Drain. Install System per Manufacturer Installation Instructions.
Foundation Weep Screed.
Copper Flashing with Hemmed Edge Between Grade and Bottom of Synthetic Stone Veneer.
Polyguard Flow 15-P Sheet Drain, Integrate with Polyguard Total-flow Sheet Drain 2'-0" above Top of Footer Install System per Manufacturer Installation Instructions.
Top Soil to 6" Depth Below Grade. Slope Away from Foundation 6" (Vertical) Per 10'-0" (Horizontal).
Gravel Drainage Plane with Filter Fabric Surround.
Fill Soil.
A13
Section Detail
Below Grade Exterior Wall
Scale: 3" = 1'-0"
237.01 Stoneledge at Lake Keowee
Repair Detail
September 30, 2011
A13
CSE

03206


Polyguard 650 Membrane From Bottom of Foundation Footer Continuous to Under Through Wall Flashing at Synthetic Stone Veneer Intersection. Prime Concrete Foundation with Polyguard 650 LT Liquid Adhesive. Integrate with Polyguard Flow 15-P Sheet Drain and Polyguard Total-flow Sheet Drain. Install System per Manufacturer Installation Instructions.
Clean (Washed) #57 Stone Gravel Drainage Plane with Filter Fabric Surround, Minimum 1'-0" Coverage from New Polyguard 650 Membrane System.
Polyguard Flow 15-P Sheet Drain. Integrate with Polyguard Total-flow Sheet Drain 2'-0" above Top of Footer. Install System per Manufacturer Installation Instructions.
Fill Soil
Polyguard Total-flow Sheet Drain from 2'-0" above Top of Footer. Over Grouted Cant and Down Footer Edge. Terminate Total-Flow Sheet Drain At Bottom of Footer. Integrate with Polyguard Flow 15-P Sheet Drain 2'-0" above Top of Footer. Integrate with 6" Diamter Foundation Drain with Integrated Filter Fabric. Install System per Manufacturer Installation Instructions
Grouted Cant. Slope 1" (Vertical) per 6" (Horizontal), Minimum
6" Diamter Foundation Drain with Integrated Filter Fabric. Integrate with Polyguard Total-flow Sheet Drain per Manufacturer Installation Instructions. Tie into Existing Storm Water Management System.
1 Wall Section Detail
A14 Below Grade exterior Wall
Scale: 2" = 1'-0"
03207
CSE
Construction Science and Engineering, Inc.
237.01 Stoneledge at Lake Keowee
Repair Detail
September 30, 2011
A14

PRODUCT NAME

Waterproofing Membrane, Liquid Adhesive and Mastic

MANUFACTURER

POLYGUARD PRODUCTS. INC.
Ennis, TX 75120-0755
Phone: (214) 515-5000
Fax: (972) 875-9425
Web: www.polyguardproducts.com

PRODUCT DESCRIPTION

Basic Use: *POLYGUARD 650 MEMBRANES* are used on concrete for foundation waterproofing, mud slabs, sills and spandrel beams, tunnels, plaza decks, parking garages and related applications where waterproofing is critical. *POLYGUARD MEMBRANES* may also be used on wood, concrete block structures and insulated concrete forms. Wide membrane widths allow fast and easy application to continuous flat surfaces. Narrow width material is available for trim corners, construction joints and other applications. *POLYGUARD MEMBRANES* should be applied according to specifications. Remedial work can offer special problems in the use of waterproofing materials. Specifiers should discuss remedial work with *POLYGUARD* prior to specification and detailing.

POLYGUARD MEMBRANES are cold applied and selfadhered to poured concrete over *POLYGUARD LIQUID ADHESIVES.*

POLYGUARD 650 MASTIC is used with *POLYGUARD SHEET MEMBRANE* at all T-joints and terminations. It is used as a night seal at the top edge of the membrane and to seal the bottom termination edge of the membrane at the base of the foundation.

POLYGUARD LM-95 LIQUID MEMBRANE is used with *POLYGUARD SHEET MEMBRANES* to eliminate double-ply sheet on inside and outside corners. As a fillet on inside corners, *POLYGUARD LM-95 LIQUID MEMBRANE* insures adhesion to concrete in difficult areas to seal. It is also recommended for planter boxes and all slab penetrations.

Substitutions of components to the *POLYGUARD System* may compromise the quality and performance of the installation. Therefore, substitutions are not allowed.

No other use of these materials can be made without prior approval of *POLYGUARD* as to service and method of application.

Limitations: Porous surfaces may adversely affect adhesion.

POLYGUARD MEMBRANES are not recommended for pond or tank liners except when applied between two concrete slabs.

Waterproofing of T-beam structures requires placing a 12" *(305 mm)* wide strip of *POLYGUARD MEMBRANE* centered over the joint. *POLYGUARD MEMBRANE* should then be placed over the entire surface.

Caution should be taken to prevent contact of the rubberized asphalt element with any product containing fresh coal tar or coal tar pitch. Sealants and liquid waterproofing products containing polysulfide polymer or silicone may be incompatible. Contact *POLYGUARD* for specific information.

Composition of Materials:
POLYGUARD 650 MEMBRANE is a strong, pliable, self-adhesive sheet consisting of high density polyethylene film bonded to a layer of rubberized asphalt waterproofing compound. Factory bonding assures uniform membrane thickness of 60 mils. *POLYGUARD 650 MEMBRANE* is formulated for low temperature application down to 25°F *(-4°C). MEMBRANE* is wound on a disposable treated release sheet to prevent blocking in the rolls. Standard roll size is 48" x 50' *(1.22m x 15.2m)*, and 39.36" x 61' *(1m x 18.59m).*

650 Foundation Wall Application

POLYGUARD 650 LT LIQUID ADHESIVE is a fast drying, high tack rubber-based adhesive in solvent solution used on horizontal and vertical surfaces at temperatures above 25°F *(-4°C).*

TYPICAL PROPERTIES OF POLYGUARD 650 WATERPROOFING MEMBRANES

Property	Test Method	English	Metric
Film Color		Blk./White	Blk./White
Membrane Thickness	ASTM D 1000 inch *(mm)*	.060	*1.5*
Tensile Strength - Membrane	ASTM D-412 (Modified Die C) PSI *(N/mm2)*	325	*2.24*
Tensile Strength - Film	ASTM D-882 PSI *(N/mm2)*	6500	*44.82*
Elongation - Ultimate failure of rubberized asphalt	ASTM D-412	600%	*600%*
Permeance	ASTM E-96-B grains/sq.ft./hr.lin.HGF *(grains/hr/m2)*	.03	.02
Cycling Over Crack @ -15°	ASTM C836	No effect	*No effect*
Peel Adhesion	ASTM D-1000 lb/in. width (N/mm)	10.0	*1.75*
Overlap Bond	ASTM D-1000 lb/in. width (N/mm)	8.0	*1.4*
Pliability	ASTM D-146 - 180° bend over 1" mandrel at -25°F *(-32°C)*	No effect	*No effect*
Puncture Resistance - Membrane	ASTM E-154 (Blunt Instrument) lb *(N)*	50	*182*
Resistance to Hydrostatic head	ASTM-D 5385-93 ft *(M)*	231	*70.4*
Exposure to Fungi in Soil	GSA-PBS 07115-16 Weeks	No effect	*No effect*
Water Absorption	ASTM D-570	.1%	.1%

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This Information is based on our best knowledge, but POLYGUARD cannot guarantee the results to be obtained.

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Web Site: www.polyguardproducts.com

Polyguard has been ISO 9000 certified since 1996. Current certifications are:
- American Nat. Standards Institute
- Dutch Council for Certification
- Deutscher Akkreditierungs Rat

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POLYGUARD SHUR-TAC WATER-BASE LIQUID ADHESIVE is available where VOC limitations may apply.

POLYGUARD 650 MASTIC is a rubberized asphalt mastic with a low solvent content.

POLYGUARD LM-95 LIQUID MEMBRANE is a two-component elastomeric extended rubber urethane, mixed prior to application. *POLYGUARD LM-95 LIQUID MEMBRANE* is formulated to be compatible with the *POLYGUARD* rubberized asphalt compound.

Applicable Standards: *POLYGUARD MEMBRANE* conforms to the following specifications:

- Corps of Engineers CEGS-0711
- AIA MASTERSPEC SECTION 07111
- Federal Construction Guide FCGS 07111
- General Service Administration PBS (PCD) 07111
- Department of the Navy NAV FAC TS 07111
- Veterans Administration 14-08-1 SECTION 07311
- American Railway Engineering Association (AREA) 29-2

TECHNICAL DATA

Typical properties of *POLYGUARD 650 MEMBRANE* are shown in the table below.

INSTALLATION

Material Storage: Membrane and accessories should be unloaded and stored carefully. Cartons and containers must be protected from weather, sparks, flames, excessive heat, cold and lack of ventilation. DO NOT stack membrane material higher than 5' *(1.5m)* vertically, nor double stack pallets. Cartons should be stored on pallets and covered to prevent water damage. For best results, membrane should be stored 50-75°F prior to application.

Application Temperatures: Apply *POLYGUARD 650 LT LIQUID ADHESIVE* on both vertical and horizontal surfaces at temperatures above 25°F *(-4°C)*.

Apply *POLYGUARD SHUR-TAC WATERBASE LIQUID ADHESIVE* by sprayer, when temperature is 25°F *(-4°C)* and rising. At this temperature the weather conditions and substrate must be dry.

Apply POLYGUARD 650 MEMBRANE at temperatures above 25°F *(-4°C)*.

Preparatory Work: Prior to starting work, check that all horizontal surfaces to be waterproofed slope towards drainage. This material is not designed to be applied in areas where water will pond. *Surface Preparation:* A smooth monolithic concrete surface is required. Broom surfaces are not recommended. Concrete should be dry, frost free and cured a minimum of seven days prior to application of *POLYGUARD MEMBRANE* and *LIQUID ADHESIVE*. Surface must be free of voids, spalled areas, sharp projections, loose aggregate and form release agents. Concrete curing compounds containing oil, wax or pigments should not be used. Form release agents must be the self dissipating type which will not transfer to the membrane. Surface defects such as cracks, holes or cavities should be filled and finished flush with a Portland cement grout or concrete. Top surfaces of projecting ledges, below grade, except footings, should be finished to a bevel with Portland cement mortar. Concrete block walls or brick require a well adhered parge coat before application of membrane. Striking off joints flush with surface is also required.

Clean all surfaces to remove debris, dust and loose stones before application begins. DO NOT apply *LIQUID ADHESIVE or* MEMBRANE to frozen concrete.

Priming: Stir *LIQUID ADHESIVE* before use. *POLYGUARD 650 LT LIQUID ADHESIVE* should be applied over the entire surface at a rate of 250-350 square feet, per gallon *(6-8.5 m²/l)*. Primed surfaces must be re-primed if membrane is not applied to the *LIQUID ADHESIVE* within the same working day. Use brush or lambs wool roller for application. *LIQUID ADHESIVE* must be dry prior to application of membrane. *POLYGUARD 650 LT LIQUID ADHESIVE* retains a tacky adhesive surface.

Primed surfaces should be immediately covered or protected to prevent contamination occurring on the *LIQUID ADHESIVE*. Metal surfaces may require *LIQUID ADHESIVE* to obtain bond of membrane to substrate. Field test to determine adhesion level. Surface must be free of contaminates.

Liquid Membrane: Apply fillets formed by *POLYGUARD LM-95 LIQUID MEMBRANE*, latex modified cement mortar or epoxy mortar at the base of foundation walls and footings. DO NOT use wood or fiber cant strips. Fillets or *POLYGUARD LM-95 LIQUID MEMBRANE* should be applied to provide a 3/4" *(19mm)* face and extend 6" *(152mm)* vertically and horizontally, 90 mils *(2.286 mm)*.

DO NOT prime underneath *POLYGUARD LM-95 LIQUID MEMBRANE*.

Cover all corners, joints and the base of the foundation wall and footing using a 12" *(305 mm)* wide strip of membrane centered along the axis. Press or roll firmly to achieve a complete seal. Apply a second ply of membrane. *POLYGUARD LM-95 LIQUID MEMBRANE* may be substituted for the initial 12" *(305 mm)* wide membrane strip on inside corners.

Pretreat inside corners with *POLYGUARD LM-95 LIQUID MEMBRANE* 6" *(152 mm)* in each direction from corners, and form a fillet with *POLYGUARD LM-95 LIQUID MEMBRANE* and apply a 12" *(305 mm)* strip of membrane centered on the corners.

POLYGUARD LM-95 LIQUID MEMBRANE may be substituted for the initial layer of sheet membrane on drains and protrusions by applying a 90 mil *(2.286 mm)* thick layer from the drain or protrusion out and extending 6" *(152 mm)* underneath sheet membrane. Apply *POLYGUARD LM-95 LIQUID MEMBRANE* vertically to be level with height of wearing surface. Flash drains and projections with a second ply of *MEMBRANE* for a distance of 6" *(152 mm)* from drain or projection. Seal all terminations with *POLYGUARD 650 MASTIC*.

Two coats, 45 mils *(1.1430 mm)* each, of *POLYGUARD LM-95 LIQUID MEMBRANE* should be used for waterproofing irregular shapes or circular structures such as planter boxes.

Detail work should be completed prior to mixing *POLYGUARD LM-95 LIQUID MEMBRANE*. Pot life of this product is approximately 60 minutes after mixing at 70°F *(21°C)*.

Sheet Membranes:

POLYGUARD MEMBRANE can be applied in any width up to 48" *(1.2 M)* wide. Side laps must be a minimum of 2-1/2" *(64 mm)*. Staggered end laps should be minimum 6" *(152 mm)*.

When applying *POLYGUARD MEMBRANE* on vertical walls, a determined effort must be made to assure complete adhesion of membrane to the primed surface. Hand roll over lap seams with a wall type narrow roller. Use heavy hand pressure while smoothing out the membrane surface, as it is applied.

On horizontal surfaces, apply membrane from low to high pitch for maximum drainage. Use linoleum

roller or water filled garden roller, covered with two plies of indoor-outdoor carpet to roll membrane immediately after application, with special attention at overlaps and "T-Joint". Seal all end laps with *POLYGUARD 650 MASTIC.*

It is recommended that when vertical sections of more than 8' *(2.4 M)* are to be waterproofed, membrane should be applied in sections no longer than 8' *(2.4 M)*, starting from the lower foundation base and rising to the top with the 6" *(152 mm)* overlap, shingling down on each ply of membrane. *POLYGUARD MEMBRANE* should be applied over the edge of the footing at the foundation base.

The upper terminating edge of *POLYGUARD MEMBRANE* applied to a vertical wall should be completed over the top of the wall. If terminated in the vertical surface, such termination should be at a reglet or counter flashing. The terminated edge should be pressed firmly with a silicone roller and protected with a troweled bead of *POLYGUARD 650 MASTIC.*

Cracks of more than 1/16" *(1.5 mm)* on horizontal or vertical surfaces should be properly sealed in accordance to sealant manufacturer's instruction and prestripped with a 12" *(305 mm)* wide strip of membrane.

Cold joints, T-Joints and evident working cracks should be properly sealed with joint fillers, waterstop or sealant. A 12" *(305 mm)* strip should be placed directly over and centered in the crack with the final applied membrane providing double strength at the area of movement.

All expansion joints, contraction joints and control joints should be properly sealed with joint fillers, waterstop or sealant. An inverted 8" *(203 mm)* strip covered by a 12" *(305 mm)* strip, shall be placed directly over the joint, before the final membrane application.

All intersections must be reinforced, including footings as well as projections, such as drains, pipe, conduit, etc.

Inspection and Repairs: Visually inspect membrane for tears, punctures, air blisters and "fishmouths", prior to water tests, placement of protection board and backfilling. Make repairs by removing all damaged membrane so that only well bonded membrane remains. Reprime any exposed concrete. After *LIQUID ADHESIVE* is dry, apply a new sheet of membrane over the concrete, extending 6" *(152 mm)* onto previously applied membrane. Care should be taken to obtain good adhesion between membrane used for repairs and originally applied membrane.

Slit all "fishmouths", overlap the pieces, place patch over area and roll or press in place. Puncture air blisters, expel the air, prime and cover with patch. Seal edges with *POLYGUARD 650 MASTIC.*

Mastic Application: *POLYGUARD 650 MASTIC* should be applied at all terminations at the end of each day's work. *POLYGUARD 650 MASTIC* should never be applied underneath the *POLYGUARD MEMBRANE.*

Flashing: Finish vertical wall membrane on top edge under flashing or in reglet. Seal T-Joints and terminations with a troweled bead of *POLYGUARD 650 MASTIC.*

Ultraviolet Protection: *POLYGUARD 650 MEMBRANE* can be adversely affected by ultraviolet light. The waterproofing system must be covered as soon as possible and not left exposed to sunlight for over 30 days.

Testing: On horizontal areas, a 24 hour flood test with minimum of 2" *(51 mm)* head of water is recommended. Leaks in membrane must be repaired before any slabs or wearing surfaces are applied. Before flooding, make sure structure will withstand the dead load.

Membrane Protection: Protection board is required over *POLYGUARD 650 MEMBRANE.* Extruded polystyrene is actable for vertical applications; *POLYGUARD LOWFLOW™* and *POLYGUARD FLOW 15-P* as well as some other drainage boards have built in protection which is adequate for vertical surfaces. *POLYGUARD 1/8" (3 mm) ASPHALT PROTECTION BOARD* should be used to protect membrane on horizontal surfaces subject to normal construction traffic. *POLYGUARD 1/4" (6 mm) ASPHALT PROTECTION BOARD* should be used to protect the membrane on horizontal surfaces subject to heavy construction traffic. Protection board systems are to be applied according to the manufacturer's application and guide specifications.

Protection board should be installed over the membrane the same day the membrane is installed or immediately after a 24 hour flood test. If flood testing is not going to be performed the same day membrane is applied, a temporary covering should be applied over the membrane to protect it from damage by traffic, other trades, and to prevent outgassing of moisture in the concrete under the membrane that is exposed to direct sunlight. Membrane left exposed on top of foundation walls or parapets should be covered with weather resistant flashing.

Membrane surfaces should be free of stones and dirt prior to protection board installation.

When adhering protection board systems to *POLYGYARD MEMBRANE*, use a *POLYGUARD* approved adhesive system. Spot adhesion, rather than full adhesion, should be used so that in the event of backfill settlement exerting downward pressure, the protection system will detach from the membrane and slip downwards.

The use of chairs with rolled feet or plastic tips are required to prevent holes being punctured in the protection board and membrane surface. Wire mesh must be supported to prevent the concrete weight from pushing the cut ends of the mesh into the membrane.

Drainage Board: *POLYGUARD's FLOW 15-P* and *LOWFLOW™ PROTECTION / DRAINAGE BOARD* with built in protection for vertical surfaces or *POLYGUARD 18-H* for horizontal surfaces are used to expedite water dispersion. Most require a protection course or slip sheet to be placed before application over *POLYGUARD 650 MEMBRANE.*

Consult *POLYGUARD* for specific recommendations.

Drainage: Drainage systems should be designed with pipe sizes large enough to prevent water accumulation against the foundation. Perforated pipe should be covered with fabric to prevent fines or dirt from plugging perforations. Pipe should be of sufficient strength to prevent deformation due to soil weight or movement. Consideration should be given to provide drain outlets to the interior of the building when the water table level is above the base of the waterproofing membrane.

Backfill: No waiting is required before backfilling. Backfill material should be dry sand or dry soil dirt as following:

- Fill material must be free of large dirt clods, rock, tree roots and debris.
- Backfill should be of a type readily compactable upon deposit.
- It should be placed against the protection board in 6" *(152mm)* to 8" *(203mm)* compacted layers to avoid vertical settlement.
- Backfill should not have a high water content that would cause the soil to shrink upon drying.
- Mechanical compaction in horizontal layers should be used to achieve these results if necessary.

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- Avoid sharp impact to the protection board when backfilling.

Topping Systems: Topping, such as concrete, soil or pavers, may be used to finish a horizontal application. Multi level drainage systems are recommended at both topping and POLYGUARD 650 MEMBRANE elevations.

Precautions: The *LIQUID ADHESIVE* is an industrial coating and would be harmful or fatal if swallowed. It is marked as red label from the standpoint of flash point.

Prohibit flames, sparks, welding and smoking during application.

Refer to product label for handling, using and storage precautions.

Solvents could be irritating to the eyes, flush with water and contact physician.

Avoid prolonged contact with skin and breathing of vapor or spray mist. from liquid adhesive. *In confined areas, use adequate forced ventilation, fresh air masks, explosion-proof equipment and clean clothing.*

Avoid solvent contact with light bulbs or other high temperature surfaces.

CLOSE CONTAINER AFTER EACH USE. KEEP OUT OF REACH OF CHILDREN.

This material is offered for sale by *POLYGUARD PRODUCTS, INC.* only for the expressed purposes as described in this literature. Any use of the products other than taught therein by *POLYGUARD PRODUCTS, INC.* shall be the responsibility of the purchaser, and *POLYGUARD PRODUCTS, INC.* does not warrant, nor will be responsible for any misuses of these products.

POLYGUARD PRODUCTS, as described herein, are for industrial use ONLY. The application procedures should be performed by workmen who are skilled in the application of materials described herein in accordance with the manufacturer specifications.

Material Safety Data: All Material Safety Data Sheets and precautionary labels should be read and understood by all user supervisory personnel and employees before using. Consult *POLYGUARD PRODUCTS, INC.* Material Safety Data Sheets and OSHA regulations for additional safety and health information for the products described herein. Purchaser is responsible for complying with all applicable federal, state or local laws and regulations covering use of the product, including waste disposal.

This is not a Material Safety Data Sheet and is not to be used as such. *POLYGUARD PRODUCTS, INC.* has prepared separate Material Safety Data Sheets on each product.

AVAILIBILITY AND COST

Contact *POLYGUARD PRODUCTS Inc.*, for further information.

WARRANTY

POLYGUARD products are warranted to be free of defects in manufacture for five years. Material will be provided at no charge to replace any defective product.

MAINTENANCE

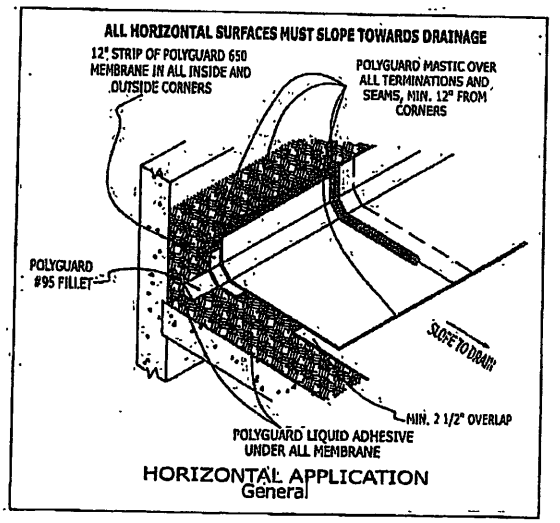
None required, if installed according to instructions.

TECHNICAL SERVICES

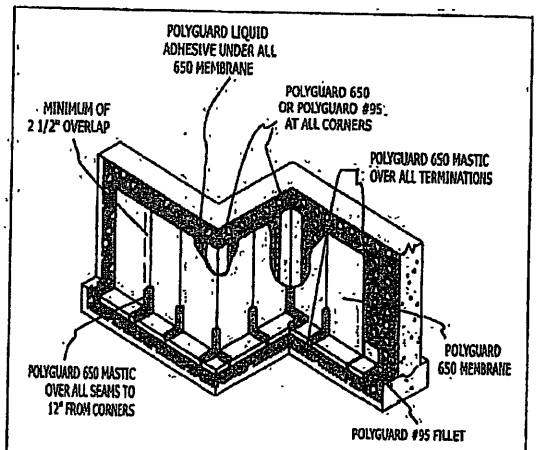
Technical assistance and information are available from any *POLYGUARD* dealer, or contact *POLYGUARD PRODUCTS, INC.*

FILING SYSTEMS

POLYGUARD brochures are available from *POLYGUARD* dealers, website, or the manufacturer.



HORIZONTAL APPLICATION
General



VERTICAL APPLICATION
General

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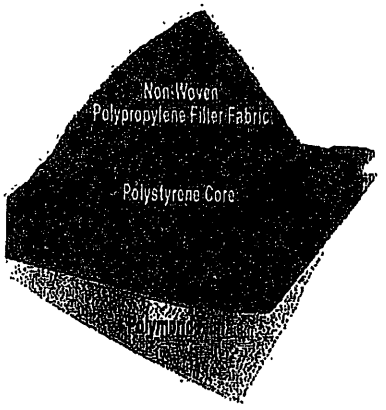
Polyguard

Architectural Products

Polyflow™ 15 & Polyflow™ 15-P
DRAINAGE MATS FOR VERTICAL DRAINAGE



POLYGUARD *Polyflow™ DRAINAGE MATS* are three-part prefabricated geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows the water to flow to designated drainage exits. ***Polyflow™15*** and ***15-P*** are designed for vertical applications.

Polyflow™ DRAINAGE MAT also has a built-in film protection layer. Use of a protection board is not necessary on most applications as the polymeric film layer and core protect softer waterproofing materials such as ***POLYGUARD 650*** waterproofing membrane. If the drainage mat is not to be used over a soft waterproofing system, it can be ordered without the built-in protection layer as ***Polyflow™ 15***.

The many uses of ***Polyflow™ DRAINAGE MATS*** include foundation walls, retaining walls, inclined drains, french drains, trench drains, interceptor drains, embankment drainage, earthen dams, planters, under slabs, and under foot traffic pavers. Virtually anywhere an aggregate drainage system has been used to relieve hydrostatic pressure ***Polyflow™*** can be used more efficiently.

TYPICAL PROPERTIES	ASTM TEST METHOD	UNIT OF MEASURE (English and *Metric*)	*Polyflow™* 15-P	*Polyflow™* 15
DRAIN PROPERTIES:			with soft waterproofing	if no soft waterproofing
Flow Capacity	D 4716	gpm/ft of width *l/min/m of width*	16 / *200*	16 / *200*
Roll Length, feet	-	Feet / *m*	50 / *15.24*	50 / *15.24*
Roll Width, feet	-	Feet / *m*	4 / *1.22*	4 / *1.22*
Roll Weight, lbs	-	Lbs / *kg*	45 / *20.4*	45 / *20.4*
CORE PROPERTIES:				
Material	-	-	Polystyrene	Polystyrene
Thickness	D 1777	Inch / cm	.975 / *.952*	.975 / *.952*
Compressive Strength, lbs/ft² (+ or – 5%)	D 1621 (modified)	lbs/ft² / kg/m²	15,000 / *719*	15,000 / *719*
Polymeric film layer	-	-	yes	No
FABRIC PROPERTIES:				
Material	-	-	Polypropylene	Polypropylene
Grab Tensile Strength	D 4632	Lb / kg	110 / *50*	110 / *50*
Grab Elongation	D 4632	Percent	60	60
Puncture Strength	D 4833	PSI	65 psi	65 psi
EOS *(AOS)*	D 4751	US Sieve mm	100 /*0.152*	100 /*0.152*
Flow Rate, gpm/ft	D 4491	gpm/ft² / (*l/min/m²*)	150 / *6110*	150 / *6110*
UV at 500 hours *(strength retained)*	D 4355	percent	70	70

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Collection Systems:

Polyflow™ DRAINAGE MATS may be used with ***Polyguard TotalFlow™***, perforated pipe, or drain tile for collection of drainage to the designed exit drainage.

Vertical Installation:

Measuring:

If using ***TotalFlow™***, measure perimeter of wall and place a two foot section of ***TotalFlow™*** around the perimeter. Measure wall height from top of ***TotalFlow™***, unroll the ***Polyflow™ DRAINAGE MAT,*** and cut to length.

If using perforated pipe, measure wall height or lift, adding sufficient material for overlapping pipe detail. Unroll ***Polyflow™ DRAINAGE MAT*** and cut to length. Peel back fabric from drainage core and remove 4 " of core. Drain core should remain 6"-12" below backfill.

If using drain tile, measure wall height, adding sufficient material so that there is enough fabric, when fabric is peeled back from drainage core, to wrap around the drainage tile.

Installing:

At the top termination, glue fabric to wall or, if using a furring strip or ***Polyguard*** termination bar, tuck fabric under core. Furring strip / termination bar can be removed after backfill is completed.

Glue or tape adjacent panels at the vertical joints, making sure the fabric overlaps to prevent soil intrusion during backfill.

Tie-in to the collection system can be done with a simple fabric overlap (if using the ***TotalFlow™*** system). If using perforated pipe, peel back fabric from ***Polyflow™ DRAINAGE MAT*** core and remove 4" of core. Drain core should remain 6"-12" below backfill. If using drain tile, wrap fabric which has been pulled away from the core completely around the drain tile. Tuck excess fabric back behind the core. Make sure the drain tile is in direct contact with the ***Polyflow™ DRAINAGE MAT*** core.

Backfill as soon as possible after drain installation.

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DRAINAGE MATS

For Vertical: *Flow 15-P*
For Horizontal: *Flow 18-H*

Soil Drainage Mat with Built-In Protection Layer

POLYGUARD DRAINAGE MATS are three-part prefabricated geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows the water to flow to designated drainage exits. ***POLYGUARD FLOW 15-P*** is designed primarily for vertical applications and ***POLYGUARD FLOW 18-H*** is designed for horizontal applications.

POLYGUARD DRAINAGE MATS also have a built-in film protection layer. Use of a protection board is not necessary on most applications as the polymeric film layer protects softer waterproofing materials such as ***POLYGUARD 650*** waterproofing membrane.

The many uses include foundation walls, retaining walls, inclined drains, french drains, trench drains, interceptor drains, embankment drainage, athletic fields, earthen dams, planters, under slabs, and under pavers.

TYPICAL PROPERTIES	TEST METHOD	15-P	18-H
FABRIC PROPERTIES:			
Material		Polypropylene	Polypropylene
Weight, oz/yd²	ASTM D3776	4.0	4.0
Grab Tensile Strength, lbs	ASTM D4632	110	365x200
Puncture Strength	ASTM D4833	65psi	105lbs
EOS *(AOS)*	ASTM D4751	100	40
Flow Rate, gpm/ft	ASTM D4491	150	100
CORE PROPERTIES:			
Material		Polystyrene	Polystyrene
Thickness, inch		.375	.375
Compressive Strength, lbs/ft²	ASTM D1621 *(Mod.)*	15,000	21,000
DRAIN PROPERTIES:			
Flow Capacity, gpm/ft of width	ASTM D4716	16	18
Roll Length, feet		50	50
Roll Width, feet		4	4
Roll Weight, lbs		40	46

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This Information is based on our best knowledge, but POLYGUARD cannot guarantee the results to be obtained.

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Web Site: www.polyguardproducts.com

Polyguard has been ISO 9000 certified since 1994. Current certifications are:
- American Natl. Standards Institute
- Dutch Council for Certification
- Deutscher Akkreditierungs Rat

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VERTICAL INSTALLATION *(Primarily FLOW 15-P)*

1. Measure wall height or lift, adding sufficient material for overlapping pipe detail. Unroll ***FLOW 15-P*** and cut to length.
2. Peel back fabric from drainage core and remove 4" of core. *(Drain core should remain 6-12 inches below backfill.)*
3. At top termination glue fabric to wall or tuck fabric under core when using a furring strip. *(Furring strip can be removed after backfilling.)*
4. Glue adjacent panels at the vertical joints, making sure that fabric overlaps to prevent soil intrusion when backfilling.
5. At drain tile, peel back fabric from drainage core and wrap around drain tile. Tuck excess fabric under core, making sure inner core has direct contact with drain tile.
6. Backfill as soon as possible.

HORIZONTAL INSTALLATION *(FLOW 18-H)*

1. Clean horizontal surface of loose debris and unroll ***FLOW 18-H*** fabric side up in the direction of maximum slope.
2. Attach ***FLOW 18-H*** to the surface with double-sided tape or adhesive that is compatible with waterproofing membranes.
3. For overlaps, place adjacent panels so that the cores abut.
4. Secure the fabric overlap at five foot intervals with glue or tape.
5. Join roll ends by peeling back fabric and removing 4" of core.
6. Place end panels so that cores abut, then glue or tape fabric overlap.

NOTE: All core joints must be covered by fabric overlay. Protect waterproofing with approved protection system.

RECOMMENDED ADHESIVES

Polyguard 650 LT Liquid Adhesive, Maxbond Construction Adhesive, H B Fuller Co Plionail, Goodyear Liquid Nails, Miracle 297, 294, and Gibson-Homans Shur-Stick 94.

NOTE ON ISO 9000

Polyguard drainage mats are not covered by Polyguard's ISO 9001 quality system registration.

TOTAL FLOW
Soil Sheet Drain

POLYGUARD TOTAL FLOW is a combination of our Polyguard ***TOTAL FLOW*** sheet drain products with our unique ***TOTAL FLOW*** product. In the ***TOTAL FLOW*** System, the sheet drain performs its normal function of water collection, while the ***TOTAL FLOW*** section provides both water collection and a high-profile section allowing for high-capacity water flow to designated drainage exits. The ***TOTAL FLOW*** System provides three advantages over the use of perforated pipe:

- The high-profile ***TOTAL FLOW*** section has a larger open area than perforated pipe, allowing it to accept higher water flow from the sheet drain and surrounding soil.
- ***TOTAL FLOW***, with its manufactured transition between the sheet drain and high profile section, provides a secure flow path that is not dependent upon field installation.
- The ***TOTAL FLOW*** System is fast and easy to install. It eliminates the select backfill requirements that are normally required to provide strength to perforated pipe.

TYPICAL PROPERTIES	TEST METHOD	TOTAL FLOW
FLOW CAPACITY:		
Sheet Section	ASTM D 4716	16 gal/min/ft
High Profile Section	ASTM D 4716	100 gal/min/ft
CORE THICKNESS:		
Sheet Section		7/16 in
Roll Length, feet		50
Roll Width, feet		2
Roll Weight, lbs		30

NOTE ON ISO 9000

Polyguard drainage mats are not covered by Polyguard's ISO 9001 quality system registration.

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This Information is based on our best knowledge, but POLYGUARD cannot guarantee the results to be obtained.

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Web Site: www.polyguardproducts.com

Polyguard has been ISO 9000 certified since 1998. Current certifications are:
- American Nat'l. Standards Institute
- Dutch Council for Certification
- Deutscher Akkreditierungs Rat

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INSTALLATION INSTRUCTIONS
TOTAL-FLOW AND FLOW 15-P
Prefabricated Soil Sheet Drain

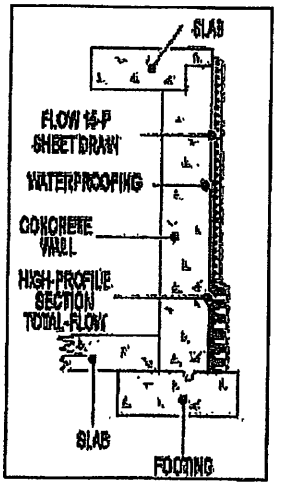
REQUIRED MATERIALS
1. 2' X 50' rolls of TOTAL-FLOW sheet drain.
2. 4' x 50' rolls of FLOW 15P sheet drain, if full wall drainage is required.
3. TOTAL-FLOW sheet drain corner guards
4. 3" wide underground tape
5. Attached materials (see below)
6. Knife or scissors, rubber hammer.

DRAIN ATTACHMENT METHODS
For attaching drain to waterproofing material, concrete or wood, several methods may be used including metal stick pins, nails driven through washers or wood lathing, construction adhesives or double sided tape. Discuss materials compatibility with waterproofing supplier before adhesives. Typically any method used for attaching waterproofing protection board will work for drain. For attaching drain to bare earth, 4-8" anchor pins with washers work well.

CLEAN WALL / WATERPROOF / INSULATE
Clean wall and apply waterproofing or insulation if required.

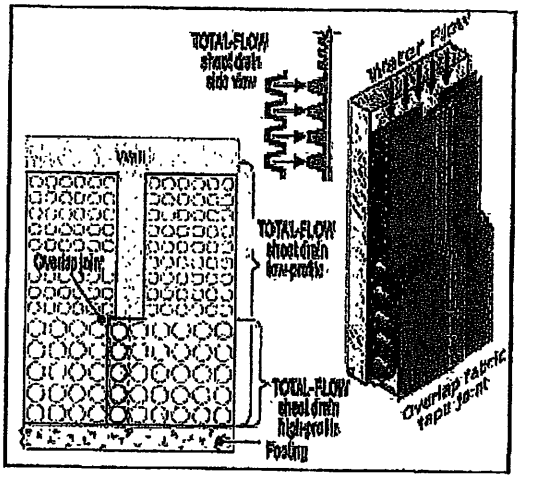
INSTALLING FIRST ROW OF DRAIN
(The TOTAL-FLOW sheet drain row)

The first row of drain to be installed is the TOTAL-FLOW at the bottom of the wall. The drain should sit on top of the footing with the high profile part of the drain at the bottom to provide high lateral water flow.

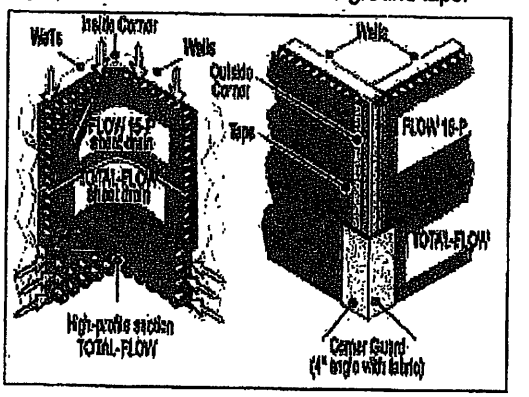


If not using Flow 15-P sheet drain for full wall coverage, close the top end of the drain to prevent soil intrusion by folding the fabric behind the drain. Close the high profile section with 3" underground tape.

INSTALLING NEXT ROLL OF FLOW
To attach the next roll of TOTAL-FLOW drain, cut one row of low-profile dimples from each end of the two sections to be joined. Do not cut fabric. Interlock one row of the high-profile section and secure connection. Overlap fabric and apply 3" wide underground tape from the top to the bottom of the joint to prevent soil intrusion.



GOING AROUND CORNERS
Bend drain to make inside corners. For outside corners, cut the low-profile core flush with corner and tape edges. Slit fabric on high-profile section, bend around corner, and place guard with fabric over slit of high-profile drain. Secure with underground tape.



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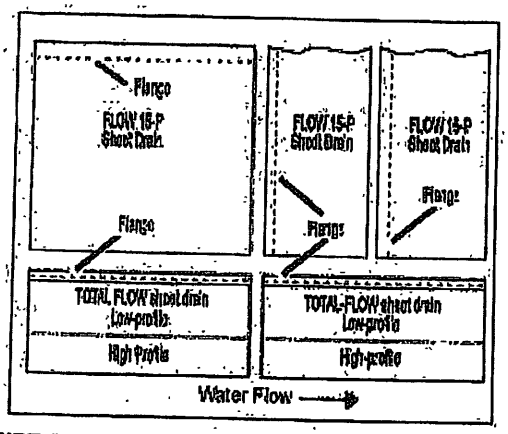
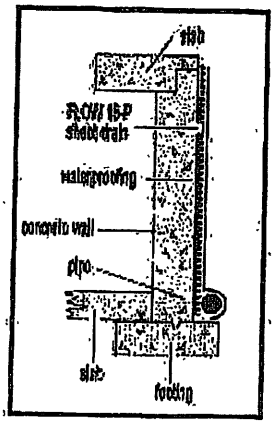
INSTALLATION INSTRUCTIONS
TOTAL-FLOW AND FLOW 15-P
Prefabricated Soil Sheet Drain

CONNECTING FLOW 15-P SHEET DRAIN:
If full wall drainage is required, FLOW 15-P soil sheet drain is attached above the TOTAL-FLOW sheet drain. The FLOW 15-P may be installed either horizontally or vertically.

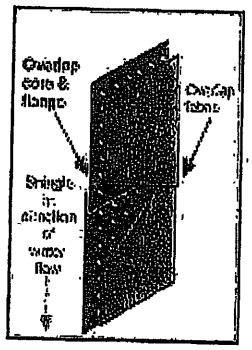
VERTICAL WALL:
When the FLOW 15-P sheet drain is installed vertically, the flange should be facing the direction opposite if the TOTAL-FLOW water flow. When the FLOW 15-P sheet drain is installed horizontally, the edge of the core with the flange should be at the top. This flange position, similar to roof shingle applications, minimizes seepage of water behind the drain. Fold back the fabric at the top of the TOTAL-FLOW sheet drain and place the FLOW 15-P sheet drain on top of the TOTAL-FLOW core flange. Fold fabric from sheet drain section down over the TOTAL-FLOW section and secure with 3" tape.

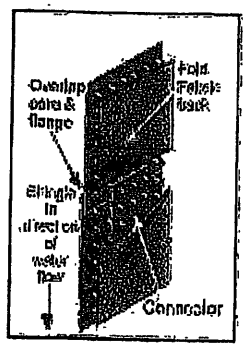


PIPE COLLECTION SYSTEM:
For foundation walls where a drain pipe will be used, position lower end of core horizontally on ground. Peel back fabric to allow drainage pipe to rest on core. Tuck fabric around drainage pipe and under core. Place small amount of select backfill material on fabric to hold in place until backfill is completed.



ATTACHING NEXT ROLL OF FLOW 15-P:
There are two acceptable methods for joining two sections of sheet drain.





METHOD #1
Fold back edge of fabric on lower (or downstream) drain. Do not detach from dimples. Place cones of upper (upstream) drain over flange of lower drain. Overlap fabric of upper drain over lower drain. Seal seam with 3" tape.

METHOD #2
Overlap drain core as shown at right. Peel back fabric exposing two rows of cones. Place connector over two rows of cones on each side of joint. Overlap fabric of upper drain over lower drain.

OPTIONAL METHOD
For either method, overlap fabric in direction of water flow. Use tape or spray adhesive, if necessary, to keep fabric at joint in place prior to backfilling. All edges of drain should have extra fabric tucked behind core edge to prevent soil from entering core.

NOTE:
The non-woven fabric is bonded to the core on the flange side with permanent glue (will not adhere if pulled from core) and on the flush side away from the flange with pressure sensitive glue (will re-adhere if pressure is applied). The pressure sensitive glue permits the fabric to be peeled back easily to be placed around pipes. Woven fabric is attached with all pressure sensitive glue. Permanent glue can be softened, if necessary, with a blow drier. Do not use near open flame to avoid damaging the fabric.

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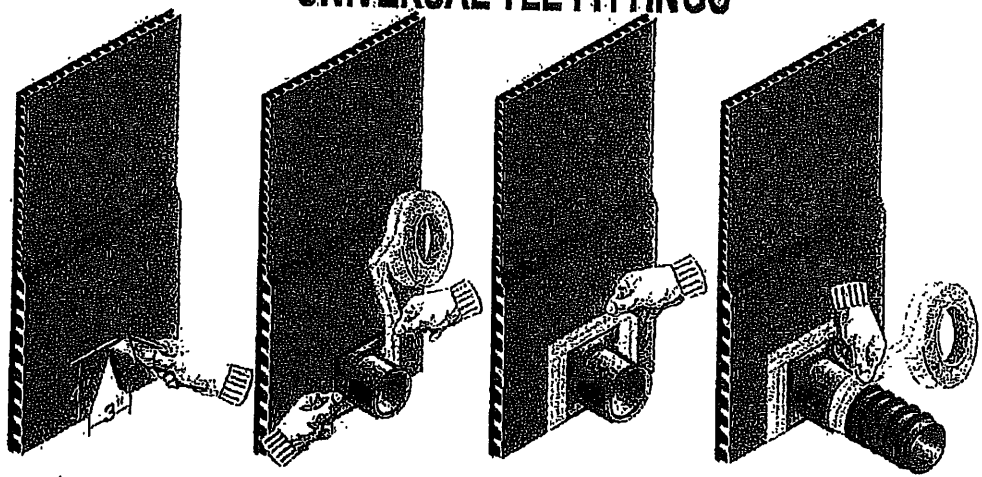
INSTALLATION INSTRUCTIONS
TOTAL-FLOW UNIVERSAL FITTINGS

UNIVERSAL TEE FITTINGS



STEP # 1

Use razor knife and cut a V-notch in the bottom portion of the TOTAL-FLOW approximately 3" wide at the bottom and 4" high and discard

STEP # 2

Insert fitting over notch and tape bottom of the TOTAL-FLOW

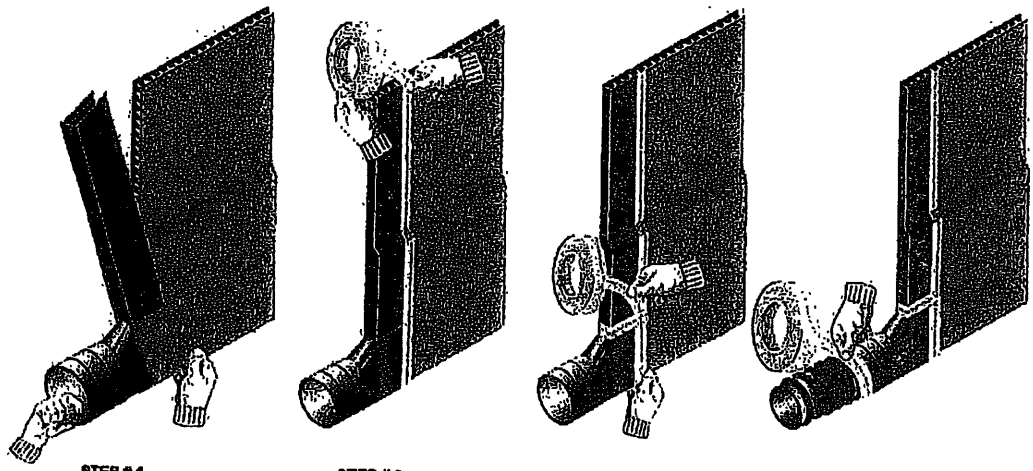
STEP # 3

Make sure all edges of fitting are covered with tape

STEP # 4

Insert pipe into fitting and secure with tape

UNIVERSAL OUTLET FITTINGS



STEP # 1

Place end outlet over bottom corner of TOTAL-FLOW with fabric up

STEP # 2

Fold fabric around exposed edge of core and tape with 3" underground tape

STEP # 3

Secure all edges with 3" tape to prevent soil intrusion

STEP # 4

Insert 4" pipe into end of outlet and secure connection with 3" tape

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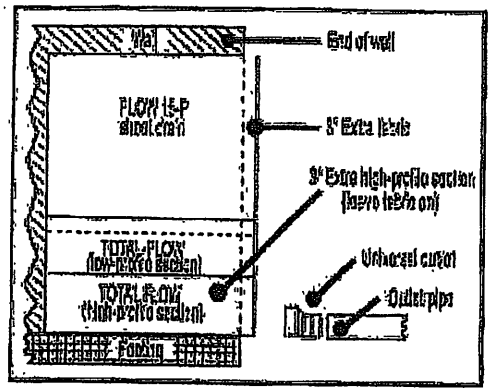
INSTALLATION INSTRUCTIONS
TOTAL-FLOW UNIVERSAL FITTINGS

GOING AROUND CORNERS
Bend drain to make inside corners. For outside corners, cut and bend drain core to reach corner and provide 3" of extra fabric to wrap around corner. Attach drain to wall and overlap fabric at joint.



RETAINING WALLS- (see Figure 1)
Cut bottom of drain to match bottom of wall. (Cut 1/2" diameter holes in flat back of core, opposite fabric) at weep locations. **DO NOT CUT FABRIC.** Place drain on wall fabric toward soil. Tuck extra fabric at downstream edge of core. Attach drain with appropriate attachment method.

SHORING WALLS - (see Figure 2) Place drain with fabric side toward soil to be drained. Cut 1/2" diameter holes on flat back of core at discharge pipe location. **DO NOT CUT FABRIC.** Concrete or gunnite/shotcrete may be placed directly against the core side of the drain.

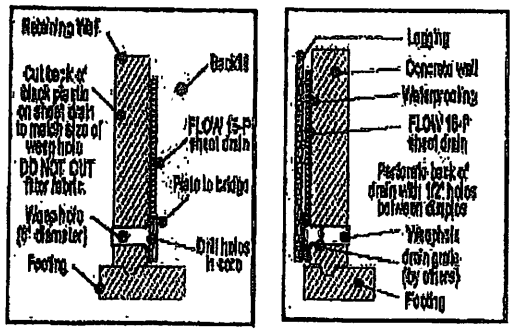


FIGURE 2

SEALING EDGES:
All edges of drain should have extra fabric tucked behind core edge seal to prevent soil from entering core.

BACKFILLING:
Soil should be placed and compacted directly against the drain. Direct compactor exhaust away from the drain to prevent damage. Backfill to a minimum of 6" above drain to allow for coverage after settlement.

FOR HORIZONTAL PLAZAS- (see Figure 3)
Place drain with fabric side up. Cut core and fabric to fit tightly around floor drain.

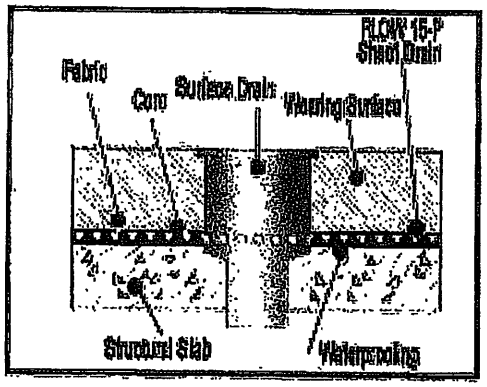
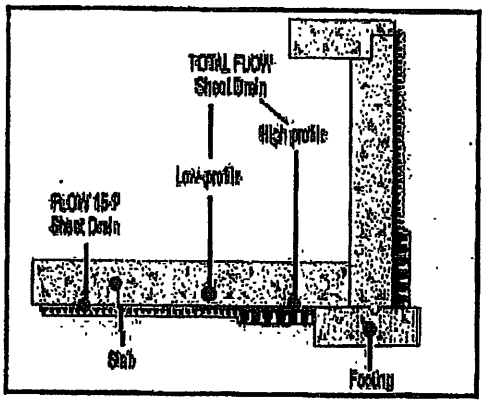


FIGURE 3

INSTALLATION UNDER SLABS
For under floor slab installation, position TOTAL-FLOW sheet drain as shown with geotextile to soil side. Waterproofing and/or floor slab can be applied directly to the back of the core.



QUANTITY TO ORDER:
It is suggested that in the absence of exact information on the amount of material required, add 5% to the estimated quantity.

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Stoneledge at Lake Keowee

3/22/3011 updated 10/22/2013

Estimate Summary- Repairs to Stoneledge at Lake Keowee

Phase I [redacted] (Buildings 1-8), 37 Total Units

Line	Item	Takeoff Quantity	Takeoff Units	Labor Unit Px	Material Unit Px	Sub C Unit Px	Labor Total	Material Total	Sub C Total	Line Total
Roofing:										
1	Remove existing shingles	711	SQ			$ 35.00	$ -	$ -	$ 24,885.00	$ 24,885.00
2	Remove roof sheathing (15%)	334	Shts	$ 15.00			$ 5,010.00	$ -	$ -	$ 5,010.00
3	Replace roof sheathing (15%)	334	Shts	$ 15.00	$ 20.00		$ 5,010.00	$ 6,680.00	$ -	$ 11,690.00
4	Install new 30 lb felt paper	395	rolls		$ 15.00	$ 10.00	$ -	$ 5,925.00	$ 3,950.00	$ 9,875.00
5	Install new shingles and flashings	711	SQ		$ 125.00	$ 50.00	$ -	$ 88,875.00	$ 35,550.00	$ 124,425.00
6	Structural truss repair allowance	1	ls			$ 23,125.00	$ -	$ -	$ 23,125.00	$ 23,125.00
Exterior wall Cladding systems:							$ -	$ -	$ -	$ -
A. Removal:							$ -	$ -	$ -	$ -
1	Remove cedar lap siding	83580	sf			$ 1.00	$ -	$ -	$ 83,580.00	$ 83,580.00
2	remove cedar shake siding	17502	sf			$ 1.00	$ -	$ -	$ 17,502.00	$ 17,502.00
3	Remove existing WRB	178006	sf			$ 0.10	$ -	$ -	$ 17,800.60	$ 17,800.60
4	Remove exterior windows	382	ea			$ 25.00	$ -	$ -	$ 9,550.00	$ 9,550.00
5	remove exterior doors	278	ea			$ 45.00	$ -	$ -	$ 12,510.00	$ 12,510.00
6	Remove Cultured stone	76924	sf			$ 1.00	$ -	$ -	$ 76,924.00	$ 76,924.00
7	Remove int. gyp wall shtg	0	sf			$ 0.50	$ -	$ -	$ -	$ -
8	Remove damaged OSB shtg (25% wall area)	44502	sf			$ 0.50	$ -	$ -	$ 22,250.75	$ 22,250.75
B. Replacement:							$ -	$ -	$ -	$ -
1	Repairs to wood stud framing	1	allowance			$ 46,250.00	$ -	$ -	$ 46,250.00	$ 46,250.00
2	Replace wall sheathing	44502	sf		$ 0.85	$ 1.00	$ -	$ 37,826.70	$ 44,502.00	$ 82,328.70
3	Install 30lb felt WRB	969	rolls		$ 15.00	$ 15.00	$ -	$ 14,835.00	$ 14,835.00	$ 29,670.00
4	Reinstall windows and flashing	382	ea		$ 10.00	$ 65.00	$ -	$ 3,820.00	$ 24,830.00	$ 28,650.00
5	purchase new windows/doors	1	allowance			$ 23,125.00	$ -	$ -	$ 23,125.00	$ 23,125.00
6	Reinstall doors with pans/flashing	278	ea		$ 15.00	$ 75.00	$ -	$ 4,170.00	$ 20,850.00	$ 25,020.00
7	Install new cedar lap siding	83580	sf		$ 3.00	$ 3.00	$ -	$ 250,740.00	$ 250,740.00	$ 501,480.00
8	Install new cedar shake siding	17502	sf		$ 4.00	$ 5.00	$ -	$ 70,008.00	$ 87,510.00	$ 157,518.00
9	Install new cultured stone	76924	sf		$ 7.00	$ 6.00	$ -	$ 538,468.00	$ 461,544.00	$ 1,000,012.00
10	Stone transition flashings	7878	lf		$ 3.00	$ 2.00	$ -	$ 23,634.00	$ 15,756.00	$ 39,390.00
11	Exterior staining and caulking	101082	sfca			$ 1.75	$ -	$ -	$ 176,893.50	$ 176,893.50
Rear elevated Concrete Balconies: (30 total)							$ -	$ -	$ -	$ -
A. Demolition:							$ -	$ -	$ -	$ -
1	remove concrete toppings	10,080	sf			$ 4.00	$ -	$ -	$ 40,320.00	$ 40,320.00
2	Remove damaged subfloor.	10,080	sf			$ 0.75	$ -	$ -	$ 7,560.00	$ 7,560.00
3	Inspect/remove damaged framing	30	ea			$ 500.00	$ -	$ -	$ 15,000.00	$ 15,000.00
4	Demo rotten t+g ceiling	10,080	sf			$ 0.75	$ -	$ -	$ 7,560.00	$ 7,560.00
5	Remove screen enclosure/rails	30	ls			$ 850.00	$ -	$ -	$ 25,500.00	$ 25,500.00
B. Replacement:							$ -	$ -	$ -	$ -
1	Repair floor framing/structure	30	ls			$ 2,127.66	$ -	$ -	$ 63,829.80	$ 63,829.80

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2	Install new treated subfloor	10,080	sf		$ 0.94	$ 0.50	$ -	$ 9,475.20	$ 5,040.00	$	14,515.20
3	Install polyguard and drain mat	10,080	sf			$ 8.00	$ -	$ -	$ 80,640.00	$	80,640.00
4	Install new flashings	3,540	lf			$ 5.00	$ -	$ -	$ 17,700.00	$	17,700.00
5	Install new concrete slabs	10,080	sf			$ 5.00	$ -	$ -	$ 50,400.00	$	50,400.00
6	Install new t+g ceilings	10,080	sf			$ 4.50	$ -	$ -	$ 45,360.00	$	45,360.00
7	Reassemble screen enclosure	30	ea		$ 250.00	$ 850.00	$ -	$ 7,500.00	$ 25,500.00	$	33,000.00
8	Stain new t+g ceilings	10,080	sf			$ 1.00	$ -	$ -	$ 10,080.00	$	10,080.00
							$ -	$ -	$ -	$	-
Interior Finishes:							$ -	$ -	$ -	$	-
1	Allowance for gypsum Repairs	37	units			$ 2,500.00	$ -	$ -	$ 92,500.00	$	92,500.00
2	Allowance for flooring repairs	37	units			$ 2,500.00	$ -	$ -	$ 92,500.00	$	92,500.00
3	Allowance for trim carp. Repairs	37	units			$ 1,000.00	$ -	$ -	$ 37,000.00	$	37,000.00
4	Allowance for interior painting	37	units			$ 2,500.00	$ -	$ -	$ 92,500.00	$	92,500.00
							$ -	$ -	$ -	$	-
Fire Protection:							$ -	$ -	$ -	$	-
1	Repair fire walls, allowance	1	ls			$ 46,250.00	$ -	$ -	$ 46,250.00	$	46,250.00
							$ -	$ -	$ -	$	-
Unforseen Conditions Allowance:		10%	total			$ 3,690,755.06	$ -	$ -	$ 369,075.51	$	369,075.51
							$ -	$ -	$ -	$	-
							$ -	$ -	$ -	$	-
	Direct Cost Subtotals:						$ 10,020.00	$ 1,061,956.90	$ 2,618,778.16	$	3,690,755.06
Indirect Costs:											
1	General Conditions	7%	total							$	258,352.85
2	Sales Tax, Oconee County	6%	material							$	63,717.41
3	Payroll Burden	32%	labor							$	3,206.40
4	Sub G/L insurances	0.57%	subcontracts							$	14,927.04
5	General Contractors Fee	6%	total							$	221,445.30
6	General Contractors Contingency	3%	total							$	110,722.65
7	P&P Bond Costs	1.25%	total							$	46,134.44
Total Estimate Value: (not including basement/below grade scope of work)										$	4,409,261.15
Below Grade Remediation/Waterproofing (From 30 January 2012 Estimate - see detailed estimate)											
	Phase I, units with Basements:	29	ea								
	Average cost per unit x total basement units:	29	ea			36197				$	1,049,713
	Garage shoring or demo/rebuild allowance:	28	ea			10000				$	280,000
Below Grade Scope of Work Total, Phase I										$	1,329,713.00

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Stoneledge @ La[redacted]eowee - Phase I

Apple To Apple

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PRELIMINARY DRAFT 4/30/12

Item #	Description of Work	Unit	Qty	Mat/Sub	Mat/Sub T	Lab	Lab T	Total	Notes
1.00	Roofing								
1.01	Remove Existing Shingles	SF	75,806			0.40	30,322.40	30,322.40	
1.02	Remove Roof Sheathing	Sht	356			32.00	11,392.00	11,392.00	
1.03	Replace Roof Sheathing	Sht	356	16.00	5,696.00	48.00	17,088.00	22,784.00	
1.04	Install New 30lb Felt	SF	75,806	0.07	5,306.42	0.25	18,951.50	24,257.92	
1.05	Install New Shingles & Flashing	SF	75,806	1.00	75,806.00	1.25	94,757.50	170,563.50	
1.06	Structural Truss Repair Allowance	Allc	1					23,125.00	
	1.00 total							282,444.82	
2.00	Exterior Wall Cladding System: Removal								
2.01	Remove Cedar Lap Siding	SF	67,849			1.00	67,849.00	67,849.00	
2.02	Remove Cedar Shake Siding	SF	7,241			1.00	7,241.00	7,241.00	
2.03	Remove Existing WRB	SF	115,042			0.10	11,504.20	11,504.20	
2.04	Remove Exterior Windows	Ea	382			50.00	19,100.00	19,100.00	
2.05	Remove Exterior Doors	Ea	278			75.00	20,850.00	20,850.00	
2.06	Remove Cultured Stone	SF	39,952			1.50	59,928.00	59,928.00	
2.07	Remove Int Gyp Wall Shtg	SF							Not used
2.08	Remove Damaged OSB Shtg - 25%	SF	28,761			0.50	14,380.25	14,380.25	
	2.00 total							200,852.45	
3.00	Exterior Wall Cladding System: Replacement								
3.01	Repairs to Wood Stud Framing	Allc	1					46,250.00	
3.02	Replace Wall Sheathing	SF	28,761	0.75	21,570.38	1.50	43,140.75	64,711.13	
3.03	Install 30lb felt WRB	SF	115,042	0.10	11,504.20	0.40	46,016.80	57,521.00	
3.04	Reinstall Windows & Flashing	Ea	382	10.00	3,820.00	100.00	38,200.00	42,020.00	
3.05	Purchase New Window/Door	Allc	1					23,125.00	
3.06	Reinstall Door w/ Pans/Flashing	Ea	278	20.00	5,560.00	150.00	41,700.00	47,260.00	
3.07	Install New Cedar Lap Siding	SF	67,849	3.00	203,547.00	3.00	203,547.00	407,094.00	
3.08	Install New Cedar Shake Siding	SF	7,241	5.00	36,205.00	5.00	36,205.00	72,410.00	
3.09	Install New Cultured Stone	SF	39,952	7.00	279,664.00	6.00	239,712.00	519,376.00	
3.10	Stone Transition Flashing	LF	5,684	3.00	17,052.00	2.00	11,368.00	28,420.00	
3.11	Exterior Staining & Caulking	SF	75,090	0.50	37,545.00	1.25	93,862.50	131,407.50	
	3.00 total							1,439,594.63	
4.00	Rear Elevated Concrete Balconies: Demo								
4.01	Remove Concrete Toppings	SF	12,804			3.00	38,412.00	38,412.00	
4.02	Remove Damaged Subfloor	SF	12,804			1.00	12,804.00	12,804.00	
4.03	Inspect/Remove Damaged Framing	Unit	37			500.00	18,500.00	18,500.00	bldg 19 on slab
4.04	Demo Rotten T&G Ceilings	SF	10,656			0.75	7,992.00	7,992.00	4 units with crawlspace
4.05	Remove Screen Enclosure/Rails	Unit	37						in 5.07 & 5.09
	4.00 total							77,708.00	

PLAINTIFF'S EXHIBIT 30 11-4-13

03225

[redacted] Services, Inc
Bus:(843)448-3900
Fax:(843)448-7150

Stoneledge @ La[redacted]owea - Phase I

Apple To Apple

[redacted] 2

PRELIMINARY DRAFT 4/30/12

Item #	Description of Work	Unit	Qty	Mat/Sub	Mat/Sub T	Lab	Lab T	Total	Notes
5.00	Rear Elevated Concrete Balconies: Replace								
5.01	Repair Floor Framing/ Structure	Unit	37	2,127.66	78,723.42			78,723.42	
5.02	Install New PT Plywood Subfloor	SF	12,804	0.75	9,603.00	2.00	25,608.00	35,211.00	
5.03	Install Polyguard & Drain Mat	SF	12,804	8.00	102,432.00			102,432.00	
5.04	Install New Flashing	LF	3,267	3.00	9,801.00	2.00	6,534.00	16,335.00	
5.05	Install New Concrete Slabs	SF	12,804	5.00	64,020.00			64,020.00	
5.06	Install New T&G Ceilings	SF	10,656	1.50	15,984.00	3.00	31,968.00	47,952.00	
5.07	Remove/Replace screens	SF	14,724	2.50	36,810.00	3.00	44,172.00	80,982.00	changed
5.08	Remove/Reinstall handrails	LF	624			8.00	4,992.00	4,992.00	changed
5.09	Stain New T&G Ceilings	SF	10,656	0.25	2,664.00	1.00	10,656.00	13,320.00	
	5.00 total							**443,967.42**	
6.00	Interior Finishes								
6.01	Allowance for Gypsum Repairs	Unit	37	2,500.00	92,500.00			92,500.00	Allowance
6.02	Allowance for Flooring Repairs	Unit	37	2,500.00	92,500.00			92,500.00	Allowance
6.03	Allowance for Trim Carp. Repairs	Unit	37	1,000.00	37,000.00			37,000.00	Allowance
6.04	Allowance for Interior Painting	Unit	37	2,500.00	92,500.00			92,500.00	Allowance
	6.00 total							**314,500.00**	
7.00	Fire Protection								
7.01	Repair Fire Walls, Allowance	LS	1					46,150.00	Allowance
	7.00 total							**46,150.00**	
8.00	Unforeseen Conditions Allowance								
8.01	Contingency								In contingency
	8.00 total								
9.00	General Conditions								
9.01	General Conditions	Pct	7.00%		2,605,217.32			196,365.21	
	9.00 total							**196,365.21**	
	Sections 1.00 - 9.00 Total							**3,001,582.53**	
	Permits & License	Pct	1.25%					37,519.78	
	Overhead	Pct	10.00%					300,158.25	
	Profit	Pct	10.00%					300,158.25	
	Contingency	Pct	10.00%					300,158.25	
	P&P Bond	Pct	1.85%					55,529.28	
	TOTAL							**3,995,106.34**	

03226

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From: Chip Albert <chip.albert@intbgrs.net>
Sent: Tuesday, July 12, 2005 3:01 PM
To: <lucyhhayes@msn.com>
Subject: FW: Stoneledge Appointment Confirmation

Attachments: HotelReservation.doc (0.02 MB) Directions to Stoneledge.doc (0.02 MB)

Hello Bob,

It was a pleasure speaking with you earlier today. I believe Stoneledge is exactly what you and Lucy are in the market for. I wanted to send you this initial email to simply confirm your appointment time for 1:00 on Saturday, July 23rd for our Grand opening release of Phase II here at Stoneledge. I do currently have you on my waiting list for an earlier time slot so you can be one of the first customers out the door if possible on Saturday morning. I will be touching base with you periodically over the next few weeks to help narrow down exactly what type of lot location, floor plans and interior amenities you prefer as well as help you with directions to the community. If you have any questions or concerns, please do not hesitate to give me a call or send an email at your convenience. I look forward to meeting you in a few weeks and I will speak with you soon.

Best regards,

Chip Albert

Account Executive

Stoneledge at Lake Keowee

Office: (877) 687-7600

Mobile: (864) 314-1883

www.StoneledgeAtKeowee.com

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lucyhhayes@msn.com | Free Newsletters |

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From : Chip Albert <chip.albert@integrys.net>

Sent : Thursday, August 4, 2005 2:13 PM

To : <lucyhhayes@msn.com>

Subject : FW: Lot #66 at Stoneledge

Hi

Lucy, I am forwarding you the email from the builder.

Chip Albert

-----Original Message-----
From: Rick Thoennes [mailto:rick@marickhomebuilders.com]
Sent: Thu 8/4/2005 2:01 PM
To: Chip Albert
Cc:
Subject: RE: Lot #66 at Stoneledge

The wet bar is included.Â They have a little more time on the audio/Video questions and we can try to accomadate.Â We will need to have answeres by the time we start their building.

Rick III

-----Original Message-----
From: Chip Albert [mailto:chip.albert@integrys.net]
Sent: Tuesday, August 02, 2005 6:21 PM
To: rick@marickhomebuilders.com
Subject: FW: Lot #66 at Stoneledge

Rick, Please respond to me on these questions. They are coming to the property this weekend and i will go over your response with them personally.

Thanks,
Chip

Â Â Â Â Â Â Â -----Original Message-----
Â Â Â Â Â Â Â From: lucy h hayes [mailto:lucyhhayes@msn.com]
Â Â Â Â Â Â Â Sent: Mon 8/1/2005 5:35 PM
Â Â Â Â Â Â Â To: Chip Albert
Â Â Â Â Â Â Â Cc:
Â Â Â Â Â Â Â Subject: RE: Lot #66 at Stoneledge
Â Â Â Â Â Â Â
Â Â Â Â Â Â Â

Â Â Â Â Â Â Â Hi Chip,
Â Â Â Â Â Â Â
Â Â Â Â Â Â Â Thanks for your prompt response.Â No, our friends would not be in a position
Â Â Â Â Â Â Â to purchase a home at Stoneledge.Â They are just interested in

STONELEDGE
at Lake Keowee

Dear Bob,

Construction has begun on your new townhome on lot # 66 here at Stoneledge. Per your contract, your current amount due is $37,010.00. This final down payment is due no later that February 20th, 2005 and fulfills your "10% down" obligation. Also, please be sure to provide us with your "Selection Sheet" for the interior of your home as soon as possible if you haven't already done so.. Please make your check payable to "IMK Development LLC" and mail them to:

IMK
Attn. Bill Cox
770 Pelham Rd. Suite 200
Greenville, SC 29615.

I would also like to remind you all of our new "Customer Referral Program" for current property owners. If you have any friends or family that would like the opportunity to get in on the ground floor here at Stoneledge we will pay a $5,000 referral incentive* to any owner that provides us with a buyer between December 1st and March 1st. We will be holding our final sales event on April 29th & 30th and there are only 33 homes and home sites still available out of 94 so the time is now for anyone close to you to beat the rush.

If you have any questions or comments please do not hesitate to give us a call @ (877) 682-3600 at your convenience. Thank you again for your purchase and patience and I will personally keep you posted throughout the construction process.

Best Regards,
Ty Savage
Director of Sales & Marketing
Stoneledge at Lake Keowee
Office: (877) 682-3600
Mobile: (864) 444-7399
Ty.Savage@Integrys.net
www.StoneledgeAtKeowee.com

* Ask you sales representative for the details of this offer.

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Thursday, January 24, 2008 3:35 PM
To: John Ludwig
Cc: Tim Roberson; Larry Lollis
Subject: Stoneledge
John,

It was good to meet with you today. We are certainly hopeful that Stoneledge will in the end prove to be a profitable investment for you and us. Just to make sure we are on the same page, I believe we basically agreed to the following:

1. SDI will purchase the assets of IMK with the exception of the 2 units financed by GrandSouth Bank (the other two that we discussed are owned by Rick Iland Larry Lollis directly).

2. The consideration for Marick's 50% share will be based on the terms you have already established with them.

3. The consideration for Integrys Keowee's 50% will be $ 1,000,000 cash at the closing plus 10% of the gross sales price for any Stoneledge town home sold in the future paid at the closing of each sale. This includes units already constructed as well as any units constructed in the future.

4. SDI will assume the BB&T indebtedness which currently stands at $3,173,141.28. We will need to draw some additional monies to cover current accounts payable for the next 30 days. This includes BB&T interest and some current construction, punch list work, warranty repairs and the on site people. Rick, Sr. is getting me those numbers. Some of the construction that we have done and are doing is reducing the amount needed to finish that we gave Barry. This amount may be in the $50,000 - $70,000 range. I will give you the details as soon as I get them.

5. SDI will assume responsibility for the Stoneledge HOA until it is turned over to the owners.

Let me know if I have missed anything.

Thanks,

Bill Cox

(O) 679-3400
(M) 979-1822

REAL ESTATE PURCHASE AGREEMENT

THIS REAL ESTATE PURCHASE AGREEMENT (this "Agreement") is made this 9th day of April, 2008 (the "Effective Date") by and between Ludwig Properties, LLC, a South Carolina limited liability company, or its assigns, hereinafter referred to as "Buyer," and IMK Development Co., LLC, a South Carolina limited liability company, hereinafter referred to as "Seller".

WHEREAS, Seller is the owner of certain townhome/condominium units and land located in Oconee County, South Carolina, at Stoneledge at Lake Keowee which it desires to sell to Buyer and which Buyer desires to purchase upon the terms as hereinafter set forth.

NOW, THEREFORE, for and in consideration of the sum of FOUR MILLION THREE HUNDRED FORTY-FIVE THOUSAND NINE HUNDRED SIX AND NO/100 ($4,345,906.00) ("Purchase Price") and other good and valuable consideration the extent of which is recited herein, the Seller and Buyer have agreed as follows:

1. Sale and Purchase. Seller agrees to sell and convey, and Buyer agrees to purchase all that property owned by Seller in the Stoneledge at Lake Keowee development denoted by unit number and street address as follows (the "Units"), as well as certain undeveloped land owned by Seller, and more particularly described on the attached Exhibit A, and subject to the encumbrances and exceptions to title set forth herein, all of which is collectively referred to herein as the "Property":

UNIT	ADDRESS
12	321 Blue Water Way
14	317 Blue Water Way
24	224 Hidden Shores Lane
27	400 Blue Water Way
33	416 Sunset Point Dr
34	418 Sunset Point Dr
35	420 Sunset Point Dr
36	422 Sunset Point Dr
41	436 Sunset Point Dr
55	512 Sunset Point Dr
57	514 Sunset Point Dr
58	516 Sunset Point Dr
62	524 Sunset Point Dr
67	534 Sunset Point Dr
69	538 Sunset Point Dr
70	540 Sunset Point Dr
71	542 Sunset Point Dr
77	554 Sunset Point Dr
78	556 Sunset Point Dr
79	558 Sunset Point Dr
85	570 Sunset Point Dr
92	602 Driftwood Lane
93	604 Driftwood Lane

PLAINTIFF'S EXHIBIT 40 35 11-25-13

94 606 Driftwood Lane

2. Purchase Price. The purchase price for the Property shall be payable at Closing, as follows:

a. Three Million Three Hundred Fifty-Six Thousand One Hundred Forty-One and 00/100 Dollars ($3,356,141.00) in full satisfaction of the Seller's Note to BB&T, plus interest accruing between the date of full execution of this Agreement and the Closing Date.

b. Six Hundred Thirty Nine Thousand Seven Hundred Sixty-Five and 00/100 Dollars ($639,765.00) to Integrys Keowee, LLC.

c. Execution of a Promissory Note to Integrys Keowee, LLC, in the amount of Three Hundred Fifty Thousand and 00/100 Dollars ($350,000.00) due and payable on upon closing the sale of the 4th Unit Buyer sells. The obligations of this paragraph shall survive the Closing of this transaction.

2.A. Further Obligations of Buyer. Buyer shall be obligated to pay Integrys Keowee, LLC, a consulting fee equal to 10% of the gross proceeds of each sale of a Unit less any realtor commissions due (not to exceed 7%), including those Units constructed by Buyer, its successors or assigns, on any undeveloped lots within the Property ("Consulting Fee"); provided, however, that no Consulting Fee shall be paid on the first 4 of the Units sold by Buyer. The Consulting Fee shall be in consideration of Integrys Keowee, LLC consulting Buyer in the marketing and sales of the Units and shall be deemed earned on the date of the Closing and payable in installments as the Units are sold. The obligations of this paragraph shall survive the Closing of this transaction.

3. Further Agreements.

A. Seller and/or its members or affiliates are retaining ownership of Units # 5, 15,18, and 20. For purposes of this agreement only, the following sales values are assigned to each Unit, with an annual value increase of 3% to be applied: Unit 5 - $680,000, Unit 15 -$650,000.00, Unit 18 - $660,000.00 and Unit 20 - $690,000.00 (collectively the "IMK Retained Units"). If any of these Units are sold for 85% or less of its sales value set forth above or 85% of the sales price for comparable units sold by Buyer within the previous six (6) months of such a sale, whichever is less ("IMK Target Sales Price"), Buyer may credit 10% of the gross proceeds of the IMK Unit Sold against any future Consulting Fees due to Integrys Keowee, LLC. The obligations of this paragraph shall survive the Closing of this transaction.

B. With respect to Unit 16, also known as 230 Hidden Shores Lane ("Model Unit"), Seller shall convey to Buyer all furniture and other accessories heretofore purchased for the Model Unit, including the return of any such furniture/accessories that may have been removed from the Model Unit.

C. Seller shall convey to Buyer all marketing rights associated with Stoneledge, with no limitations, as well as any and all marketing materials, data files, artwork, and/or any intellectual property rights

associated with Stoneledge, including but not limited to website content/domain names and telephone numbers related to Stoneledge.

D. If a contract for sale of any Unit is entered into prior to the Units being conveyed to Buyer via this Agreement, Seller and Buyer hereby agree that all proceeds derived from such sale(s) shall be disbursed to the Buyer.

E. Seller agrees to convey to Buyer at Closing the assets listed in Exhibit B subject to any material or consumables used in the warranty repairs of town homes in Stoneledge between the execution of this Agreement and the Closing.

F. After the Closing, Buyer agrees to provide Seller a listing of outstanding sales contracts for the Units with expected closing dates on a monthly basis.

G. Seller shall continue to pay all payroll and warranty expenses related to the Property until the Closing. The payroll expense is set forth in Exhibit C to this Agreement. Seller shall provide Buyer an itemized list of all such expenses, and Buyer shall reimburse Seller for all such undisputed expenses at the Closing; provided, however, that no reimbursement shall be due Seller if the Closing fails to occur.

H. Upon execution of this Agreement and prior to the Closing, Seller and Buyer acknowledge and agree that Buyer shall have unrestricted access to the Property, and that Buyer may, at its own expense, undertake any construction, repair, or otherwise on the Property with the prior approval of Seller, which shall not be unreasonably withheld.

4. Closing and Possession Dates. The purchase and sale shall be closed, and a general warranty deed in a form acceptable to Buyer transferring title to the Property from Seller to Buyer shall be delivered, at a closing (the Closing) to be held on or before April 30, 2008 (the "Closing Date").

5. Conveyance. Seller agrees to convey the Units to Buyer by general warranty deed, free and clear of all monetary liens (except liens of ad valorem taxes for the tax year during which the Property is conveyed to Buyer), and all liens, restrictions, covenants, reservations, encumbrances, and outstanding mineral or royalty interests and special assessments affecting subject property, except as provided in and objected to by Buyer pursuant to Paragraph 7 of this Agreement.

6. Documentation to be Delivered at Closing by Seller. At the Closing, the following documents and instruments shall be delivered by Seller to Buyer, in a form reasonably satisfactory to Buyer's title insurer and counsel, to wit:

a) A general warranty deed executed, acknowledged, and delivered by Seller to Buyer and dated on or before the Closing Date, conveying fee simple title to the Units to Buyer;

b) An assignment of the Declarant's Rights under the DCCRS (hereinafter defined);

c) Such documents as are reasonably required by a title insurer to permit the issuance of a policy of title insurance with respect to the Units but at no additional expense or liability to Seller;

d) Tax Compliance Certificate of Seller, and

e) A closing statement and such other instruments and documents to be delivered at the Closing as may be reasonably requested by Buyer in order to consummate the transaction and permit the conveyance of the Units from Seller to Buyer but at no additional expense or liability to Seller.

7. Exceptions. The Property is sold and is to be conveyed subject to the matters of public record, except as objected to by Buyer pursuant to this Paragraph 7 (the "Permitted Encumbrances") and any other matters to which Buyer has not objected in accordance with this Paragraph 7. Buyer shall procure a full examination of title to and a survey of the Land within 25 days following the date of this Agreement (the "Title Objection Date"). If Buyer's title examination or survey indicates encumbrances to the title which Buyer finds objectionable, Buyer shall provide written notice to Seller setting forth Buyer's objections accompanied by a copy of the instrument and the title examination report, or the survey, if the objection relates to a matter shown by survey, obtained by Buyer. If Buyer fails to provide notice in accordance with this provision on or before the Title Objection Date, Buyer shall have waived any objection to title existing on the Title Objection Date. Buyer shall promptly notify Seller of any objections to title arising subsequent to the Title Objection Date. Within ten (10) days after receiving such notice, Seller shall notify Buyer that Seller will or will not attempt to cure such objections. If Seller elects not to cure one or more of Buyer's objections, Buyer shall have the rights set forth in Paragraph 8 of this Agreement.

8. Remedies. If Seller elects not to cure one or more of Buyer's objections to title pursuant to Paragraph 7 of this Agreement, Buyer shall have the following rights as its sole and exclusive remedy:

a) To accept whatever title the Seller is able to convey; or

b) To reject title. In the event that title is rejected under this Paragraph 8(b), neither party shall have any liability whatsoever to the other arising hereunder.

9. Representations By Seller. Seller makes the following representations and warranties and agrees to indemnify and hold Buyer harmless against any loss or damage, including reasonable attorneys' fees, resulting from breach of said warranties:

(a) Authorization and Compliance. Seller warrants that this Agreement is duly authorized, executed and delivered and, to Seller's actual knowledge, is not a breach of, or in conflict with, any agreement, judgment, restriction, statute or regulation applicable to Seller.

(b) Pending Actions. Seller warrants that there is no litigation, judicial or administrative proceeding or government investigation against the Seller

or the Land (as defined below) which would materially adversely affect the Seller's ability to comply with the terms of this Agreement.

(c) Leases. Except for that certain Agreement between Stoneledge at Lake Keowee Owner's Association, Inc., and Seller, Seller warrants that there are no leases, leasing agreements, management agreements or other agreements affecting the Property subject to the DCCR's (as defined in paragraph 18).

(d) Assessments. Seller warrants that to its knowledge there are no existing or pending assessments which are chargeable against the Land or personal property covered by this Agreement other than ad valorem taxes for the current year which will be prorated at Closing and rollback taxes, if any.

(e) Liens/Property Condition. Seller warrants that all subcontractors and/or materialmen have been paid in full and/or that there shall be no mechanic's liens filed against the property.

(f) Accuracy of Information. All information and reports provided by Seller to Buyer under paragraph 9 are true and accurate in all material aspects.

10. Information in the Possession of Seller. Within ten (10) days of the Effective Date, Seller agrees to use reasonable efforts to provide or make available for inspection by Buyer any title insurance policy, environmental records, surveys, third party engineering and environmental reports, wetlands studies, soil tests and similar information respecting the Land, currently in the possession and under the control of Seller or readily available to Seller.

11. Funds to be Escrowed. Upon the closing of any Unit, if there are any then-existing or reasonably anticipated liabilities ("Known Liability") related to the Unit, Buyer may direct that Seller's Consulting Fee be deposited in an escrow account with the law firm of Temple, Mann, Briggs, and Hill ("Escrow Agent"). Buyer will provide written evidence of any Known Liability to Seller and Escrow Agent and any Consulting Fees thus escrowed shall be held as reserves to be utilized in satisfaction of such Known Liability.

12. Use of Purchase Money to Satisfy Liens, Etc. If at closing there be any liens or encumbrances which Seller is obligated to pay and discharge, including, but not limited to, liens for unpaid taxes, mechanic's liens, water charges and assessments and mortgages, Seller shall use such portion of the balance of the purchase price as is needed to satisfy the same; if required, Seller shall make arrangements with the title company or closing attorney in advance of Closing and shall deposit with said company sufficient monies, acceptable to and required by such title company, to assure obtaining and the recording of all necessary satisfactions and the issuance of title insurance to Buyer, either free of any such liens or encumbrances or with insurance against the same. The existence of any such liens or encumbrances shall not be deemed objections to title if the foregoing requirements are met.

13. Fees and Expenses. Seller shall pay the fees and expenses relating to the following items:

a) Any deed recording fee or transfer tax assessed; and

b) Deed preparation.

Buyer shall pay the fees and expenses relating to the following items:

a) Title insurance; and

b) Inspections, appraisals, title examinations and surveys obtained or to be obtained by Buyer.

14. **Attorney Fees and Court Costs.** Except as otherwise provided in this Agreement, each party shall bear its own attorney fees for this transaction. However, in connection with any litigation (including appellate proceedings) arising out of this Agreement, the prevailing party shall be entitled to recover reasonable attorney fees and court costs from the other.

15. **Real Estate Commission.** The parties each represent and warrant that they have not dealt with any broker or real estate sales agent in connection with the Units. This Agreement is consummated by each party in reliance on the representation of the other that no broker or agent was granted an exclusive listing or, in any way was a procuring cause of this transaction. Each party hereby agrees to indemnify, defend and hold harmless the other against the claim of any other broker or agent for a commission due by reason of having dealt with the indemnifying party.

16. **Eminent Domain.** Seller hereby represents that it has no actual knowledge of any outstanding notices of taking by condemnation. In the event that prior to Closing, notice that all or a material part of the Land is to be taken by eminent domain, Buyer may elect to terminate this Agreement by written notice to that effect given to Seller within fifteen (15) days after notice of such proposed taking and thereupon neither party shall have any liability whatsoever to the other arising hereunder. Seller shall immediately notify Buyer in writing should Seller receive notice of any such intended taking. If Buyer does not elect to terminate this Agreement, then Seller agrees to assign to Buyer at Closing all rights to condemnation money by reason of such taking or notice thereof, and Seller will, at Buyer's request, include an appropriate clause in its deed to Buyer or in a separate instrument to effectuate the foregoing.

17. **Inspection by Buyer.** Seller hereby grants to Buyer the right to enter upon the Land for a period of 25 days from the date of this Agreement (the "Inspection Period") for the purpose of

a. Inspecting the Property and Units, including the right to survey and conduct soil, environmental, engineering and other tests Buyer shall require;

b. Buyer shall pay all costs and expenses associated with such surveys, inspections, permitting, approvals and inquiries;

c. Buyer shall indemnify, defend and hold Seller harmless from any costs, liens, claims, damages, losses or liabilities arising out of Buyer's exercise of the rights granted herein;

d. If the results of such surveys and inspections reveal conditions which Buyer finds objectionable, Buyer shall have the right to terminate this Agreement by written notice to Seller delivered prior to the end of the Inspection Period. If Buyer fails to provide notice in accordance with this provision within the Inspection Period, the right to terminate provided herein shall be deemed waived by Buyer and shall be null and void.

e. Buyer shall promptly restore the Land to its original condition in the event this Agreement is terminated for any reason.

18. Conditions Precedent. Notwithstanding anything contained herein, the Buyer's obligation to close on the Units is subject to the satisfaction of the following conditions:

a. Written approval of the Stoneledge at Lake Keowee Homeowner's Association, its board, and its members (unanimous), that Buyer is exempt from any and all assessments provided in the Amended and Restated Bylaws of Stoneledge at Lake Keowee Owner's Association and Amended and restated Declaration of Covenants, Conditions, and Restrictions for Stoneledge at Lake Keowee recorded in Book 1464 at Page 33 in the records of the Oconee County, South Carolina Register of Deeds Office, as amended ("DCCRS");

b. Buyer obtaining financing satisfactory to it in its sole discretion;

c. Buyer and/or Seller's members entering into agreements related to the repayments of certain debts of Seller's members to Buyer;

d. Receipt by Buyer of a certification that no past due assessments or other charges are due on the Units;

e. Receipt by Buyer of a lien waiver from all contractors and subcontractors with respect to the Units.

19. Default.

a. If Buyer defaults in the performance of Buyer's obligations pursuant to this Agreement, Seller, as its sole and exclusive remedy, shall have the right to terminate this Agreement by providing five (5) days prior written notice to Buyer as Seller's sole and exclusive remedy, in which event, Buyer authorizes Seller to place the Property and Units back on the market and Buyer releases any claim Buyer may have against the Units arising hereunder.

b. If Seller defaults in the performance of Seller's obligations pursuant to this Agreement, Buyer may, as its sole and exclusive remedy, elect either: (i) terminate this Agreement by providing five (5) days prior written notice to Seller; or (ii) seek specific performance of this Agreement in equity.

20. Effective Law and Binding Effect. This Agreement is made under the laws of the state where the Land is located and its interpretation shall be governed by the laws of said state. This Agreement may not be changed or terminated orally. The provisions herein are to apply to and bind, and inure to the benefit of, the successors and assigns of the respective parties.

21. Entire Agreement. This Agreement constitutes the entire contract between the parties hereto, all understandings and agreements heretofore had between the parties being merged into this contract, which alone fully and completely expresses their agreement.

22. Notice. All notices and communications given under this Agreement shall be deemed properly given if deposited in the U.S. Postal Service, postage prepaid, return receipt requested, with the following addresses:

To Seller: IMK Development, LLC PO Box 26868 Greenville SC 29616
Attn: William C. Cox

To Buyer: Ludwig Properties, LLC
127 West Antrim Drive
Greenville, SC 29607
Attn: Chiles Steifle

Marick Home Builders, LLC
501 Brixton Circle
Simpsonville, SC 29681

23. Severability. The invalidity, illegality or unenforceability of any provision hereof shall not render invalid, illegal or unenforceable any other provision hereof.

24. Successors and Assigns. This Agreement shall inure to the benefit of, and be binding upon, the parties hereto, and their successors and permitted assigns.

25. Third party Beneficiary. The parties agree that Integrys Keowee, LLC, is a third party beneficiary under this Agreement and is entitled to enforce the provisions of this Agreement against the Buyer by any action at law or in equity in the event of a default by Buyer of its obligations to Integrys Keowee, LLC under this Agreement.

26. Marick debt to SDI Funding, LLC. The parties acknowledge and agree that this Agreement does not in any way reduce or release Marick Home Builders, LLC, and by virtue of personal guarantys, Rick Thoennes, Sr. and Rick Thoennes, III, from debt owed to SDI Funding, LLC by virtue of that certain promissory note dated September 1, 2006 between SDI and Marick.

IN WITNESS WHEREOF, this Agreement has been duly executed by the parties hereto.

BUYER: LUDWIG PROPERTIES, LLC

By: Brad Seckinger
Its: Member

SELLER: IMK DEVELOPMENT CO., LLC
By: Integrys Keowee, LLC
Its: Member

By: _____
William Cox
Title: Manager of IMK

By: Marlck Home Builders, LLC
Its: Member

By: _____
Rick Thoennes
Title: Manager of IMK

THIRD PARTY BENEFICIARY: INTEGRYS KEOWEE, LLC

By: _____
William Cox
Title: Manager

EXHIBIT "A"

Parcel 1:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, containing 12.40 acres, more or less, and being known and designated as Stoneledge at Lake Keowee, Phase 1, as shown on a plat prepared by Freeland & Associates, Inc., dated June 16, 2005, and recorded June 28, 2005, in the Register of Deeds Office for Oconee County, South Carolina, in Plat Book B-73 at Page 3, and having such metes and bounds, courses and distances as reference to said plat will more fully reveal.

LESS AND EXCEPTING THEREFROM, the following lots sold by Keowee Townhouses, LLC, and/or IMK Development Co., LLC:

Lot No. 1, Phase 1
Lot No. 2, Phase 1
Lot No. 3, Phase 1
Lot No. 4, Phase 1
Lot No. 5, Phase 1
Lot No. 6, Phase 1
Lot No. 7, Phase 1
Lot No. 8, Phase 1
Lot No. 9, Phase 1
Lot No. 10, Phase 1
Lot No. 11, Phase 1
Lot No. 13, Phase 1
Lot No. 15, Phase 1
Lot No. 17, Phase 1
Lot No. 18, Phase 1
Lot No. 21, Phase 1
Lot No. 19, Phase 1
Lot No. 20, Phase 1
Lot No. 21, Phase 1
Lot No. 22, Phase 1
Lot No. 23, Phase 1
Lot No. 25, Phase 1
Lot No. 26, Phase 1
Lot No. 28, Phase 1
Lot No. 29, Phase 1
Lot No. 30, Phase 1
Lot No. 31, Phase 1
Lot No. 32, Phase 1
Lot No. 37, Phase 1

ALSO, LESS AND EXCEPTING THEREFROM, the "Common Area", "Common Areas", "Hidden Shores Lane", "Sunset Point Drive", and "Blue Water Way" on that certain plat entitled "Keowee Townhouses, LLC, Phase 1, Section 1" prepared by Freeland & Associates, Inc., last dated August 2003, and recorded in the Office of the Register of Deeds for Oconee County, South Carolina, in Plat Book A-961 at Pages 3 and 4.

Tax Map No.: 178-05-01-040

Parcel 2:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, containing 17.894 acres, more or less, and being known and designated as Stoneledge at Lake Keowee, Phase 2, Sheets 1 and 2, as shown on a plat entitled prepared by Freeland & Associates, Inc., dated January 3, 2006, and recorded January 22, 2007, in the Register of Deeds Office for Oconee County, South Carolina, in Plat Book B-185 at pages 3-6, and having such metes and bounds, courses and distances as reference to said plat will more fully reveal.

LESS AND EXCEPTING THEREFROM, the following lots sold by Keowee Townhouses, LLC, and/or IMK Development Co., LLC:

Lot No. 42, Phase 2
Lot No. 43, Phase 2
Lot No. 56, Phase 2
Lot No. 59, Phase 2
Lot No. 60, Phase 2
Lot No. 61, Phase 2
Lot No. 63, Phase 2
Lot No. 64, Phase 2
Lot No. 65, Phase 2
Lot No. 66, Phase 2
Lot No. 68, Phase 2
Lot No. 72, Phase 2
Lot No. 73, Phase 2
Lot No. 74, Phase 2
Lot No. 75, Phase 2
Lot No. 76, Phase 2
Lot No. 80, Phase 2
Lot No. 81, Phase 2
Lot No. 82, Phase 2
Lot No. 83, Phase 2
Lot No. 84, Phase 2
Lot No. 86, Phase 2
Lot No. 87, Phase 2

Lot No. 88, Phase 2
Lot No. 89, Phase 2
Lot No. 90, Phase 2

Tax Map No.: Part of 178-00-02-074

Parcel 3:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, containing 14.396 acres, more or less, as shown on a plat entitled ALTA/ACSM Land Title Survey for IMK Development Co., LLC, prepared by Freeland & Associates, Inc., dated April 20, 2005, last revised April 28, 2005, Sheets 1 through 5, and recorded in the Register of Deeds Office for Oconee County in Plat Book B-64 at Page 3, and having such metes and bounds as shown thereon, reference to said plat being made for a more complete description.

Tax Map No.: Part of 178-00-02-074

Parcel 4:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, containing 2.435 acres, more or less, as shown on a plat entitled ALTA/ACSM Land Title Survey for IMK Development Co., LLC, prepared by Freeland & Associates, Inc., dated April 20, 2005, last revised April 28, 2005, Sheets 1 through 5, and recorded in the Register of Deeds Office for Oconee County in Plat Book B-64 at Page 4, and having such metes and bounds as shown thereon, reference to said plat being made for a more complete description.

Tax Map No.: 178-00-02-096

The above described Parcels 1-4 being the same property conveyed unto IMK Development Co., LLC, by deed from Keowee Townhouses, LLC, dated April 28, 2005, and recorded June 20, 2005, in the Office of the Register of Deeds for Oconee County, South Carolina, in Deed Book 1426 at Page 179. (See also deeds recorded in Deed Book 1415, Page 24, and in Deed Book 1415, Page 19, in the Office of the Register of Deeds for Oconee County, South Carolina.)

EXHIBIT B
Transferred Assets and Materials

Exhibit C – Payroll/Interim Expenses

Telephone
Last Paid - 3/14/08

Trim Labor - John Gambrell
Trim Labor - Ricky Gambrell
Trim Labor - Kevin Barnes
General Liab.
Workers Comp.
Total Trim Labor

Labor-Common - Sherri Gambrell
Payroll Taxes
Labor-Common - Eric McCoy
Payroll Taxes
General Liab.
Workers Comp.
Total Labor-Common

Temporary Power - Blue Ridge Elec.
Last Paid - 3/24/08

Temporaray Water - Seneca Lt.
Last Paid - 3/25/08

Temp. Toilet
General Liab.

Waste Removal
General Liab.

PROMISSORY NOTE

For value received, the undersigned, LUDWIG CORPORATION, LLC, a South Carolina limited liability company, its successors and assigns, promises to pay to the order of INTEGRYS KEOWEE DEVELOPMENT, LLC, a South Carolina limited liability company, with its principal office located at 2445 Pelham Road, Suite 102, Greenville, SC 29615 ("Integrys"), the principal sum of THREE HUNDRED FIFTY and 00/100 DOLLARS ($350,000.00). The principal payable hereunder shall mature and be due and payable to Integrys at such time as the undersigned closes the sale of its fourth (4th) town home unit which it has this day purchased from IMK Development Co., LLC ("IMK"), pursuant to that certain Real Estate Purchase Agreement dated April 9, 2008, as amended (the "Purchase Agreement"). Payment on this Note shall be made at the offices of Integrys or at such other address as the legal holder of this Note may, from time to time, appoint in writing.

This Note may be prepaid in whole or in part without charge. This Note is secured by the terms and agreements contained in the Purchase Agreement which the undersigned expressly agrees shall survive the purchase of the Property (as that term is defined in the Purchase Agreement) from IMK. All of the terms and conditions of the Purchase Agreement necessary to the enforcement of this Note are incorporated and made part of this Note.

In the event of default in the payment of any of the installments, the undersigned shall pay interest at a rate of twelve and three-quarters percent (12.75%) per annum. If default is made in the payment of any of the installments, the principal sum, or any balance that may be unpaid, together with all interest, shall, at the option of Integrys, its successors, or assigns, become immediately due and payable without notice and all of the principal, interest, and advances, together with interest at the rate provided for in the event of a default in payment shall be collectible immediately, or at any time after the default.

The makers, sureties, guarantors, and endorsers of this Note, if any, jointly and severally, waive notice of and consent to any and all extensions of this Note or any part of it without notice, and each waives demand, presentment for payment, notice of nonpayment and protest, and any and all notice of whatever kind or nature and the exhaustion of legal remedies.

This Note shall be the joint and several obligation of all makers, sureties, guarantors, and endorsers, and shall be binding on them, their heirs, personal representatives, and assigns.

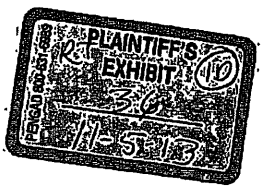
Each party has caused this agreement to be executed on the date indicated below.

LUDWIG CORPORATION, LLC

By: CL SHL (SEAL)

Its: CFO

Date: 6-13-08



AGREEMENT ON CONSULTING FEES AND PROMISSORY NOTE

THIS AGREEMENT ("Agreement") is made this 13th day of June 2008, by INTEGRYS KEOWEE DEVELOPMENT, LLC, ("Consultant"), LUDWIG CORPORATION, LLC, a South Carolina limited liability company ("Borrower") and BRANCH BANKING AND TRUST COMPANY, a North Carolina banking corporation ("Bank").

RECITALS

Whereas, pursuant to that certain Real Estate Purchase Agreement dated April 9, 2008 ("Purchase Agreement") a copy of which is attached hereto as Exhibit A for the sale of certain real property more fully described on Exhibit B attached hereto ("Property") Borrower has agreed to pay to Consultant certain "Consulting Fees" as defined in paragraph 2.A of the Purchase Agreement; and

Whereas, Borrower will execute in connection with the consummation of the sale described in the Purchase Agreement, a Promissory Note in the amount of $350,000 payable to Consultant ("Promissory Note") upon the sale of the fourth town home unit as further described in the Purchase Agreement; and

Whereas in order to fund the initial acquisition of the Property, Bank has agreed to make a loan to Borrower in the principal amount of up to Six Million Fifty Thousand Dollars ($6,050,000.00), evidenced by Borrower's Promissory Note payable to the order of the Bank dated June 13, 2008 (the Notes and all modifications, renewals and extensions thereto being collectively referred to as the "Bank Note"); and

As an inducement to the Bank to make a loan to Borrower and in consideration of the foregoing recitals and for other good and valuable consideration, the receipt of which is hereby acknowledged, the Consultant hereby agrees as follows:

1. Any and all of Consultant's Claims related to the Promissory Note are and shall be subordinate and inferior to Bank's Claims. If Borrower should not pay to Consultant the amounts due under the Promissory Note within twenty (20) days of the sale of the fourth unit (as described in the Purchase Agreement) and provided that Borrower is current with all payment installments due the Bank under the Bank's Note, then following the receipt of a written request from Consultant to Bank and Borrower together with evidence of the sale of four units (as described in the Purchase Agreement) satisfactory to the Bank, Bank will make an advance directly to Consultant for repayment of the Promissory Note and Consultant shall immediately deliver to Borrower the Promissory Note marked paid and satisfied. Borrower's signature below constitutes an irrevocable direction and authorization of Bank by Borrower to so disburse loan funds. No further authorization from Borrower shall be necessary to warrant such direct advances, all of which shall be secured by the Mortgage as though fully made to Borrower. Further Borrower agrees to indemnify and hold Bank harmless from any and all loss or liability arising out of this Agreement. For purposes of this paragraph, "Consultant's Claims" means any demand, legal proceeding, including but not limited to bankruptcy, reorganization, dissolution, or

liquidation of the Borrower, against the Borrower or the filing of any lien against the Borrower or the Property for the recovery of an amount due.

2. Consultant shall not demand, receive, collect or undertake any legal proceeding, including but not limited to bankruptcy, reorganization, dissolution, or liquidation of the Borrower, or file any lien against the Borrower or the Property for the recovery of any amount due related to the Consulting Fees without giving the Bank at least thirty (30) days prior written notice and the right to cure such default within said period.

3. Any notice required hereunder shall be in writing and shall be effective when sent with sufficient postage by certified mail, return receipt requested to Bank at 301 College Street, Greenville SC 29601, Attn: Senior Credit Officer and to Consultant at 3445 PELHAM ROAD, SUITE 102, GREENVILLE SC 29615

4. No renewal or modification of payment of the Bank Note, no release or surrender of any guarantee or collateral, no delay in enforcement of payment of Bank Note or in the enforcement of this Agreement, no waiver of any default by Bank, and no delay or omission in exercising any right or power of the Bank under the Bank Note or under this Agreement shall in any manner impair or affect Bank's rights hereunder. Consultant hereby waives notice of the creation, existence, extension, and renewal of Bank's Note; provided that at any time Consultant can inquire from the Bank as to the outstanding balance due under the Bank Note. Borrower specifically agrees to the disclosure of the outstanding balance to Consultant.

5. No amendment or modification of this Agreement shall be effective unless such amendment or modification is in writing and signed by Bank and Consultant.

6. This Agreement shall extend to and bind the respective successors and assigns, of Bank and Consultant, and the covenants of this Agreement shall extend to, include, and be enforceable by any transferee or endorsee of Bank's Note or Bank's security interest(s), mortgage(s), or other lien(s) in the collateral.

7. In order to carry, out the terms and intent of this Agreement, Consultant will perform all acts reasonably necessary and appropriate to preserve for Bank the benefits of this Agreement and will execute all documents or agreements which Bank may reasonably request for that purpose.

8. This Agreement shall be governed by the laws of the State of South Carolina.

[SIGNATURES NEXT PAGE]

IN WITNESS WHEREOF, the parties have executed this Agreement under seal, as of the date first written above.

Witnesses

Ludwig Corporation, LLC

By: _____

Print Name: _____

Print Title: _____

Integrys Keowee Development, LLC

By: _____

Print Name: _____

Print Title: _____

Branch Banking and Trust Company

By: _____

Barry Maness, Senior Vice President

Exhibit A

Real Estate Purchase Agreement

Exhibit B

Property Description

Parcel 1:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, and being shown and designated as Lots 12, 14, 24, 27, 33, 34, 35, and 36, Stoneledge at Lake Keowee, Phase 1, as shown on a plat prepared by Freeland & Associates, Inc., dated June 16, 2005, and recorded June 28, 2005, in the Register of Deeds Office for Oconee County, South Carolina, in Plat Book B-73 at Page 3, and having such metes and bounds, courses and distances as reference to said plat will more fully reveal.

Tax Map No.: 178-05-01-012; 178-05-01-014; 178-05-01-024; 178-05-01-027; 178-05-01-033; 178-05-01-034; 178-05-01-035; and 178-05-01-036

Parcel 2:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, and being shown and designated as Lots 38, 39, 40, 41, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 57, 58, 62, 67, 69, 70, 71, 77, 78, 79, 85, 92, 93, and 94, Stoneledge at Lake Keowee, Phase 2, Sheets 1 and 2, as shown on a plat prepared by Freeland & Associates, Inc., dated January 3, 2006, and recorded January 22, 2007, in the Register of Deeds Office for Oconee County, South Carolina, in Plat Book B-185 at pages 3-6, and having such metes and bounds, courses and distances as reference to said plat will more fully reveal.

Tax Map No.: 178-05-01-038; 178-05-01-039; 178-05-01-040; 178-05-01-041; 178-05-01-044; 178-05-01-045; 178-05-01-046; 178-05-01-047; 178-05-01-048; 178-05-01-049; 178-05-01-050; 178-05-01-051; 178-05-01-052; 178-05-01-053; 178-05-01-054; 178-05-01-055; 178-05-01-057; 178-05-01-058; 178-05-01-062; 178-05-01-067; 178-05-01-069; 178-05-01-070; 178-05-01-071; 178-05-01-077; 178-05-01-078; 178-05-01-079; 178-05-01-085; 178-05-01-092; 178-05-01-093; and 178-05-01-094;

Easement Parcel:

TOGETHER with the easements, road rights-of-way and any and all other rights granted to unit holders under the Amended and Restated Declaration of Covenants, Conditions and Restrictions dated November 1, 2005, and recorded November 30, 2005, in Book 1464 at Page 33, and Supplement to the Amended and Restated Declaration of Covenants, Conditions and Restrictions recorded in Book 1578 at Page 316. (As to Parcels 1 and 2 only)

Parcel 3:

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Monday, April 23, 2007 2:56 PM
To: Matt Smith
Cc: Tim Roberson; Larry Lollis; Rick Thoennes; Rick Thoennes
Subject: IMK Distribution Checks
Matt,

Please issue the following amounts from closings through unit 72 which closed today:

SDI Funding	$149,090.00
Integrys Holdings	$ 14,909.00
Bill Cox	$ 53,672.40
Tim Roberson	$ 53,672.40
Larry Lollis	$ 26,836.20

Thanks,

WCC

03251

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Monday, May 21, 2007 12:27 PM
To: Matt Smith
Cc: Tim Roberson; Larry Lollis; Rick Thoennes; rick@marickhomebuilders.com
Subject: SDI and IK payouts
Matt,

Please pay the following distributions out of IMK for the closings of Shaw (76) and Elman (89):

SDI Funding	$71,325.00
Integrys Holdings	$ 7,132.50
Bill Cox	$25,677.00
Tim Roberson	$25,677.00
Larry Lollis	$12,838.50

Thanks,

WCC

03252

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Monday, June 11, 2007 5:07 PM
To: Matt Smith
Cc: Tim Roberson; Larry Lollis; Rick Thoennes; rick@mariokhomebuilders.com
Subject: IMK Distribution Checks for Ulmer closing (#42)
Matt,

Please cut the following distribution checks from IMK:

SDI Funding	$28,897.00
Integrys Holdings LLC	$ 2,897.00
William Cox	$10,402.92
Tim Roberson	$10,402.92
Larry Lollis	$ 5,201.46

Thanks,

WCC

03253

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Thursday, June 21, 2007 2:14 PM
To: Matt Smith
Cc: Tim Roberson; Larry Lollis; Rick Thoennes; rick@marickhomebuilders.com
Subject: Distribution Checks

Matt,

Please cut checks to the following for closings on 43 (Skalky) and 68 (Sallarullo):

SDI Funding	$39,465.00
Integrys Holdings	$ 3,946.50
William Cox	$14,207.40
Tim Roberson	$14,207.40
Larry Lollis	$ 7,103.70

Thanks,

WCC

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Thursday, September 20, 2007 11:53 AM
To: Matt Smith
Cc: Rick Thoennes; ricksr@marick.net; Tim Roberson; Larry Lollis
Subject: IMK Distribution
Matt,

Please cut the following distribution checks for the closing of #73. Also, please include the unit # on SDI's check so they will know which closing it is coming from. Also, we need to send Paul Fournier a refund of his down payment on #73 of $69,982.00 by next Friday, September 28. Sherri or I will get you his address.

Thanks,

WCC

SDI	$31,000.00
Integrys	$ 3,100.00
Bill Cox	$11,160.00
Tim Roberson	$11,160.00
Larry Lollis	$ 5,580.00

03255

From: Bill Cox [Bill.Cox@integrys.net]
Sent: Thursday, October 04, 2007 5:13 PM
To: Matt Smith
Cc: Tim Roberson; rickrr@marick.net; rick@marick.net; Larry Lollis
Subject: IMK Distributions

Matt,

Please out the following distribution checks on Monday provided we get the money from the closings of # 28 & # 88:

SDI	$39,600.00
Integrys	$ 3,960.00
WCC	$14,256.00
Tim	$14,256.00
Larry Lollis	$ 7,128.00

Thanks,

WCC

03256

COMMISSION AGREEMENT

This Commission Agreement (the "Agreement") is made and entered into by and between MEDALLION AT KEOWEE, LLC ("Medallion at Keowee") and INTEGRYS KEOWEE DEVELOPMENT, LLC ("IK Development"), as of the ____ day of March, 2010.

WHEREAS, Medallion at Keowee is the owner and the successor in interest to Ludwig Corporation, LLC of certain real property located in Oconee County, South Carolina, known as Stoneledge at Lake Keowee ("Stoneledge"), as more fully described in that certain deed from IMK Development Company, LLC, to Ludwig Corporation, recorded in the Oconee County Register of Deeds Office on June 17, 2008, in Deed Book 1666, at Page 322; and

WHEREAS, Medallion at Keowee has developed townhouses at Stoneledge and is obligated to pay IK Development certain "Consulting Fees" as defined and set forth in Section 2.A., of that certain Real Estate Purchase Agreement dated April 9, 2008, as amended, between IK Development and Ludwig Corporation, LLC (the "Purchase Agreement"); and,

WHEREAS, Medallion at Keowee is obligated to pay BB&T, its construction lender, a release fee upon the sale of each townhouse at Stoneledge, as a result of which, Medallion at Keowee wishes to restructure its obligations to IK Development; and

WHEREAS, Medallion and IK Development have agreed to modify the terms for the payment of the Consulting Fees, pursuant to the terms and conditions of this Agreement; and

WHEREAS, Medallion at Keowee currently owes IK Development Consulting Fees for the following sold townhouses, in the following amounts:

WHEREAS, IK Development has agreed to defer the above-described Consulting Fees and 50% of all future Consulting Fees which shall accrue pursuant to the terms and conditions of the Purchase Agreement as modified by this Agreement until such time as BB&T is paid in full; and

WHEREAS, Medallion at Keowee has agreed to secure its obligation to pay the Consulting Fees to IK Development by means of a mortgage to be filed against Stoneledge, which lien shall be administered and released pursuant to the terms and conditions of this Agreement.

NOW, THEREFORE, for and in consideration of the mutual promises, obligations, and agreements contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the undersigned hereby agree as follows:

(1) **Calculation of the Consulting Fee.** IK Development shall be entitled to receive a Consulting Fee in the amount of Ten Percent (10%) of the gross sales price of all townhouses sold in Stoneledge, less sales commissions paid at closing on each townhouse up to Seven Percent (7%).

(2) **Consulting Fee Due from Auction Sales.** In addition to the currently-due Consulting Fees described in the fourth "WHEREAS" clause above, Medallion at Keowee has agreed to pay IK Development the following amounts on the following units, which amounts were generated from the sales of the units sold at auction:

Unit 12 $ 24,496

(the "Auction Fee"). Medallion at Keowee agrees to pay IK Development one-half (1/2) of the Auction Fee upon receipt of an anticipated insurance settlement related to claims made against the repair of decks and porches in Phase I and II of Stoneledge. The balance of the Auction Fee shall be deferred and paid as described in Paragraph 3 below.

(3) **Deferral of Consulting Fees.** The payment of all Consulting Fees and all of the Auction Fee described herein, with the exception of those partial fee payments described in Paragraph 2 to be paid earlier if and when an insurance settlement is made, shall be deferred until such time as the BB&T mortgage is paid in full and satisfied.

(4) **Security.** In order to secure the obligation owed by Medallion at Keowee to IK Development, Medallion at Keowee shall execute and deliver a mortgage on the Stoneledge property for the benefit of IK Development (the "IK Development Mortgage"). Culbertson + Alexander, LLC (the "Law Firm") is hereby instructed to hold the IK Development Mortgage in trust and file same upon payment in full and satisfaction of the BB&T mortgage. Medallion at Keowee shall notify the Law Firm and IK Development of each closing involving Stoneledge property. IK Development shall release townhouses from its mortgage pursuant to the release fee schedule contained

below, and shall immediately satisfy its mortgage upon payment in full of the obligations described in this Agreement.

(5) **Release Fee Schedule.** At such time as the BB&T mortgage is paid in full and satisfied, Medallion at Keowee shall pay to IK Development at the closing of each townhouse a release fee equal to Sixty Percent (60%) of the gross sales price of the townhouse; not to exceed the amount of outstanding consulting fees due. Should BB&T be paid in full at the closing of a townhouse and the amount required to make such payoff is less than Seventy Percent (70%) of the gross sales price of the townhouse, Medallion at Keowee shall pay to IK Development an amount that, when added to the BB&T payoff, equals Seventy Percent (70%) of the gross sales price of the townhouse, not to exceed the amount of outstanding consulting fees due.

(6) **Restrictions on Sales Price.** Medallion at Keowee agrees that it shall not restrict the sales price of Units 5, 15, 18, and 20, for so long as they are owned by IMK Development, LLC, Tim Roberson, and Larry Lollis, respectively.

(7) **Independent Counsel.** This Agreement has been carefully read by all parties and the contents are known and understood by all parties. The parties acknowledge that they have executed this Agreement after independent investigation and having had the opportunity to consult with their respective legal counsel, and without fraud, duress, or undue influence.

(8) **Integration.** This document constitutes the entire agreement between the parties, with all oral agreements being merged herein, and supersedes all prior representations. There are no representations, agreements, arrangements, or understandings, oral or written, between or among the parties relating to the subject matter of this Agreement that are not fully expressed herein.

(9) **Successors and Assigns.** Subject to the provisions otherwise contained in this Agreement, this Agreement shall inure to the benefit of and be binding upon the heirs, successors and assigns of the respective parties.

(10) **Amendment.** The provisions of this Agreement may be modified at any time by agreement of the parties. Any such agreement hereafter made shall be ineffective to modify this Agreement in any respect unless in writing and signed by all of the parties.

(11) **Counterparts.** This Agreement may be executed in any number of counterparts with the same effect as if the parties had all signed the same document. Copies hereof, including, but not limited to, facsimile copies, shall have the same effect as if they were originals. All counterparts shall be construed together and shall constitute one agreement.

(12) **Choice of Law.** The rights and obligations of the parties and the interpretation and performance of this Agreement shall be governed by the laws of the State of South Carolina.

MAK 001019

03259

3401

(13) **Attorneys' Fees.** If the services of an attorney are required by any party to secure the performance of this Agreement or otherwise upon the breach or default of another party to this Agreement, or if any judicial remedy or alternative dispute resolution procedure is necessary to enforce or interpret any provision of this Agreement or the rights and duties of any person in relation thereto, the prevailing party shall be entitled to reasonable attorneys' fees, costs, and other expenses, in addition to any other relief to which such party may be entitled. Any award of damages following judicial remedy or alternative dispute resolution procedure as a result of the breach of this Agreement or any of its provisions shall include an award of prejudgment interest from the date of the breach at the maximum amount of interest allowed by law.

(14) **Recitals.** The recitals set forth hereinabove are incorporated herein by reference and made a part of this Agreement.

(15) **No Third Party Beneficiaries.** The terms, provisions, conditions and requirements made and set forth herein are for the benefit of the parties hereto. It is specifically intended that BB&T and no other party shall be a third party beneficiary hereunder except and unless it is specifically provided herein that any provision shall operate or inure to the use and benefit of such third party.

(16) **No Joint Venture.** Neither this Agreement nor any agreements, instruments, documents or transactions contemplated hereby, shall in any respect be interpreted, deemed or construed as making IK Development a partner or joint venturer with Medallion or as creating any similar relationship or entity.

MAK 001020

03260

3402

IN WITNESS WHEREOF, the undersigned parties have, by and through their duly authorized representatives, officers, and agents, executed this Agreement under seal as of the date above.

In the presence of:

Witness

Witness

MEDALLION AT KEOWEE, LLC

By:

Brad Seckinger
Its: Member

MAK 001021

03261

In the presence of:

INTEGRYS KEOWEE
DEVELOPMENT, LLC

_____
Witness

By: _____
Print Name: _____
Its: _____

_____
Witness

MAK 001022

03262

COMMISSION AGREEMENT

This Commission Agreement (the "Agreement") is made and entered into by and between MEDALLION AT KEOWEE, LLC. ("Medallion at Keowee") and INTEGRYS KEOWEE DEVELOPMENT, LLC ("IK Development"), as of the _____ day of March, 2010.

WHEREAS, Medallion at Keowee is the owner and the successor in interest to Ludwig Corporation, LLC of certain real property located in Oconee County, South Carolina, known as Stoneledge at Lake Keowee ("Stoneledge"), as more fully described in that certain deed from IMK Development Company, LLC, to Ludwig Corporation, recorded in the Oconee County Register of Deeds Office on June 17, 2008, in Deed Book 1666, at Page 322; and.

WHEREAS, Medallion at Keowee has developed townhouses at Stoneledge and is obligated to pay IK Development certain "Consulting Fees" as defined and set forth in Section 2.A., of that certain Real Estate Purchase Agreement dated April 9, 2008, as amended, between IK Development and Ludwig Corporation, LLC (the "Purchase Agreement"); and,

WHEREAS, Medallion at Keowee is obligated to pay BB&T, its construction lender, a release fee upon the sale of each townhouse at Stoneledge, as a result of which, Medallion at Keowee wishes to restructure its obligations to IK Development; and

WHEREAS, Medallion and IK Development have agreed to modify the terms for the payment of the Consulting Fees, pursuant to the terms and conditions of this Agreement; and

WHEREAS, Medallion at Keowee currently owes IK Development Consulting Fees for the following sold townhouses, in the following amounts:

WHEREAS, IK Development has agreed to defer the above-described Consulting Fees and 50% of all future Consulting Fees which shall accrue pursuant to the terms and conditions of the Purchase Agreement as modified by this Agreement until such time as BB&T is paid in full; and

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WHEREAS, Medallion at Keowee has agreed to secure its obligation to pay the Consulting Fees to IK Development by means of a mortgage to be filed against Stoneledge, which lien shall be administered and released pursuant to the terms and conditions of this Agreement.

NOW, THEREFORE, for and in consideration of the mutual promises, obligations, and agreements contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the undersigned hereby agree as follows:

(1) **Calculation of the Consulting Fee.** IK Development shall be entitled to receive a Consulting Fee in the amount of Ten Percent (10%) of the gross sales price of all townhouses sold in Stoneledge, less sales commissions paid at closing on each townhouse up to Seven Percent (7%).

(2) **Consulting Fee Due from Auction Sales.** In addition to the currently-due Consulting Fees described in the fourth "WHEREAS" clause above, Medallion at Keowee has agreed to pay IK Development the following amounts on the following units, which amounts were generated from the sales of the units sold at auction:

Unit 12 $24,496

(the "Auction Fee"). Medallion at Keowee agrees to pay IK Development one-half (1/2) of the Auction Fee upon receipt of an anticipated insurance settlement related to claims made against the repair of decks and porches in Phase I and II of Stoneledge. The balance of the Auction Fee shall be deferred and paid as described in Paragraph 3 below.

(3) **Deferral of Consulting Fees.** The payment of all Consulting Fees and all of the Auction Fee described herein, with the exception of those partial fee payments described in Paragraph 2 to be paid earlier if and when an insurance settlement is made, shall be deferred until such time as the BB&T mortgage is paid in full and satisfied.

(4) **Security.** In order to secure the obligation owed by Medallion at Keowee to IK Development, Medallion at Keowee shall execute and deliver a mortgage on the Stoneledge property for the benefit of IK Development (the "IK Development Mortgage"). Culbertson + Alexander, LLC (the "Law Firm") is hereby instructed to hold the IK Development Mortgage in trust and file same upon payment in full and satisfaction of the BB&T mortgage. Medallion at Keowee shall notify the Law Firm and IK Development of each closing involving Stoneledge property. IK Development shall release townhouses from its mortgage pursuant to the release fee schedule contained

below, and shall immediately satisfy its mortgage upon payment in full of the obligations described in this Agreement.

(5) **Release Fee Schedule.** At such time as the BB&T mortgage is paid in full and satisfied, Medallion at Keowee shall pay to IK Development at the closing of each townhouse a release fee equal to Sixty Percent (60%) of the gross sales price of the townhouse, not to exceed the amount of outstanding consulting fees due. Should BB&T be paid in full at the closing of a townhouse and the amount required to make such payoff is less than Seventy Percent (70%) of the gross sales price of the townhouse, Medallion at Keowee shall pay to IK Development an amount that, when added to the BB&T payoff, equals Seventy Percent (70%) of the gross sales price of the townhouse, not to exceed the amount of outstanding consulting fees due.

(6) **Restrictions on Sales Price.** Medallion at Keowee agrees that it shall not restrict the sales price of Units 5, 15, 18, and 20, for so long as they are owned by IMK Development, LLC, Tim Roberson, and Larry Lollis, respectively.

(7) **Independent Counsel.** This Agreement has been carefully read by all parties and the contents are known and understood by all parties. The parties acknowledge that they have executed this Agreement after independent investigation and having had the opportunity to consult with their respective legal counsel, and without fraud, duress, or undue influence.

(8) **Integration.** This document constitutes the entire agreement between the parties, with all oral agreements being merged herein, and supersedes all prior representations. There are no representations, agreements, arrangements, or understandings, oral or written, between or among the parties relating to the subject matter of this Agreement that are not fully expressed herein.

(9) **Successors and Assigns.** Subject to the provisions otherwise contained in this Agreement, this Agreement shall inure to the benefit of and be binding upon the heirs, successors and assigns of the respective parties.

(10) **Amendment.** The provisions of this Agreement may be modified at any time by agreement of the parties. Any such agreement hereafter made shall be ineffective to modify this Agreement in any respect unless in writing and signed by all of the parties.

(11) **Counterparts.** This Agreement may be executed in any number of counterparts with the same effect as if the parties had all signed the same document. Copies hereof, including, but not limited to, facsimile copies, shall have the same effect as if they were originals. All counterparts shall be construed together and shall constitute one agreement.

(12) **Choice of Law.** The rights and obligations of the parties and the interpretation and performance of this Agreement shall be governed by the laws of the State of South Carolina.

(13) **Attorneys' Fees.** If the services of an attorney are required by any party to secure the performance of this Agreement or otherwise upon the breach or default of another party to this Agreement, or if any judicial remedy or alternative dispute resolution procedure is necessary to enforce or interpret any provision of this Agreement or the rights and duties of any person in relation thereto, the prevailing party shall be entitled to reasonable attorneys' fees, costs, and other expenses, in addition to any other relief to which such party may be entitled. Any award of damages following judicial remedy or alternative dispute resolution procedure as a result of the breach of this Agreement or any of its provisions shall include an award of prejudgment interest from the date of the breach at the maximum amount of interest allowed by law.

(14) **Recitals.** The recitals set forth hereinabove are incorporated herein by reference and made a part of this Agreement.

(15) **No Third Party Beneficiaries.** The terms, provisions, conditions and requirements made and set forth herein are for the benefit of the parties hereto. It is specifically intended that BB&T and no other party shall be a third party beneficiary hereunder except and unless it is specifically provided herein that any provision shall operate or inure to the use and benefit of such third party.

(16) **No Joint Venture.** Neither this Agreement nor any agreements, instruments, documents or transactions contemplated hereby, shall in any respect be interpreted, deemed or construed as making IK Development a partner or joint venturer with Medallion or as creating any similar relationship or entity.

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IN WITNESS WHEREOF, the undersigned parties have, by and through their duly authorized representatives, officers, and agents, executed this Agreement under seal as of the date above.

In the presence of:

MEDALLION AT KEOWEE, LLC

Witness

By: _____
Brad Seekinger
Its: Member

Witness

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In the presence of:

INTEGRYS KEOWEE DEVELOPMENT, LLC

_____
Witness

By: _____
Print Name: _____
Its: _____

_____
Witness

MAK 001022

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Filing Instructions

IMK DEVELOPMENT CO., LLC

Form 1065 - U.S. Return of Partnership Income

Taxable Year Ended December 31, 2009

Date Due:	April 15, 2010
Remittance:	None is required.
Mail To:	Department of the Treasury Internal Revenue Service Cincinnati, OH 45999-0011
Signature:	The return should be signed and dated on page 1 by a limited liability company member.
Other:	Initial and date the copy of Form 1065, and retain it for your records.

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Form **1065**
Department of the Treasury
Internal Revenue Service

U.S. Return of Partnership Income

For calendar year 2009, or tax year beginning ..... , ending .....
◆ See separate instructions.

OMB No. 1545-0099
2009

A Principal business activity: LAND DEVELOP
B Principal product or service: SALES
C Business code number: 531390

Use the IRS label. Otherwise, print or type.

Name of partnership: IMK DEVELOPMENT CO., LLC
Number, street, and room or suite no. If a P.O. box, see the instructions.: 3445 PELHAM ROAD, SUITE 102
City or town, state, and ZIP code: GREENVILLE SC 29615

D Employer identification number: 20-2736926
E Date business started: 04/26/2005
F Total assets (see the instructions): $ 1,150,491

G Check applicable boxes: (1) ☐ Initial return (2) ☐ Final return (3) ☐ Name change (4) ☐ Address change (5) ☐ Amended return (6) ☐ Technical termination - also check (1) or (2)
H Check accounting method: (1) ☐ Cash (2) ☒ Accrual (3) ☐ Other (specify) ◆ .....
I Number of Schedules K-1. Attach one for each person who was a partner at any time during the tax year ◆ 2
J Check if Schedules C and M-3 are attached ..... ☐

Caution. Include only trade or business income and expenses on lines 1a through 22 below. See the instructions for more information.

Income	1a	Gross receipts or sales		
	b	Less returns and allowances	1b	
	2	Cost of goods sold (Schedule A, line 8)		1c
	3	Gross profit. Subtract line 2 from line 1c		2
	4	Ordinary income (loss) from other partnerships, estates, and trusts (attach statement)		3
	5	Net farm profit (loss) (attach Schedule F (Form 1040))		4
	6	Net gain (loss) from Form 4797, Part II, line 17 (attach Form 4797)		5
	7	Other income (loss) (attach statement)		6
	8	Total income (loss). Combine lines 3 through 7		7
Deductions (see the instructions for limitations)	9	Salaries and wages (other than to partners) (less employment credits)		8
	10	Guaranteed payments to partners		9
	11	Repairs and maintenance		10
	12	Bad debts		11
	13	Rent		12
	14	Taxes and licenses		13
	15	Interest		14
	16a	Depreciation (if required, attach Form 4562)		15
	b	Less depreciation reported on Schedule A and elsewhere on return	16b	16c
	17	Depletion (Do not deduct oil and gas depletion.)		17
	18	Retirement plans, etc.		18
	19	Employee benefit programs		19
	20	Other deductions (attach statement)		20
	21	Total deductions. Add the amounts shown in the far right column for lines 9 through 20		21
	22	Ordinary business income (loss). Subtract line 21 from line 8		22

Sign Here

Under penalties of perjury, I declare that I have examined this return, including accompanying schedules and statements, and to the best of my knowledge and belief, it is true, correct, and complete. Declaration of preparer (other than general partner or limited liability company member manager) is based on all information of which preparer has any knowledge.

▶ _____ Signature of general partner or limited liability company member manager ▶ _____ Date

May the IRS discuss this return with the preparer shown below (see instructions)? ☒ Yes ☐ No

Paid Preparer's Use Only

Preparer's signature: JACKIE HIGHLEY
Date: 04/01/10
Check if self-employed ◆ ☐
REDACTED

Firm's name (or yours if self-employed), address, and ZIP code: PORTER & HIGHLEY, CPAS
512 PETTIGRU STREET
GREENVILLE, SC 29601

EIN ◆ 57-0706552
Phone no. 864-235-5265

For Privacy Act and Paperwork Reduction Act Notice, see separate instructions. Form 1065 (2009)

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Form 1065 (2009) TMK DEVELOPMENT CO., LLC 20-2736926 Page 2

Schedule K Cost of Goods Sold (see the instructions)

1	Inventory at beginning of year	1	
2	Purchases less cost of items withdrawn for personal use	2	
3	Cost of labor	3	
4	Additional section 263A costs (attach statement)	4	
5	Other costs (attach statement)	5	
6	Total. Add lines 1 through 5	6	
7	Inventory at end of year	7	
8	Cost of goods sold. Subtract line 7 from line 6. Enter here and on page 1, line 2	8	

9a Check all methods used for valuing closing inventory:
- (i) [X] Cost as described in Regulations section 1.471-3
- (ii) [ ] Lower of cost or market as described in Regulations section 1.471-4
- (iii) [ ] Other (specify method used and attach explanation) ◆

b Check this box if there was a writedown of "subnormal" goods as described in Regulations section 1.471-2(c) ◆ [ ]

c Check this box if the LIFO inventory method was adopted this tax year for any goods (if checked, attach Form 970) ◆ [ ]

d Do the rules of section 263A (for property produced or acquired for resale) apply to the partnership? [ ] Yes [X] No

e Was there any change in determining quantities, cost, or valuations between opening and closing inventory? [ ] Yes [ ] No
If "Yes," attach explanation.

Schedule K Other Information

		Yes	No
1	What type of entity is filing this return? Check the applicable box:		
a	[ ] Domestic general partnership b [ ] Domestic limited partnership		
c	[X] Domestic limited liability company d [ ] Domestic limited liability partnership		
e	[ ] Foreign partnership f [ ] Other ◆		
2	At any time during the tax year, was any partner in the partnership a disregarded entity, a partnership (including an entity treated as a partnership), a trust, an S corporation, an estate (other than an estate of a deceased partner), or a nominee or similar person?		X
3	At the end of the tax year:		
a	Did any foreign or domestic corporation, partnership (including any entity treated as a partnership), trust, or tax-exempt organization own, directly or indirectly, an interest of 50% or more in the profit, loss, or capital of the partnership? For rules of constructive ownership, see instructions. If "Yes," attach Schedule B-1, Information on Partners Owning 50% or More of the Partnership		X
b	Did any individual or estate own, directly or indirectly, an interest of 50% or more in the profit, loss, or capital of the partnership? For rules of constructive ownership, see instructions. If "Yes," attach Schedule B-1, Information on Partners Owning 50% or More of the Partnership		X
4	At the end of the tax year, did the partnership:		
a	Own directly 20% or more, or own, directly or indirectly, 50% or more of the total voting power of all classes of stock entitled to vote of any foreign or domestic corporation? For rules of constructive ownership, see instructions. If "Yes," complete (i) through (iv) below		X

(i) Name of Corporation	(ii) Employer Identification Number (if any)	(iii) Country of Incorporation	(iv) Percentage Owned in Voting Stock

b Own directly an interest of 20% or more, or own, directly or indirectly, an interest of 50% or more in the profit, loss, or capital in any foreign or domestic partnership (including an entity treated as a partnership) or in the beneficial interest of a trust? For rules of constructive ownership, see instructions. If "Yes," complete (i) through (v) below [ ] [X]

(i) Name of Entity	(ii) Employer Identification Number (if any)	(iii) Type of Entity	(iv) Country of Organization	(v) Maximum Percentage Owned in Profit, Loss, or Capital

Form 1065 (2009)

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Form 1065 (2009) IMK DEVELOPMENT CO., LLC 20-2736926

		Yes	No
5	Did the partnership file Form 8893, Election of Partnership Level Tax Treatment, or an election statement under section 6231(a)(1)(B)(ii) for partnership-level tax treatment, that is in effect for this tax year? See Form 8893 for more details		X
6	Does the partnership satisfy all four of the following conditions?		
a	The partnership's total receipts for the tax year were less than $250,000.		
b	The partnership's total assets at the end of the tax year were less than $1 million.		
c	Schedules K-1 are filed with the return and furnished to the partners on or before the due date (including extensions) for the partnership return.		
d	The partnership is not filing and is not required to file Schedule M-3		
	If "Yes," the partnership is not required to complete Schedules L, M-1, and M-2; Item F on page 1 of Form 1065; or Item L on Schedule K-1.		X
7	Is this partnership a publicly traded partnership as defined in section 469(k)(2)?		X
8	During the tax year, did the partnership have any debt that was canceled, was forgiven, or had the terms modified so as to reduce the principal amount of the debt?		X
9	Has this partnership filed, or is it required to file, Form 8918, Material Advisor Disclosure Statement, to provide information on any reportable transaction?		X
10	At any time during calendar year 2009, did the partnership have an interest in or a signature or other authority over a financial account in a foreign country (such as a bank account, securities account, or other financial account)? See the instructions for exceptions and filing requirements for Form TD F 90-22.1, Report of Foreign Bank and Financial Accounts. If "Yes," enter the name of the foreign country. ◆		X
11	At any time during the tax year, did the partnership receive a distribution from, or was it the grantor of, or transferor to, a foreign trust? If "Yes," the partnership may have to file Form 3520, Annual Return To Report Transactions With Foreign Trusts and Receipt of Certain Foreign Gifts. See instructions		X
12a	Is the partnership making, or had it previously made (and not revoked), a section 754 election? See instructions for details regarding a section 754 election.		X
b	Did the partnership make for this tax year an optional basis adjustment under section 743(b) or 734(b)? If "Yes," attach a statement showing the computation and allocation of the basis adjustment. See instructions.		X
c	Is the partnership required to adjust the basis of partnership assets under section 743(b) or 734(b) because of a substantial built-in loss (as defined under section 743(d)) or substantial basis reduction (as defined under section 734(d))? If "Yes," attach a statement showing the computation and allocation of the basis adjustment. See instructions.		X
13	Check this box if, during the current or prior tax year, the partnership distributed any property received in a like-kind exchange or contributed such property to another entity (other than entities wholly owned by the partnership throughout the tax year) ▶ ☐		X
14	At any time during the tax year, did the partnership distribute to any partner a tenancy-in-common or other undivided interest in partnership property?		X
15	If the partnership is required to file Form 8858, Information Return of U.S. Persons With Respect To Foreign Disregarded Entities, enter the number of Forms 8858 attached. See instructions ◆		
16	Does the partnership have any foreign partners? If "Yes," enter the number of Forms 8805, Foreign Partner's Information Statement of Section 1446 Withholding Tax, filed for this partnership. ◆		X
17	Enter the number of Forms 8865, Return of U.S. Persons With Respect to Certain Foreign Partnerships, attached to this return. ◆		

Designation of Tax Matters Partner (see instructions)

Enter below the general partner designated as the tax matters partner (TMP) for the tax year of this return:

Name of designated TMP ▶	WILLIAM C. COX	Identifying number of TMP ▶	REDACTED
If the TMP is an entity, name of TMP representative ▶		Phone number of TMP ▶	
Address of designated TMP ▶	770 PELHAM ROAD GREENVILLE SC 29615		

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Form 1065 (2009) IMK DEVELOPMENT CO., LLC 20-2736926 Page 4

Schedule K Partners' Distributive Share Items

			Total amount
Income (Loss)	1 Ordinary business income (loss) (page 1, line 22)	1	
	2 Net rental real estate income (loss) (attach Form 8825)	2	-102,804
	3a Other gross rental income (loss) 3a		
	b Expenses from other rental activities (attach statement) 3b		
	c Other net rental income (loss). Subtract line 3b from line 3a	3c	
	4 Guaranteed payments	4	
	5 Interest income	5	
	6 Dividends: a Ordinary dividends	6a	
	b Qualified dividends 6b		
	7 Royalties	7	
	8 Net short-term capital gain (loss) (attach Schedule D (Form 1065))	8	
	9a Net long-term capital gain (loss) (attach Schedule D (Form 1065))	9a	
	b Collectibles (28%) gain (loss) 9b		
	c Unrecaptured section 1250 gain (attach statement) 9c		
	10 Net section 1231 gain (loss) (attach Form 4797)	10	
	11 Other income (loss) (see instructions) Type ◆	11	
Deductions	12 Section 179 deduction (attach Form 4562)	12	0
	13a Contributions	13a	
	b Investment interest expense	13b	
	c Section 59(e)(2) expenditures: (1) Type ◆ (2) Amount ◆	13c(2)	
	d Other deductions (see instructions) Type ◆	13d	
Self-Employment	14a Net earnings (loss) from self-employment	14a	
	b Gross farming or fishing income	14b	
	c Gross nonfarm income	14c	
Credits	15a Low-income housing credit (section 42(j)(5))	15a	
	b Low-income housing credit (other)	15b	
	c Qualified rehabilitation expenditures (rental real estate) (attach Form 3468)	15c	
	d Other rental real estate credits (see instructions) Type ◆	15d	
	e Other rental credits (see instructions) Type ◆	15e	
	f Other credits (see instructions) Type ◆	15f	
Foreign Transactions	16a Name of country or U.S. possession ◆		
	b Gross income from all sources	16b	
	c Gross income sourced at partner level	16c	
	Foreign gross income sourced at partnership level		
	d Passive category ◆ e General category ◆ f Other ◆	16f	
	Deductions allocated and apportioned at partner level		
	g Interest expense ◆ h Other ◆	16h	
	Deductions allocated and apportioned at partnership level to foreign source income		
	i Passive category ◆ j General category ◆ k Other ◆	16k	
	l Total foreign taxes (check one): ◆ Paid ☐ Accrued ☐	16l	
	m Reduction in taxes available for credit (attach statement)	16m	
	n Other foreign tax information (attach statement)		
Alternative Minimum Tax (AMT) Items	17a Post-1986 depreciation adjustment	17a	
	b Adjusted gain or loss	17b	
	c Depletion (other than oil and gas)	17c	
	d Oil, gas, and geothermal properties-gross income	17d	
	e Oil, gas, and geothermal properties-deductions	17e	
	f Other AMT items (attach statement)	17f	
Other Information	18a Tax-exempt interest income	18a	
	b Other tax-exempt income	18b	
	c Nondeductible expenses SEE STATEMENT 1	18c	10,214
	19a Distributions of cash and marketable securities	19a	350,000
	b Distributions of other property	19b	
	20a Investment income	20a	
	b Investment expenses	20b	
	c Other items and amounts (attach statement)		

DAA Form 1065 (2009)

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Analysis of Net Income (Loss)

1	Net income (loss). Combine Schedule K, lines 1 through 11. From the result, subtract the sum of Schedule K, lines 12 through 13d, and 16l				1	-102,804
2	Analysis by partner type:	(i) Corporate	(ii) Individual (active)	(iii) Individual (passive)	(iv) Partnership	(v) Exempt organization	(vi) Nominee/Other
a	General partners						
b	Limited partners				-102,804		

Schedule L Balance Sheets per Books

	Assets	Beginning of tax year (a)	Beginning of tax year (b)	End of tax year (c)	End of tax year (d)
1	Cash		1,419		
2a	Trade notes and accounts receivable				
b	Less allowance for bad debts				
3	Inventories				
4	U.S. government obligations				
5	Tax-exempt securities				
6	Other current assets (attach statement)				
7	Mortgage and real estate loans				
8	Other investments (attach statement)				
9a	Buildings and other depreciable assets	1,253,905		1,266,782	
b	Less accumulated depreciation	125,079	1,128,826	135,293	1,131,489
10a	Depletable assets				
b	Less accumulated depletion				
11	Land (net of any amortization)				
12a	Intangible assets (amortizable only)				
b	Less accumulated amortization				
13	Other assets (attach statement) SEE STMT 2		369,002		19,002
14	Total assets		1,499,247		1,150,491
	Liabilities and Capital				
15	Accounts payable		22,227		84,356
16	Mortgages, notes, bonds payable in less than 1 year		1,010,100		1,010,100
17	Other current liabilities (attach statement) SEE STMT 3		81,200		56,434
18	All nonrecourse loans				
19	Mortgages, notes, bonds payable in 1 year or more				
20	Other liabilities (attach statement)				
21	Partners' capital accounts		385,720		-399
22	Total liabilities and capital		1,499,247		1,150,491

Schedule M-1 Reconciliation of Income (Loss) per Books With Income (Loss) per Return

Note. Schedule M-3 may be required instead of Schedule M-1 (see instructions).

1	Net income (loss) per books	-113,019	6	Income recorded on books this year not included on Schedule K, lines 1 through 11 (itemize):	
2	Income included on Schedule K, lines 1, 2, 3c, 5, 6a, 7, 8, 9a, 10, and 11, not recorded on books this year (itemize):		a	Tax-exempt interest $	
3	Guaranteed payments (other than health insurance)		7	Deductions included on Schedule K, lines 1 through 13d, and 16l, not charged against book income this year (itemize):	
4	Expenses recorded on books this year not included on Schedule K, lines 1 through 13d, and 16l (itemize):		a	Depreciation $	
a	Depreciation $		b	Travel and entertainment $ SEE STATEMENT 4 10,215	10,215
b	Travel and entertainment $ SEE STATEMENT 4 10,215	10,215	8	Add lines 6 and 7	10,215
5	Add lines 1 through 4	-102,804	9	Income (loss) (Analysis of Net Income (Loss), line 1). Subtract line 8 from line 5	-102,804

Schedule M-2 Analysis of Partners' Capital Accounts

1	Balance at beginning of year	385,720	6	Distributions: a Cash	350,000
2	Capital contributed: a Cash	76,900		b Property	
	b Property		7	Other decreases (itemize):	
3	Net income (loss) per books	-113,019			
4	Other increases (itemize):		8	Add lines 6 and 7	350,000
5	Add lines 1 through 4	349,601	9	Balance at end of year. Subtract line 8 from line 5	-399

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Form **8825** (Rev. December 2006)
Department of the Treasury
Internal Revenue Service

Rental Real Estate Income and Expenses of a Partnership or an S Corporation

◆ See instructions on back.
◆ Attach to Form 1065, Form 1065-B, or Form 1120S.

OMB No. 1545-1186

Name: IMK DEVELOPMENT CO., LLC

Employer identification number: 20-2736926

1 Show the kind and location of each property. See page 2 to list additional properties.

RENTAL INCOME

A

B

C

D

		Properties			
Rental Real Estate Income		A	B	C	D
2 Gross rents	2	23,920			
Rental Real Estate Expenses					
3 Advertising	3				
4 Auto and travel	4				
5 Cleaning and maintenance	5	1,729			
6 Commissions	6	3,593			
7 Insurance	7				
8 Legal and other professional fees	8	8,669			
9 Interest	9	84,616			
10 Repairs	10				
11 Taxes	11	4,985			
12 Utilities	12	4,968			
13 Wages and salaries	13				
14 Depreciation (see instructions)	14				
15 Other (list) ◆ SEE STATEMENT 5	15	18,164			
16 Total expenses for each property. Add lines 3 through 15	16	126,724			

17	Total gross rents. Add gross rents from line 2, columns A through H	17	23,920
18	Total expenses. Add total expenses from line 16, columns A through H	18	126,724
19	Net gain (loss) from Form 4797, Part II, line 17, from the disposition of property from rental real estate activities	19	
20a	Net income (loss) from rental real estate activities from partnerships, estates, and trusts in which this partnership or S corporation is a partner or beneficiary (from Schedule K-1)	20a	
b	Identify below the partnerships, estates, or trusts from which net income (loss) is shown on line 20a. Attach a schedule if more space is needed: (1) Name ... (2) Employer identification number		
21	Net rental real estate income (loss). Combine lines 17 through 20a. Enter the result here and on: ◆ Form 1065 or 1120S: Schedule K, line 2, or ◆ Form 1065-B: Part I, line 4	21	-102,804

For Paperwork Reduction Act Notice, see back of form.
DAA

Form **8825** (12-2006)

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SCHEDULE B-1 (Form 1065)
(December 2008)
Department of the Treasury
Internal Revenue Service

Information on Partners Owning 50% or More of the Partnership

◆ Attach to Form 1065. See instructions on back.

OMB No. 1545-0099

Name of partnership: IMX DEVELOPMENT CO., LLC

Employer identification number (EIN): 20-2736926

Part I Entities Owning 50% or More of the Partnership (Form 1065, Schedule B, Question 3a)

Complete columns (i) through (v) below for any foreign or domestic corporation, partnership (including any entity treated as a partnership), trust, or tax-exempt organization that owns, directly or indirectly, an interest of 50% or more in the profit, loss, or capital of the partnership (see instructions).

(i) Name of Entity	(ii) Employer Identification Number (if any)	(iii) Type of Entity	(iv) Country of Organization	(v) Maximum Percentage Owned in Profit, Loss, or Capital
MARICK HOME BUILDERS, LLC	58-2450631	PARTNERSHIP	UNITED STATES	50.000000
INTEGRYS KEOWEE DEVELOPMENT, LLC	20-2737015	PARTNERSHIP	UNITED STATES	100.000000

Part II Individuals or Estates Owning 50% or More of the Partnership (Form 1065, Schedule B, Question 3b)

Complete columns (i) through (iv) below for any individual or estate that owns, directly or indirectly, an interest of 50% or more in the profit, loss, or capital of the partnership (see instructions).

(i) Name of Individual or Estate	(ii) Identifying Number (if any)	(iii) Country of Citizenship (see instructions)	(iv) Maximum Percentage Owned in Profit, Loss, or Capital

For Paperwork Reduction Act Notice, see the instructions for Form 1065.

Schedule B-1 (Form 1065) (12-2008)

OAA

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PARTNER# 1
Schedule K-1
(Form 1065)

Department of the Treasury
Internal Revenue Service

2009

For calendar year 2009, or tax year beginning _____ ending _____

Partner's Share of Income, Deductions, Credits, etc. ◆ See back of form and separate instructions.

☐ Final K-1 ☐ Amended K-1 651109 OMB No. 1545-0099

Part I Information About the Partnership

A Partnership's employer identification number
20-2736926

B Partnership's name, address, city, state, and ZIP code
IMK DEVELOPMENT CO., LLC
3445 PELHAM ROAD, SUITE 102
GREENVILLE SC 29615

C IRS Center where partnership filed return
CINCINNATI, OH 45999-0011

D ☐ Check if this is a publicly traded partnership (PTP)

Part II Information About the Partner

E Partner's identifying number
[redacted]

F Partner's name, address, city, state, and ZIP code
MARICK HOME BUILDERS, LLC
501 BRIXTON CIRCLE
SIMPSONVILLE SC 29681

G ☐ General partner or LLC member-manager ☒ Limited partner or other LLC member

H ☒ Domestic partner ☐ Foreign partner

I What type of entity is this partner? PARTNERSHIP

J Partner's share of profit, loss, and capital (see instructions):

	Beginning	Ending
Profit	0.000000 %	0.000000 %
Loss	0.000000 %	0.000000 %
Capital	50.000000 %	50.000000 %

K Partner's share of liabilities at year end:
Nonrecourse $ _____
Qualified nonrecourse financing $ _____
Recourse $ _____

L Partner's capital account analysis:
Beginning capital account $ 213,357
Capital contributed during the year $ _____
Current year increase (decrease) $ _____
Withdrawals & distributions $ ( )
Ending capital account $ 213,357

☒ Tax basis ☐ GAAP ☐ Section 704(b) book
☐ Other (explain)

M Did the partner contribute property with a built-in gain or loss?
☐ Yes ☒ No
If "Yes", attach statement (see instructions)

Part III Partner's Share of Current Year Income, Deductions, Credits, and Other Items

1	Ordinary business income (loss)	15	Credits
2	Net rental real estate income (loss)		
3	Other net rental income (loss)	16	Foreign transactions
4	Guaranteed payments		
5	Interest income		
6a	Ordinary dividends		
6b	Qualified dividends		
7	Royalties		
8	Net short-term capital gain (loss)		
9a	Net long-term capital gain (loss)	17	Alternative minimum tax (AMT) items
9b	Collectibles (28%) gain (loss)		
9c	Unrecaptured section 1250 gain		
10	Net section 1231 gain (loss)	18	Tax-exempt income and nondeductible expenses
11	Other income (loss)		
12	Section 179 deduction	19	Distributions
13	Other deductions		
		20	Other information
14	Self-employment earnings (loss)		

*See attached statement for additional information.

For IRS Use Only

For Paperwork Reduction Act Notice, see instructions for Form 1065.
DAA

Schedule K-1 (Form 1065) 2009

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PARTNER# 2
Schedule K-1
(Form 1065)

Department of the Treasury
Internal Revenue Service

2009

For calendar year 2009, or tax year beginning _____ ending _____

Partner's Share of Income, Deductions, Credits, etc. ◆ See back of form and separate instructions.

☐ Final K-1 ☐ Amended K-1

651109
OMB No. 1545-0099

Part I Information About the Partnership

A Partnership's employer identification number
20-2736926

B Partnership's name, address, city, state, and ZIP code
IMK DEVELOPMENT CO., LLC
3445 PELHAM ROAD, SUITE 102
GREENVILLE SC 29615

C IRS Center where partnership filed return
CINCINNATI, OH: 45999-0011

D ☐ Check if this is a publicly traded partnership (PTP)

Part II Information About the Partner

E Partner's identifying number
[redacted]

F Partner's name, address, city, state, and ZIP code
INTEGRYS KEOWEE DEVELOPMENT, LLC
3445 PELHAM ROAD, SUITE 102
GREENVILLE SC 29615

G ☐ General partner or LLC member-manager ☒ Limited partner or other LLC member

H ☒ Domestic partner ☐ Foreign partner

I What type of entity is this partner? PARTNERSHIP

J Partner's share of profit, loss, and capital (see instructions):

	Beginning	Ending
Profit	100.000000 %	100.000000 %
Loss	100.000000 %	100.000000 %
Capital	50.000000 %	50.000000 %

K Partner's share of liabilities at year end:
Nonrecourse $ _____
Qualified nonrecourse financing $ _____
Recourse $ 1,150,890

L Partner's capital account analysis:
Beginning capital account $ 172,363
Capital contributed during the year $ 76,900
Current year increase (decrease) $ -113,019
Withdrawals & distributions $ (350,000)
Ending capital account $ -213,756

☒ Tax basis ☐ GAAP ☐ Section 704(b) book
☐ Other (explain)

M Did the partner contribute property with a built-in gain or loss?
☐ Yes ☒ No
If "Yes", attach statement (see instructions)

Part III Partner's Share of Current Year Income, Deductions, Credits, and Other Items

1	Ordinary business income (loss)	15	Credits
2 *	Net rental real estate income (loss) -102,804		
3	Other net rental income (loss)	16	Foreign transactions
4	Guaranteed payments		
5	Interest income		
6a	Ordinary dividends		
6b	Qualified dividends		
7	Royalties		
8	Net short-term capital gain (loss)		
9a	Net long-term capital gain (loss)	17	Alternative minimum tax (AMT) items
9b	Collectibles (28%) gain (loss)		
9c	Unrecaptured section 1250 gain		
10	Net section 1231 gain (loss)	18	Tax-exempt income and nondeductible expenses
11	Other income (loss)	C *	10,214
		19	Distributions
12	Section 179 deduction	A	350,000
13	Other deductions		
		20	Other information
14	Self-employment earnings (loss)		

*See attached statement for additional information.

For IRS Use Only

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Form **4562**
Department of the Treasury
Internal Revenue Service (99)

Depreciation and Amortization
(Including Information on Listed Property)

◆ See separate instructions. ◆ Attach to your tax return.

OMB No. 1545-0172
2009
Attachment Sequence No. 67

Name(s) shown on return: IMK DEVELOPMENT CO., LLC
Identifying number: 20-2736926

Business or activity to which this form relates: RENTAL INCOME

Part I Election To Expense Certain Property Under Section 179
Note: If you have any listed property, complete Part V before you complete Part I.

1	Maximum amount. See the instructions for a higher limit for certain businesses	1	250,000
2	Total cost of section 179 property placed in service (see instructions)	2	12,877
3	Threshold cost of section 179 property before reduction in limitation (see instructions)	3	800,000
4	Reduction in limitation. Subtract line 3 from line 2. If zero or less, enter -0-	4	0
5	Dollar limitation for tax year. Subtract line 4 from line 1. If zero or less, enter -0-. If married filing separately, see instructions	5	250,000

6 (a) Description of property	(b) Cost (business use only)	(c) Elected cost
FURNITURE	12,877	12,877

7	Listed property. Enter the amount from line 29	7	
8	Total elected cost of section 179 property. Add amounts in column (c), lines 6 and 7	8	12,877
9	Tentative deduction. Enter the smaller of line 5 or line 8	9	12,877
10	Carryover of disallowed deduction from line 13 of your 2008 Form 4562	10	62,912
11	Business income limitation. Enter the smaller of business income (not less than zero) or line 5 (see instructions)	11	0
12	Section 179 expense deduction. Add lines 9 and 10, but do not enter more than line 11	12	0
13	Carryover of disallowed deduction to 2010. Add lines 9 and 10, less line 12 ▶	13	75,789

Note: Do not use Part II or Part III below for listed property. Instead, use Part V.

Part II Special Depreciation Allowance and Other Depreciation (Do not include listed property.) (See instr.)

14	Special depreciation allowance for qualified property (other than listed property) placed in service during the tax year (see instructions)	14	
15	Property subject to section 168(f)(1) election	15	
16	Other depreciation (including ACRS)	16	

Part III MACRS Depreciation (Do not include listed property.) (See instructions.)

Section A

17	MACRS deductions for assets placed in service in tax years beginning before 2009	17	
18	If you are electing to group any assets placed in service during the tax year into one or more general asset accounts, check here ◆		

Section B—Assets Placed in Service During 2009 Tax Year Using the General Depreciation System

(a) Classification of property	(b) Month and year placed in service	(c) Basis for depreciation (business/investment use only—see instructions)	(d) Recovery period	(e) Convention	(f) Method	(g) Depreciation deduction
19a 3-year property						
b 5-year property						
c 7-year property						
d 10-year property						
e 15-year property						
f 20-year property						
g 25-year property			25 yrs.		S/L	
h Residential rental property			27.5 yrs.	MM	S/L	
			27.5 yrs.	MM	S/L	
i Nonresidential real property			39 yrs.	MM	S/L	
				MM	S/L	

Section C—Assets Placed in Service During 2009 Tax Year Using the Alternative Depreciation System

20a	Class life					S/L
b	12-year			12 yrs.		S/L
c	40-year			40 yrs.	MM	S/L

Part IV Summary (See instructions.)

21	Listed property. Enter amount from line 28	21	
22	Total. Add amounts from line 12, lines 14 through 17, lines 19 and 20 in column (g), and line 21. Enter here and on the appropriate lines of your return. Partnerships and S corporations—see instructions	22	
23	For assets shown above and placed in service during the current year, enter the portion of the basis attributable to section 263A costs	23	

For Paperwork Reduction Act Notice, see separate instructions.
DAA

Form **4562** (2009)

THERE ARE NO AMOUNTS FOR PAGE 2

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Form 1065
State SC

Rent and Royalty Schedule

For calendar year 2009, or tax year beginning ,and ending

2009

Name

IMK DEVELOPMENT CO., LLC

Employer Identification Number

20-2736926

Property Description

RENTAL INCOME

Type of Property

Rental Real Estate [X]
Other Rental Property [ ]
Royalty Property [ ]

Is the net income (loss) from this property included in the computation of self employment income? Yes [ ] No [X]
Is the net income (loss) from this property included in the computation of Section 179 business income? Yes [ ] No [X]

Income and Expenses

Income		
Gross rents	23,920	
Gross royalties		
Other income		
Income from sale of property reported on Form 4797, Line 17		
Total gross income		23,920
Expense		
Advertising		
Auto and travel		
Cleaning and maintenance	1,729	
Commissions	3,593	
Insurance		
Legal and professional	8,669	
Interest	84,616	
Repairs		
Taxes	4,985	
Utilities	4,968	
Wages and salaries		
Depreciation		
Other expenses	18,164	
Total expenses	126,724	
Less % personal use		
Net deductible expenses		126,724
Net income or loss from this property		-102,804

03280

Statement 1 - Form 1065, Schedule K, Line 18c - Nondeductible Expenses

Description	Amount
BOOK DEPRECIATION	$ 10,214
TOTAL	$ 10,214

Federal Statements

Statement 2 - Form 1065, Schedule L, Line 13 - Other Assets

Description	Beginning of Year	End of Year
CLOSING FEES	$ 19,002	$ 19,002
RECEIVABLE-SDI CLOSING	350,000	
TOTAL	$ 369,002	$ 19,002

Statement 3 - Form 1065, Schedule L, Line 17 - Other Current Liabilities

Description	Beginning of Year	End of Year
CUSTOMER DEPOSITS	$ 31,000	$ 31,000
CURRENT LIABILITIES	50,200	25,434
TOTAL	$ 81,200	$ 56,434

Statement 4 - Form 1065, Schedule M-1, Line 4 - Expenses Recorded on Books, Not on Sch K

Description	Amount
ROUNDING ADJUSTMENT	$ 1
BOOK DEPRECIATION	10,214
TOTAL	$ 10,215

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Statement 5 - RENTAL INCOME - Form 8825, Line 15 - Other

Description	Amount
BANK CHARGES	$ 639
CREDIT CARD CHARGES	81
DUES & SUBSCRIPTIONS	16,622
INSURANCE EXPENSE	161
OFFICE SUPPLIES	220
POSTAGE	61
SUPPLIES	380
TOTAL	$ 18,164

Federal Statements

INTEGRYS KEOWEE DEVELOPMENT, LLC
20-2737015

Schedule K-1, Line 2 - Net Rental Real Estate Income (Loss)

Description	Amount
RENTAL INCOME	$ -102,804

Schedule K-1, Line 18 - Tax-Exempt Income and Nondeductible Expenses

Code	Description	Amount
C	BOOK DEPRECIATION	$ 10,214

Filing Instructions

IMK DEVELOPMENT CO., LLC

Form SC1065 - South Carolina Partnership Return

Taxable Year Ended December 31, 2009

Date Due:	April 15, 2010
Remittance:	None is required.
Mail To:	South Carolina Department of Revenue Partnership Return Columbia, SC 29214-0008
Signature:	The return should be signed and dated on page 1 by a limited liability company member.
Other:	Initial and date the copy, and retain it for your records.

03285

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STATE OF SOUTH CAROLINA
1022 **PARTNERSHIP RETURN** SC1065
Tax Year 2009 (Rev. 8/3/09)
3087
Return is due on or before the 15th day of the fourth month following the close of the taxable year.

Mail to: SC Department of Revenue, Partnership Return, Columbia SC 29214-0008
For the year January 1 - December 31, 2009, or fiscal tax year beginning _____ and ending _____

IMK DEVELOPMENT CO LLC
3445 PELHAM ROAD SUITE 102
GREENVILLE SC 29615

Check all boxes that apply:
- Check if this is the first SC1065 filed for this entity ☐
- Check if this is the last SC1065 filed for this entity ☐
- Check here if address has changed ☐

FEIN:	SC File #:	County:
20-2736926	72062601-6	GREENVILLE

Total Number of Partners: 2 | Number of Partners that are Not SC Residents:

ATTACH A COPY OF FORM 1065 FEDERAL PARTNERSHIP RETURN AND COPIES OF ALL SCHEDULES.
Read the instructions carefully and fill in all applicable lines and schedules.

Location of business property: City GREENVILLE State SC Phone Number

COMPLETE SCHEDULE SC-K FIRST

Schedule W-H Withholding Tax on Income of Nonresident Partners

STAPLE PAYMENT HERE

1. Total from line 29, page 3, SC1065	1.	-102,804
2. Amount of line 1 income taxable to nonresident partners (from SC K-1s)	2.	
3. Amount of line 2 exempt from withholding because of I-309 affidavit or composite filing	3.	
4. Subtract line 3 from line 2, if less than zero, enter -0-	4.	0
5. Withholding tax due - line 4 times .05 (5%)	5.	0
6. Withholding from nonresident sale of real estate (Attach I-290) or SC Withholding from form 1099MISC	6.	
7. Amount paid with extension SC8736	7.	
8. Add lines 6 and 7	8.	
9. Subtract line 8 from line 5. If zero or less, enter zero here. This is the amount due with this return. Refunds cannot be issued from the SC1065. An overpayment must be claimed and refunded at the partner level. BALANCE DUE	9.	0

I declare that this return and all attachments are true, correct and complete to the best of my knowledge and belief. 14-0832

Please Sign Here

Signature of general partner or LLC/LLP member — Date

I authorize the Director of the Department of Revenue or delegate to discuss this return, attachments and related tax matters with the preparer: Yes [X] No [ ] — Check if self-employed ☐

Paid Preparer's Use Only

Preparer Printed Name	JACKIE HIGHLEY	Preparer telephone number	864-235-5265
Preparer signature	JACKIE HIGHLEY	FEIN	245-66-9801
		Date	04/01/10
Firm's name (or yours if self-employed) and address	PORTER & HIGHLEY, CPAS 512 PETTIGRU STREET GREENVILLE, SC 29601		

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Form SC1065 IMK DEVELOPMENT CO., LLC 20-2736926

SCHEDULE SC-K PARTNERS' SHARES OF INCOME (LOSSES), DEDUCTIONS, CREDITS ETC. (See instructions.)

* Enter amounts from corresponding lines on your federal Schedule K in Column A.

	(A)* Amounts From Federal Schedule K	(B) Plus or Minus South Carolina Adjustment	(C) Federal Schedule K Amounts After SC Adjustments	(D) Amounts Allocated to SC	(E) Amounts Subject to Apportionment
1	Ordinary Business Income (loss)				
2	Net Real Estate Rents (loss) -102,804		-102,804		-102,804
3	Other Net Rents (loss)				
4	Guaranteed Payments				
5	Interest Income				
6	Dividends				
7	Royalties				
8	Net Short Term Cap. Gain (loss)				
9	Net Long Term Cap. Gain (loss)				
10	Net § 1231 gain (loss)				
11	Other Income (loss)				
12	§ 179 Deduction				
13a	Contributions				
13b	Investment Interest Expense				
13c	§ 59 (e)(2) Expenditures				
13d	Other Deductions				
14	Total -102,804		-102,804		-102,804

03287

Form SC1065 IMK DEVELOPMENT CO., LLC 20-2736926

15. Amounts from federal Schedule K (line 14, Schedule SC-K, Col. A)			15	-102,804
16. Amount Allocated to South Carolina (from line 14, Schedule SC-K, Col. D)			16	
17. Net income (loss) subject to apportionment (from line 14, Schedule SC-K, Col. E)			17	-102,804
APPORTIONMENT FACTORS FOR MULTISTATE BUSINESS (LINES 18 THROUGH 21-MULTISTATE ONLY)				
18. SALES	TOTALS	SC		
Total Sales or Gross Receipts				
Sales or Gross Receipts Percentage		%		
For apportionment based on gross receipts only, enter the sales percentage on line 22, skip lines 24 through 27, and enter the amount from line 23 on line 28. See instructions.				
Multiply Sales Percentage by 2 (if you have an entry on Line 19 or 20)		%		
19. PROPERTY				
Total Owned and Rented Property				
Property Percentage		%		
20. PAYROLL				
Total Wages and Salaries				
Payroll Percentage		%		
21. TOTAL PERCENT		%		
22. Apportionment factor (average percent). 100% if operating entirely within SC (see instructions)			22	100.0000%
23. Net business income (loss) apportioned to SC (line 17 multiplied by line 22) If line 22 is 100%, skip lines 24 through 27 and enter this amount on line 28			23	-102,804
24. Enter the sales percentage from line 18			24	
25. Multiply line 17 by line 24. If Line 23 is less than Line 25, STOP HERE and enter amount from Line 23 on line 28			25	
26. Line 23 minus line 25			26	
27. For Tax Year 2009, multiply line 26 by 60% (.60). This is the reduction in SC taxable income allowed this year			27	
28. Line 23 minus line 27			28	-102,804
29. Net business income (loss) taxable to SC (line 16 plus line 28)			29	-102,804

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Filing Instructions

IMK DEVELOPMENT CO., LLC

Form SC1065 - South Carolina Partnership Return

Taxable Year Ended December 31, 2010

Date Due:	April 18, 2011
Remittance:	None is required.
Mail To:	South Carolina Department of Revenue Partnership Return Columbia, SC 29214-0008
Signature:	The return should be signed and dated on page 1 by a limited liability company member.
Other:	Initial and date the copy, and retain it for your records.

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1022 STATE OF SOUTH CAROLINA
PARTNERSHIP RETURN
Tax Year 2010
Return is due on or before the 15th day of the fourth month following the close of the taxable year.

SC1065
(Rev. 8/3/10)
3007

Mail to: SC Department of Revenue, Partnership Return, Columbia SC 29214-0008
For the year January 1 - December 31, 2010, or fiscal tax year beginning _____ and ending _____

INK DEVELOPMENT CO LLC
3445 PELHAM ROAD SUITE 102
GREENVILLE SC 29615

Check all boxes that apply:
- Check if this is the first SC1065 filed for this entity ☐
- Check if this is the last SC1065 filed for this entity ☐
- Check here if address has changed ☐

FEIN:	SC File #:	County:
20-2736926	72062601-6	GREENVILLE

Total Number of Partners: 2 | Number of Partners that are Not SC Residents:

ATTACH A COPY OF FORM 1065 FEDERAL PARTNERSHIP RETURN AND COPIES OF ALL SCHEDULES.
Read the instructions carefully and fill in all applicable lines and schedules.

Location of business property: City GREENVILLE State SC Phone Number

COMPLETE SCHEDULE SC-K FIRST

Schedule W-H Withholding Tax on Income of Nonresident Partners

STAPLE PAYMENT HERE

1. Total from line 29, page 3, SC1065	1.	-84,064
2. Amount of line 1 income taxable to nonresident partners (from SC1065 K-1s)	2.	
3. Amount of line 2 exempt from withholding because of I-309 affidavit or composite filing	3.	
4. Subtract line 3 from line 2, if less than zero, enter -0-	4.	0
5. Withholding tax due - line 4 times .06 (6%)	5.	0
6. Withholding from nonresident sale of real estate (Attach I-290) or SC Withholding from form 1099MISC	6.	
7. Amount paid with extension SC8736	7.	
8. Add lines 6 and 7	8.	
9. Subtract line 8 from line 5. If zero or less, enter zero here. This is the amount due with this return. Refunds cannot be issued from the SC1065. An overpayment must be claimed and refunded at the partner level. BALANCE DUE	9.	0

I declare that this return and all attachments are true, correct and complete to the best of my knowledge and belief. 14-0832

Please Sign Here	Signature of general partner or LLC/LLP member.	Date
	I authorize the Director of the Department of Revenue or delegate to discuss this return, attachments and related tax matters with the preparer: Yes ☒ No ☐	Check if self-employed ☐
Paid Preparer's Use Only	Preparer Printed Name: JACKIE D. HIGHLEY	Preparer telephone number: 864-235-5265
	Preparer signature	PTIN: P01350834 Date: 03/03/11
	Firm's name (or yours if self-employed) and address: PORTER & HIGHLEY, CPAS, 512 PETTIGRU STREET, GREENVILLE, SC 29601	FEIN: 57-0706552

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Form SC1065: IMK DEVELOPMENT CO., LLC 20-2736926

SCHEDULE SC-K PARTNERS' SHARES OF INCOME (LOSSES), DEDUCTIONS, CREDITS ETC. (See instructions.)

* Enter amounts from corresponding lines on your federal Schedule K in Column A.

	(A)* Amounts From Federal Schedule K	(B) Plus or Minus South Carolina Adjustment	(C) Federal Schedule K Amounts After SC Adjustments	(D) Amounts Allocated to SC	(E) Amounts Subject to Apportionment
1	Ordinary Business Income (loss)				
2	Net Real Estate Rents (loss) -84,064		-84,064		-84,064
3	Other Net Rents (loss)				
4	Guaranteed Payments				
5	Interest Income				
6	Dividends				
7	Royalties				
8	Net Short Term Cap. Gain (loss)				
9	Net Long Term Cap. Gain (loss)				
10	Net § 1231 gain (loss)				
11	Other Income (loss)				
12	§ 179 Deduction				
13a	Contributions				
13b	Investment Interest Expense				
13c	§ 59 (e)(2) Expenditures				
13d	Other Deductions				
14	Total -84,064		-84,064		-84,064

03291

Form SC1065 IMK DEVELOPMENT CO., LLC 20-2736926

15. Amounts from federal Schedule K (line 14, Schedule SC-K, Col. A)			15	-84,064
16. Amount Allocated to South Carolina (from line 14, Schedule SC-K, Col. D)			16	
17. Net income (loss) subject to apportionment (from line 14, Schedule SC-K, Col. E)			17	-84,064
APPORTIONMENT FACTORS FOR MULTISTATE BUSINESS (LINES 18 THROUGH 21-MULTISTATE ONLY)				
	TOTALS	SC		
18. SALES				
Total Sales or Gross Receipts				
18a Sales or Gross Receipts Percentage		%		
For apportionment based on gross receipts only, enter the sales percentage on line 22, skip lines 24 through 27, and enter the amount from line 23 on line 28. See instructions.				
18b Multiply Sales Percentage by 2 (if you have an entry on Line 19 or 20)		%		
19. PROPERTY				
Total Owned and Rented Property				
Property Percentage		%		
20. PAYROLL				
Total Wages and Salaries				
Payroll Percentage		%		
21. TOTAL PERCENT		%		
22. Apportionment factor (average percent). 100% if operating entirely within SC (see instructions)			22	100.0000%
23. Net business income (loss) apportioned to SC (line 17 multiplied by line 22) If line 22 is 100%, skip lines 24 through 27 and enter this amount on line 28			23	-84,064
24. Enter the sales percentage from line 18a			24	
25. Multiply line 17 by line 24. If Line 23 is less than Line 25, STOP HERE and enter amount from Line 23 on line 28			25	
26. Line 23 minus line 25			26	
27. For Tax Year 2010, multiply line 26 by 80% (.80). This is the reduction in SC taxable income allowed this year			27	
28. Line 23 minus line 27			28	-84,064
29. Net business income (loss) taxable to SC (line 15 plus line 28)			29	-84,064

03292

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1022 PARTNER# 1

STATE OF SOUTH CAROLINA
DEPARTMENT OF REVENUE

PARTNER'S SHARE OF SOUTH CAROLINA INCOME, DEDUCTIONS, CREDITS, ETC.

SC1065 K-1
(Rev. 8/26/10)
3515

For calendar year 2010 or tax year beginning _____ and ending _____

Partner's identifying number ◆ 58-2450631	Partnership's FEIN ◆ 20-2736926
Partner's name, address and ZIP code MARICK HOME BUILDERS, LLC 501 BRIXTON CIRCLE SIMPSONVILLE SC 29681	Partnership's name, address and ZIP code IMK DEVELOPMENT CO., LLC 3445 PELHAM ROAD, SUITE 102 GREENVILLE SC 29615

Check if applicable: (1) ☐ Final K-1 (2) ☐ Amended K-1 (3) ☐ Nonresident

Partner's Share of Current Year Income, Deductions, Credits, etc.		(A) Federal K-1 Amounts	(B) Plus or Minus SC Adjustments	(C) Amounts Not Allocated or Apportioned to SC	(D) Amounts Allocated or Apportioned to SC
Income (Loss)	1 Ordinary business income (loss)	1	1	1	1
	2 Net rental real estate income (loss)	2	2	2	2
	3 Other net rental income (loss)	3	3	3	3
	4 Guaranteed payments	4	4	4	4
	5 Interest income	5	5	5	5
	6 Dividends	6	6	6	6
	7 Royalties	7	7	7	7
	8 Net short-term capital gain (loss)	8	8	8	8
	9 Net long-term capital gain (loss)	9	9	9	9
	10 Net Section 1231 gain (loss)	10	10	10	10
	11 Other income (loss)	11	11	11	11
Deductions	12 Section 179 deduction	12	12	12	12
	13 Other deductions	13	13	13	13
	14 Withholding tax for nonresident partner				14
Credits	List applicable South Carolina tax credits. (Attach an additional sheet if needed.)				
	15				15
	16				16
	17				17
	18				18
	19 Total South Carolina tax credits				19

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SC1065 K-1

General purpose SC1065 K-1 is prepared by the partnership to show each partner's share of the entity's income. Each item of income is adjusted as required by South Carolina law and allocated or apportioned to South Carolina or to states other than South Carolina.

INSTRUCTIONS

Column A, lines 1 through 13 - Enter amounts from the federal Schedule K-1.

Column B, lines 1 through 13 - Enter the partner's share of plus or minus South Carolina adjustments to federal taxable income (loss) from SC-K Worksheet, column B.

Column C, lines 1 through 13 - Enter the partner's share of income (loss) or deductions allocated or apportioned to states other than South Carolina.

Column D, lines 1 through 13 - Enter the partner's share of income (loss) or deductions allocated or apportioned to South Carolina.

Line 14 Partnerships are required to withhold 5% of the South Carolina taxable income of nonresident partners. Partnerships must provide nonresident partners a federal Form 1099 MISC with "South Carolina Only" written at the top showing respective amounts of income and tax withheld. Enter the tax withholding amount on line 14.

Line 15 through 18 List the partner's share of applicable South Carolina credits.

Instructions for Partnership - Include SC1065 K-1 with your SC1065 Partnership Return. Provide a copy to the partner.

Instructions for Partner - If filing a paper return, attach to your Income Tax Return. If filing electronically, keep with your records.

Social Security Privacy Act Disclosure
It is mandatory that you provide your social security number on this tax form. 42 U.S.C. 405(c)(2)(C)(I) permits a state to use an individual's social security number as a means of identification in administration of any tax. SC Regulation 117-201 mandates that any person required to make a return to the SC Department of Revenue shall provide identifying number, as prescribed, for securing proper identification. Your social security number is used for identification purposes.

The Family Privacy Protection Act
Under the Family Privacy Protection Act, the collection of personal information from citizens by the Department of Revenue is limited to the information necessary for the Department to fulfill its statutory duties. In most instances, once this information is collected by the Department, it is protected by law from public disclosure. In those situations where public disclosure is not prohibited, the Family Privacy Protection Act prevents such information from being used by third parties for commercial solicitation purposes.

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1022 PARTNER# 2

STATE OF SOUTH CAROLINA
DEPARTMENT OF REVENUE

PARTNER'S SHARE OF SOUTH CAROLINA INCOME, DEDUCTIONS, CREDITS, ETC.

SC1065 K-1
(Rev. 6/26/10)
3515

For calendar year 2010 or tax year beginning ____ and ending ____

Partner's identifying number ◆ 20-2737015

Partner's name, address and ZIP code

INTEGRYS KEOWEE DEVELOPMENT, LLC
3445 PELHAM ROAD, SUITE 102
GREENVILLE SC 29615

Partnership's FEIN ◆ 20-2736926

Partnership's name, address and ZIP code

IMK DEVELOPMENT CO., LLC
3445 PELHAM ROAD, SUITE 102
GREENVILLE SC 29615

Check if applicable: (1) ☐ Final K-1 (2) ☐ Amended K-1 (3) ☐ Nonresident

Partner's Share of Current Year Income, Deductions, Credits, etc.		(A) Federal K-1 Amounts		(B) Plus or Minus SC Adjustments		(C) Amounts Not Allocated or Apportioned to SC		(D) Amounts Allocated or Apportioned to SC
Income (Loss)	1 Ordinary business income (loss)	1		1		1		1
	2 Net rental real estate income (loss)	2	-84,064	2		2		2 -84,064
	3 Other net rental income (loss)	3		3		3		3
	4 Guaranteed payments	4		4		4		4
	5 Interest income	5		5		5		5
	6 Dividends	6		6		6		6
	7 Royalties	7		7		7		7
	8 Net short-term capital gain (loss)	8		8		8		8
	9 Net long-term capital gain (loss)	9		9		9		9
	10 Net Section 1231 gain (loss)	10		10		10		10
	11 Other income (loss)	11		11		11		11
Deductions	12 Section 179 deduction	12		12		12		12
	13 Other deductions	13		13		13		13
	14 Withholding tax for nonresident partner							14
Credits	List applicable South Carolina tax credits. (Attach an additional sheet if needed.)							
	15							15
	16							16
	17							17
	18							18
	19 Total South Carolina tax credits							19

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SC1065 K-1

General purpose-SC1065 K-1 is prepared by the partnership to show each partner's share of the entity's income. Each item of income is adjusted as required by South Carolina law and allocated or apportioned to South Carolina or to states other than South Carolina.

INSTRUCTIONS

Column A, lines 1 through 13 - Enter amounts from the federal Schedule K-1.

Column B, lines 1 through 13 - Enter the partner's share of plus or minus South Carolina adjustments to federal taxable income (loss) from SC-K Worksheet, column B.

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Column D, lines 1 through 13 - Enter the partner's share of income (loss) or deductions allocated or apportioned to South Carolina.

Line 14 Partnerships are required to withhold 5% of the South Carolina taxable income of nonresident partners. Partnerships must provide nonresident partners a federal Form 1099 MISC with "South Carolina Only" written at the top showing respective amounts of income and tax withheld. Enter the tax withholding amount on line 14.

Line 15 through 18 List the partner's share of applicable South Carolina credits.

Instructions for Partnership - Include SC1065 K-1 with your SC1065 Partnership Return. Provide a copy to the partner.

Instructions for Partner - If filing a paper return, attach to your Income Tax Return. If filing electronically, keep with your records.

Social Security Privacy Act Disclosure
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The Family Privacy Protection Act
Under the Family Privacy Protection Act, the collection of personal information from citizens by the Department of Revenue is limited to the information necessary for the Department to fulfill its statutory duties. In most instances, once this information is collected by the Department, it is protected by law from public disclosure. In those situations where public disclosure is not prohibited, the Family Privacy Protection Act prevents such information from being used by third parties for commercial solicitation purposes.

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FILED FOR RECORD
OCONEE COUNTY, S.C.
REGISTER OF DEEDS

Doc ID: 001606800008 Type: DEE
BK 1675 PG 160-165

2008 AUG -5 A 11:06

PARTIAL ASSIGNMENT OF DECLARANT'S RIGHTS

THIS PARTIAL ASSIGNMENT OF DECLARANT'S RIGHTS (the "Assignment"), dated as of June 13, 2008 (the "Effective Date") is entered into by IMK Development Co., LLC, a South Carolina limited liability company, ("Declarant"), and Ludwig Corporation, LLC, a South Carolina limited liability company ("Partial Assignee").

RECITALS:

A. The Declarant has previously filed an Amended and Restated Declaration of Covenants, Conditions and Restrictions for Stoneledge at Lake Keowee dated November 1, 2005, and recorded November 30, 2005, in the Office of the Register of Deeds for Oconee County, South Carolina, in Deed Book 1464 at Page 33; as amended by that certain Supplement to the Amended and Restated Declaration of Covenants, Conditions and Restrictions for Stoneledge at Lake Keowee dated March 15, 2007, and recorded April 12, 2007, in the aforementioned land records in Deed Book 1578 at Page 316 (the "Declaration").

B. The Declaration provides the Declarant with certain rights with respect to the property as described on Exhibit A (the "Property").

Simultaneously with this Assignment, certain units in the Property will be conveyed from the Declarant to the Partial Assignee pursuant to that certain Purchase and Sale Agreement dated April 9, 2008, as amended (the "Agreement").

Article XV of the Declaration provides that the Declarant can transfer part or all of the rights of the Declarant as a successor declarant.

The Declarant desires to transfer only a part of its rights, title and interest in, to and under the Declaration to the Partial Assignee ("Partial Transfer of Declarant's Rights").

The Partial Assignee has agreed to the Partial Transfer of Declarant's Rights and each of Declarant and Partial Assignee desire to effect the respective assignments, in accordance with the terms and conditions hereinafter set forth.

AGREEMENT:

NOW, THEREFORE, in consideration of the premises and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Declarant and Partial Assignee hereby agree as follows:

001687

1. Assignment of Declarant's Rights. Per Article XV of the Declaration, the Declarant hereby transfers the following special rights of the Declarant set forth in the Declaration to the Partial Assignee:

12
Mail: Mason Prewett
P.O. Drawer 10649
Greenville, SC 29603

NPGM.1279051.2-DOC-(LBURGESS)041793-00017

PLAINTIFF'S EXHIBIT 10

Book:1675,Page:160

03297

(a) The right of Declarant to amend the Declaration to annex property set forth in Article II, Section 3 of the Declaration;

(b) The right to vote set forth in Article V, Section 1 of the Declaration;

(c) The rights of Declarant to have assessments waived under Article VI, Section 8 of the Declaration;

(d) The right of Property to be exempt if owned by Declarant or Builder under Article VI, Section 11;

(e) The right to use one or more residences as a model and to construct units on the unimproved lots as set forth in Article X, Section 2(a), Article X, Section 2(e), and Article XV of the Declaration;

(f) The rights of Declarant and Builder under the Rules and Regulations for the Issuance of Licenses for the Use of Designated Boat Slips at Stoneledge at Lake Keowee, as amended by that certain Amendment to Rules and Regulations for the Issuance of Licenses for the Use of Designated Boat Slips at Stoneledge at Lake Keowee.

The Transfer of Declarant's Rights shall not enlarge a right beyond the rights afford the Declarant in the Declaration.

2. Acceptance by Partial Assignee. Partial Assignee hereby accepts the assignment of the Partial Transfer of Declarant's Rights by Declarant.

3. Obligations. Except the obligations directly related to the Declarant's rights assigned to Partial Assignee under Section 1, Partial Assignee shall have no obligations as Declarant or otherwise as a result of this Agreement. Partial Transferee assumes no obligations of any kind for any actions or omissions of Declarant prior to the date hereof. Notwithstanding anything contained in this Agreement to the contrary, Declarant hereby indemnifies and agrees to hold Partial Assignee harmless from and against any loss, damage, liability, cost or expenses (including reasonable attorneys' fees and court costs) resulting to Partial Assignee by virtue of the failure by Declarant to perform or comply with any term, covenant, or condition of the rights transferred to Partial Assignee required to be performed or complied with, or any other matter accruing and associated with said rights prior to the date of this Agreement. Notwithstanding anything contained in this Agreement to the contrary, Partial Assignee hereby indemnifies and agrees to hold Declarant harmless from and against any loss, damage, liability, cost or expenses (including reasonable attorneys' fees and court costs) resulting to Declarant by virtue of Partial Assignee's failure to perform or comply with any term, covenant, or condition of the rights transferred to Partial Assignee required to be performed or complied with, or any other matter accruing or associated with said rights on or after the date of this Agreement.

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4. Designation as Approved Builder. Declarant hereby appoints Partial Assignee as an Approved Builder under the Declaration.

5. Entire Agreement. This Assignment, together with the Agreement and the other documents executed in connection with the Agreement, as set forth therein, of even date executed by Declarant to Partial Assignee sets forth the entire understanding between the parties concerning the rights of Declarant transferred under this Agreement, and they supersedes all previous agreements and representations which are deemed merged herein and may not be modified in a writing executed by both parties.

6. Enforcement of Certain Rights. Nothing expressed or implied in this Assignment is intended, or will be construed, to confer upon or give any natural person or entity ("Person") other than the Declarant and Partial Assignee, and their successors or permitted assigns, any rights, remedies, obligations, or liabilities under or by reason of this Assignment, or result in such Person being deemed a third-party beneficiary of this Assignment.

7. Further Assurances: Declarant and Partial Assignee agree to execute and deliver all such further agreements, instruments and other documents as the other party shall reasonably request to evidence more effectively the assignments and assumptions made by Declarant and Partial Assignee under this Assignment.

8. Successors and Assigns. This Agreement shall inure to the benefit of each party hereto and their respective successors and assigns, if any.

NPGVL1378091.3-DOC-{BUSINESS} 041735-00017

IN WITNESS WHEREOF, each of Declarant and Partial Assignee has caused this Assignment to be duly executed by an authorized representative as of the date and year first written above.

IN THE PRESENCE OF

DECLARANT:

IMK DEVELOPMENT CO., LLC

By: INTEGRYS KEOWEE DEVELOPMENT, LLC,
Its: Member

By: W P Ke

Its: M&R

By: MARICK HOME BUILDERS, LLC
Its: Member

By:

Its:

STATE OF SOUTH CAROLINA)
) ACKNOWLEDGMENT
COUNTY OF GREENVILLE)

The foregoing instrument was acknowledged before me this 16th day of June, 2008, by W P Ke as Member of IMK Development Co., LLC, a South Carolina limited liability company.

Notary Public for South Carolina

My Commission Expires: 2/17/2014

NFOVL\57801.3-DOC-6/BURGESS 04/17/08-0017

IN THE PRESENCE OF

PARTIAL ASSIGNEE:

LUDWIG CORPORATION, LLC
a South Carolina limited liability company

By: _____
Print Name: Chiles Stiffle
Its: Authorized Agent

STATE OF SOUTH CAROLINA)
)
COUNTY OF GREENVILLE)

ACKNOWLEDGMENT

The foregoing instrument was acknowledged before me this 16 day of June, 2008, by Chiles Stiffle as Authorized Agent of Ludwig Corporation, LLC, a South Carolina limited liability company.

Notary Public for South Carolina

My Commission Expires: April 13, 2014

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NPOWL\2376811.3.DOC-(LAURDESS) 041703-00017

Book:1675,Page:150

03301

(6 of 6)

EXHIBIT "A"

Parcel 1:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, containing 12.40 acres, more or less, and being known and designated as Stoneledge at Lake Keowee, Phase 1, as shown on a plat prepared by Freeland & Associates, Inc., dated June 16, 2003, and recorded June 28, 2005, in the Register of Deeds Office for Oconee County, South Carolina, in Plat Book B-73 at Page 3, and having such metes and bounds, courses and distances as reference to said plat will more fully reveal.

Tax Map No.: 178-05-01-040

Parcel 2:

ALL that certain piece, parcel, or tract of land, with improvements thereon, situate, lying and being in the County of Oconee, State of South Carolina, containing 17.894 acres, more or less, and being known and designated as Stoneledge at Lake Keowee, Phase 2, Sheets 1 and 2, as shown on a plat entitled prepared by Freeland & Associates, Inc., dated January 3, 2006, and recorded January 22, 2007, in the Register of Deeds Office for Oconee County, South Carolina, in Plat Book B-185 at pages 3-6, and having such metes and bounds, courses and distances as reference to said plat will more fully reveal.

Tax Map No.: Part of 178-00-02-074

FILED FOR RECORD
OCONEE COUNTY, S.C.
REGISTER OF DEEDS
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Book:1675,Page:160

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CONTRACTOR	DATE	INVOICE #	ADDRESS(ES) OF REPAIRS		AMOUNT	
CDI of Seneca	5/14/2010	4657		220	$	110.50
	1/5/2010	4543		221	$	185.00
	1/1/2010	4592		333	$	872.00
	12/10/2009	4576		221	$	680.00
	12/1/2009	4572		402	$	255.00
	11/18/2009	4569		333	$	2,445.00
	10/23/2009	4556		333	$	222.00
	10/23/2009	4557		402	$	560.00
	10/1/2009	4498		219	$	685.00
	9/17/2009	4545		325	$	185.00
	9/17/2009	4544		324	$	350.00
	8/1/2009	4513		326	$	1,150.00
	7/31/2009	4514		324	$	4,775.69
	6/17/2009	4477		333	$	125.00
	6/17/2009	4478		227	$	350.00
	5/26/2009	4464		219	$	375.00
	5/26/2009	4467		327	$	172.00
	5/19/2009	4463		333	$	372.50
	4/23/2009	4445		333	$	397.00
	4/23/2009	4446		331	$	1,235.00
	4/23/2009	4447		225	$	460.00
	3/13/2009	4421		414;412;219	$	2,262.50
	1/22/2009	4384		326;331;333;225;414;219;220	$	3,338.50
CDI of Seneca			TOTAL		$	21,862.69
Trehel	4/29/2010	126333		414	$	17,350.83
	8/4/2010	126448		402;333;412;225	$	26,836.00
	9/30/2010	126506		424	$	2,119.00
	9/15/2010	126434			$	2,350.00
Trehel			TOTAL		$	48,655.83
Frano Stonework	8/24/2010					$300.00
Paragon	8/27/2013 draw #8		418;420		$	230.67
	5/30/2013		414;416;326;223;230		$	838.33
	12/31/2012 draw #6		315;326		$	476.00
	12/31/2012 draw #7		414		$	210.00
	10/17/2012 draw #5		315;424		$	753.00
	8/28/2012		various phase 1		$	3,776.29
	7/19/2012 draw #3		various phase 1		$	2,310.00
	3/16/2012		various phase 1		$	5,241.00
	12/27/2011		various phase 1		$	10,487.00
	5/20/2011		various phase 1		$	590.00
	10/23/2009		BRACING OF PHASE 1 DECKS		$	18,840.00
Paragon					$	43,752.29 TOTAL
Watkins Services	10/17/2013	3347	418,412,410,221		$	25,230.00
TOTAL					$	139,800.81

03303

PLAINTIFF'S EXHIBIT 22

RECEIVED
JUL 08 2016
SC Court of Appeals

THE STATE OF SOUTH CAROLINA
In the Court of Appeals

APPEAL FROM OCONEE COUNTY
Court of Common Pleas

Alexander S. Macaulay, Presiding Judge Seventh Judicial Circuit

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Case No. 2015-000392

Stoneledge at Lake Keowee Owners' Association, Inc.; C. Dan Carson; Jeffrey J. Dauler; Joan W. Davenport; Michael Furnari; Donna Furnair; Jessy B. Grasso; Nancy E. Grasso; Robert P. Hayes; Lucy H. Hayes; Ty Hix; Jennifer D. Hix; Paul W. Hund, III; Ruth E. Isaac; Michael D. Plourde; Mary Lou Plourde; Carol C. Pope; Steven B. Taylor; Bette J. Taylor; and Robert White, Individually and on Behalf of all other similarly situated, Respondents,

v.

IMK Development Co., LLC; Keowee Townhouses, LLC; Ludwig Corporation, LLC; SDI Funding, LLC; Medallion at Keowee, LLC; Integrys Keowee Development, LLC; Marick Home Builders, LLC; Bostic Brothers Construction, Inc.; Miller/Player & Associates; Bradford D. Seckinger; John Ludwig; William Cox; Larry D. Lollis; Rick Thoennes; M Group Construction and Development, LLC; Mel Morris; Joe Bostic; Jeff Bostic; Clear View Construction, LLC; Michael Franz; MHC Contractors; Miguel Porras Choncoas; Builders First Source-Southeast Group; Mike Green; Southern Concrete Specialties; Carl Compton d/b/a Compton Enterprize a/k/a Compton Enterprises; Gunter Heating & Air; All Pro Heating, A/C & Refrigeration, LLC; Coleman Waterproofing; Heyward Electrical Services, Inc.; Tinsley Electrical, LLC; Hutch N Son Construction, Inc.; Upstate Utilities, Inc.' Southern Basements; Carl Catoe Construction, Inc; T.G. Construction, LLC; Delfino Construction; Francisco Javier Zarate d/b/a Zarate Construction; Alejandro Avalos Cruz; Herberto Acros Hernandez; Martin Hernandez-Aviles; Francisco Villalobos Lopez; Ambrosio Martinez-Ramirez; Ester Moran Mentado; Socorro Castillo Montel; MJG Construction and Homebuilders, Inc. d/b/a MJG Construction; KMAC of the Carolinas, Inc.; Eufacio Garcia; Everado Jarmamillio; Garcia Parra Insulation, Inc.; J&J Construction; Jose Nino; Jose Manuel Garcia; Eason Construction, Inc.; Vincent Morales d/b/a Morales Masonry and Miller/Player & Associates, Defendants

Of Defendants, Marick Home Builders, LLC and Rick Thoennes .....Appellants,

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Certificate of Counsel

The undersigned hereby certified that the Record on Appeal contains all material proposed to be included by any of the parties and not any other material.

Jason M. Imhoff (SC Bar #: 69355
The Ward Law Firm, PA
PO Box 5663
Spartanburg, SC 29304
(864) 582-3075
(864) 585-3090
jimhoff@wardfirm.com
rteague@wardfirm.com

Attorneys for Appellants Marick Home Builders, LLC and Rick Thoennes

July 5, 2016

RECEIVED
JUL 08 2016
SC Court of Appeals

THE STATE OF SOUTH CAROLINA
In the Court of Appeals

APPEAL FROM OCONEE COUNTY
Court of Common Pleas

Alexander S. Macaulay, Presiding Judge Seventh Judicial Circuit

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Case No. 2015-000392

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Of Defendants, Marick Home Builders, LLC and Rick Thoennes .....Appellants,

---

PROOF OF SERVICE

I certify that I have served the Records on Appeal by depositing a copy of it in the United States Mail, First Class postage prepaid, on July 8, 2016, addressed to Respondents' attorneys of record, Robert T. Lyles, Jr., Esquire, Lyles & Lyles, LLC, PO Box 773, Charleston, SC 2940.

Amanda D. Steward
Paralegal to Jason M. Imhoff

July 8, 2016

RESPONDENTS' COUNSEL OF RECORD:

Robert T. Lyles, Jr., Esquire
Lyles & Lyles, LLC
P. O. Box 773
Charleston, SC 29401
843-577-7730
Attorneys for Respondents

RECEIVED
JUL 08 2016
SC Court of Appeals

THE STATE OF SOUTH CAROLINA
In The Court of Appeals

Stoneledge at Lake Keowee Owners' Association, Inc.; C. Dan Carson; Jeffrey J. Dauler; Joan W. Davenport; Michael Furnari; Donna Furnari; Jessy B. Grasso; Nancy E. Grasso; Robert P. Hayes; Lucy H. Hayes; Ty Hix; Jennifer D. Hix; Paul W. Hund, III; Ruth E. Isaac; Michael D. Plourde; Mary Lou Plourde; Carol C. Pope; Steven B. Taylor; Bette J. Taylor; and Robert White, Individually and on Behalf of all others similarly situated, Respondents,

v.

IMK Development Co., LLC; Keowee Townhouses, LLC; Ludwig Corporation, LLC; SDI Funding, LLC; Medallion at Keowee, LLC; Integrys Keowee Development, LLC; Marick Home Builders, LLC; Bostic Brothers Construction, Inc.; Miller/Player & Associates; Bradford D. Seckinger; John Ludwig; William Cox; Larry D. Lollis; Rick Thoennes; M Group Construction and Development; LLC; Mel Morris; Joe Bostic; Jeff Bostic; Clear View Construction, LLC; Michael Franz; MHC Contractors; Miguel Porras Choncoas; Builders First Source-Southeast Group; Mike Green; Southern Concrete Specialties; Carl Compton d/b/a Compton Enterprize a/k/a Compton Enterprises; Gunter Heating & Air; All Pro Heating; A/C & Refrigeration, LLC; Coleman Waterproofing; Heyward Electrical Services, Inc.; Tinsley Electrical, LLC; Hutch N Son Construction, Inc.; Upstate Utilities, Inc.; Southern Basements; Carl Catoe Construction, Inc.; T.G. Construction, LLC; Delfino Construction; Francisco Javier Zarate d/b/a Zarate Construction; Alejandro Avalos Cruz; Herberto Acros Hernandez; Martin Hernandez-Aviles; Francisco Villalobos Lopez; Ambrosio Martinez-Ramirez; Ester Moran Mentado; Socorro Castillo Montel; MJG Construction and Homebuilders, Inc. d/b/a MJG

Construction; KMAC of the Carolinas, Inc.; Eufacio Garcia; Everado Jarmamillio; Garcia Parra Insulation, Inc.; J&J Construction; Jose Nino; Jose Manuel Garcia; Eason Construction, Inc.; Vincent Morales d/b/a Morales Masonry and Miller/Player & Associates, Defendants,

Of Which Marick Home Builders, LLC and Rick Thoennes are the Appellants.

Appellate Case No. 2015-000392

Appeal From Oconee County
Alexander S. Macaulay, Circuit Court Judge

Opinion No. 5600
Heard December 7, 2017 – Filed October 10, 2018

AFFIRMED IN PART, REVERSED IN PART

Jason Michael Imhoff, Chad McQueen Graham, and Carl Reed Teague, all of The Ward Law Firm, PA, of Spartanburg, for Appellants.

Robert T. Lyles, Jr., of Lyles & Associates, LLC, of Charleston, for Respondent.

LOCKEMY, C.J.: In this construction defect case, Marick Home Builders, LLC (Marick) and Rick Thoennes appeal several of the trial court's orders arguing the trial court erred by (1) failing to give certain jury charges; (2) failing to grant their directed verdict motions; (3) improperly limiting their closing argument; (4) amalgamating the interests of several defendants; (5) failing to require Respondents to elect a remedy; and (6) failing to properly set off settlements Respondents received prior to trial. We affirm in part and reverse in part.

FACTS

In 2002, Bostic Brothers Construction, Inc. (Bostic) began construction as the general contractor on Stoneledge, a townhouse community on Lake Keowee. Bostic marketed the properties as "quality construction" and "maintenance free." Bostic stated, "The quality and attention to detail of the cedar and stacked-stone homes are just as breathtaking as the views." Bostic also noted "Your homeowner[']s association dues cover both maintenance of the grounds and the exterior of your home leaving you more time to enjoy the lake and surrounding attractions." Several of the units were sold in 2003, but the attempts to sellout were "erratic at best."

By late 2004, Bostic was having difficulties finishing other jobs and had to cease operations at Stoneledge. According to property owners at Stoneledge, when Bostic left in 2004, there were "a number of issues." Steven Taylor, a property owner at Stoneledge, testified "[i]t was like a ghost town." He stated property owners were concerned about whether electricity bills were being paid, whether the septic system would work properly, and who was responsible for keeping the common areas landscaped. Taylor testified Bostic had completed the exteriors of the remaining units, but had not completed the interiors when it abandoned the project.

In 2005, IMK Development Company purchased the property from Bostic, and Marick Home Builders, LLC took over the building responsibilities for Stoneledge. Marick's site superintendent, Nathan Hornaday, testified he walked through the unsold units and noted existing damage and what needed to be fixed. According to Hornaday, the exterior of the units, including the roof, porches, decks, and siding were installed in all of the homes and only two or three units needed doors or windows installed.

Hornaday testified that when he arrived on the Stoneledge site, he observed leaks around the porches and decks. Taylor testified he too noticed leaks on his porch and deck. Additionally, Hornaday stated he observed water damage inside the unfinished units, not associated with the porches. He believed that the water damage was the result of broken or missing windows and doors. Hornaday alerted Marick, and one of its principals, Rick Thoennes, about the issues. Marick pulled permits for the unfinished units to complete construction. Marick also hired Coleman Waterproofing to rectify the leaks on the decks and porches by applying a

waterproof coating to the concrete. According to Marick, the waterproofing appeared to rectify the issue.

In 2005, IMK created a homeowners association (HOA) for Stoneledge. At that time, the HOA Board was comprised of IMK representatives, including Thoennes. The HOA conducted regular business, but the homeowners did not have much interaction with the Board. The HOA performed maintenance to the units, but progress was sometimes slow. The IMK/Marick representatives of the Board turned over the HOA to the homeowners in late 2008.

In the spring of 2009, the homeowner-controlled Board began receiving complaints of leaks on the decks and porches. Some homeowners also noticed water running through the crawl-space of their homes during heavy rains. The HOA completed destructive testing on the porches and decks and found significant damage. The HOA also found hidden rot caused by water intrusion to structural columns, and homeowners began reporting interior damage caused by water infiltration from the roof.

In February 2010, the HOA filed an action against Bostic, IMK, Marick, and other development entities, subcontractors and individuals. The HOA settled with some defendants, but went to trial against Bostic, IMK, Marick and the original IMK/Marick board members, alleging negligence, breach of implied warranty of workmanlike service, breach of implied warranty of habitability, and breach of fiduciary duty.

At trial, the HOA requested the jury return a verdict for $6,309,197 for the full amount required to bring the damaged buildings up to the quality at which they were marketed. After deliberations, the jury returned a verdict in favor of the HOA for a total of $5,000,000: $3,000,000 on the negligence cause of action against Marick and Bostic, $1,000,000 on the breach of implied warranty cause of action against Marick and Bostic, and $1,000,000 for the breach of implied warranty cause of action against Marick. Following post-trial proceedings to allocate fault and setoff settlement funds, the trial court entered revised judgments. This appeal followed.

LAW/ANALYSIS

A. JURY CHARGES

"An appellate court will not reverse the trial court's decision regarding jury instructions unless the trial court committed an abuse of discretion." *Stephens v. CSX Transp., Inc.*, 415 S.C. 182, 197, 781 S.E.2d 534, 542 (2015) (quoting *Cole v. Raut*, 378 S.C. 398, 404, 663 S.E.2d 30, 33 (2008)). "An abuse of discretion occurs when the trial court's ruling is based on an error of law or is not supported by the evidence." *Id.* (quoting *Cole*, 378 S.C. at 404, 663 S.E.2d at 33).

"A trial court must charge the current and correct law." *Id.* (quoting *In re Estate of Pallister*, 363 S.C. 437, 451, 611 S.E.2d 250, 258 (2005)). "Ordinarily, a trial judge has a duty to give a requested instruction that correctly states the law applicable to the issues and evidence." *Id.* (quoting *Ross v. Paddy*, 340 S.C. 428, 437, 532 S.E.2d 612, 617 (Ct. App. 2000)). "However, jury instructions should be confined to the issues made by the pleadings and supported by the evidence." *Id.* "A trial court's refusal to give a properly requested charge is reversible error only when the requesting party can demonstrate prejudice from the refusal." *Id.* (quoting *Pittman v. Stevens*, 364 S.C. 337, 340, 613 S.E.2d 378, 380 (2005)).

"When an appellate court reviews an alleged error in a jury charge, it 'must consider the court's jury charge as a whole in light of the evidence and issues presented at trial.'" *Id.* (quoting *Keaton ex rel. Foster v. Greenville Hosp. Sys.*, 334 S.C. 488, 497, 514 S.E.2d 570, 575 (1999)). "If, as a whole, the charges are reasonably free from error, isolated portions which might be misleading do not constitute reversible error." *Id.* at 198, 781 S.E.2d at 542 (quoting *Keaton*, 334 S.C. at 497, 514 S.E.2d at 575). "This holistic approach to jury instructions is linked to the principle of appellate procedure that '[a]n error not shown to be prejudicial does not constitute grounds for reversal.'" *Id.* (quoting *Ardis v. Sessions*, 383 S.C. 528, 532, 682 S.E.2d 249, 250 (2009)).

If the record does not contain any proposed jury charges, and it does not reflect that Appellant proffered any proposed jury charges, the issue is not preserved. *Commerce Ctr. of Greenville, Inc. v. W. Powers McElveen & Assocs*, 347 S.C. 545, 556, 556 S.E.2d 718, 724 (Ct. App. 2001).

Marick argues the trial court erred by (1) not charging the jury that Marick could be held liable only for work it performed, (2) charging the jury on breach of implied warranty of habitability, even though that cause of action had been dismissed, (3) and failing to give its requested jury charge on the breach of fiduciary duty cause of action. We disagree.

1. Liability Charge

Marick asserts "[t]he trial court failed to charge the jury on the proper elements of negligence for a subsequent owner for original construction defects or similar limitations for breach of implied warranty of workmanlike service." The HOA, on the other hand, asserts Marick failed to preserve its argument because it did not proffer a proposed jury charge to the trial court prior to the court's charge to the jury.

In *Round Tree Villas Association v. 4701 Kings Corporation*, our supreme court determined whether a lender, that took control of a project in lieu of foreclosure from the builder, could be held liable for negligent work by the builder prior to the lender taking title to the property. 282 S.C. 415, 418-419, 321 S.E.2d 46, 48-49 (1984). The *Round Tree Villas* court refused to impose liability in such a case. *Id.* at 422, 321 S.E.2d at 50. Instead, the court found the lender could only be held responsible for its acts of negligence in repairing any issues. *Id.* at 423, 321 S.E.2d at 51. "Under this cause of action the Lender . . . may only be held liable for any damages proximately caused by the alleged negligent repair, but not for any original damages proximately caused by the negligence of the Builder, Architect or Contractor." *Id.*

During trial, Hornaday, Marick's site superintendent, and Taylor, a resident of Stoneledge, each testified the exteriors of many of the Phase I units were already constructed when Marick took over the project in 2005. But, Hornaday also testified he observed water damage in unfinished units and leaks around some porches and decks. Furthermore, he acknowledged Marick pulled permits to complete construction at Stoneledge totaling $1.4 million, including some that stated the work was to "complete townhome from foundation stage."

During the charge conference, the court stated it would charge the elements of negligence. Specifically, the court stated, "I'll charge as far as the elements of damages the negligence is the cost of repairs and incidental and consequential damages." The court then noted, "Have we got any -- I don't know about the duty to exercise reasonable care in making repairs." The HOA told the trial court, "That would be relevant to the claims against Marick." Marick responded, "We put the *Roundtree Villas* case in there, I believe." Later during the charge conference, the court noted it would charge the jury "the burden of proof is upon the plaintiff to prove not only that there was negligence, but that the named defendant or defendants were the cause of that [damage]." Again, Marick argued to the trial court it should include a charge from *Roundtree Villas* regarding "liability of

subsequent builder making repairs." The court noted it could not find the proposed charge but Marick quoted from the charge that

> One who undertakes to make repairs [sic], the defective components of a construction project is not liable for the negligence of the prior builder or contractor. The entity who assumes to make repairs to defective components is only liable for damages proximately caused by alleged negligent repair but not for any original damages proximately caused by the negligence of a builder or contractor.

The trial court declined to charge the language from *Roundtree Villas* because it involved a lender that took title to property, not a subsequent builder.

With regard to the HOA's issue preservation argument, we find Marick sufficiently proffered its requested charge to the trial court. While there was some discussion that the charge was not included in Marick's requests sent to the court prior to the charge conference, Marick sufficiently brought to the trial court's attention the requested content of the charge, and there is a sufficient record for this court to review it. Therefore, we find this issue has been sufficiently preserved for our review.

On the merits, the trial court charged the jury the correct statement of the law in South Carolina regarding builder negligence and liability. While we agree with Marick it may have been helpful to include the language from *Roundtree Villas* in the charge to the jury, after reviewing the entire jury charge, we find no error under the specific facts of the case.

The trial court charged the jury on the general elements of negligence. The court specifically charged the jury "[t]he plaintiffs must also prove by a preponderance or the greater weight of the evidence that they suffered damages as a result of the defendants' breach of duty." The trial court continued by instructing the jury on proximate cause. The court instructed, "The plaintiffs must prove by a preponderance of the evidence that the damages were proximately caused by the defendants' breach" and the plaintiffs must prove causation in fact "by showing that the damages would not have occurred but for the defendants' negligence." The court also charged the jury that a plaintiff must prove a builder negligently constructed a building and "the negligence or carelessness of the defendants in performing the construction work was a proximate cause of the damages sustained

by the plaintiff."[1] Finally, the court instructed, "If [two] acts happened one after the other, but not related to each other, they would not be concurring causes. In that case, only one person whose negligence actually caused the injury would be responsible."

Taken as a whole, these charges adequately instructed the jury on the law of South Carolina. Marick's requested charge is certainly appropriate here, but the court's charge as given instructed the jury that only the person or entity whose negligence caused the injury would be responsible. Accordingly, we affirm.

2. Breach of Implied Warranty of Habitability

Marick argues the trial court erred in charging the jury on the law of implied warranty of habitability because the breach of implied warranty of habitability claim had been dismissed prior to trial. The HOA asserts the trial court's error was harmless because no cause of action for breach of implied warranty was included on the verdict form. We agree with the HOA.

The HOA initially asserted a cause of action against the Stoneledge developers for breach of implied warranty of habitability. The trial court, however, granted the developers summary judgment on the breach of implied warranty of habitability prior to trial.

In preparing its jury instructions, the trial court stated it planned to charge the jury on four causes of action, including a charge for breach of the implied warranty of habitability. Marick then asked "Does anybody think there's a work habitability claim still out there?" The HOA responded, "Your Honor, I think that you dismissed the habitability claim by earlier order." The trial court agreed.

However, during the charge, the trial court instructed the jury,

> A builder who contracts to construct a dwelling impliedly warrants that the work undertaken will be performed in a careful, diligent, and workmanlike manner. This is an implied warranty of workmanlike services, and it exists as a matter of law. The implied warranty o[f]

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[1] The trial court instructed the jury on multiple other occasions that a defendant is only liable for damages for which the defendant was the proximate cause; however, for the sake of brevity, we list only a sampling of those charges.

> workmanlike manner is a duty to perform the work skillfully, carefully and diligently. The work need not be performed to absolute perfection or to the personal satisfaction of either party, but it must be performed to the satisfaction of the contract. The skill required of a person providing services is the same degree of skill, efficiency and knowledge of those of ordinary skill, competence and standing in the particular trade, profession or business in which the person is working. If you find the construction was defective by reason of the builder's workmanlike performance, the breach of warranty gives a plaintiff a claim for damages for the loss of his expectancy.
>
> The plaintiffs alleged that there has been a breach of the implied warranty of workmanlike service and a breach of implied warranty of habitability. An implied warranty is one which is presumed to be included in every sale, whether the defendant actually stated the promise or not. The proper measure of damages for the breach of an implied warranty is the actual damages shown to have been sustained by the plaintiff which are the natural, direct and proximate cause of the breach of the implied warranty and which may be reasonably regarded as within the contemplation of the parties at the time [sic] the warranty as a probable consequence of the breach of this warranty.

In the court's instruction on damages for the breach of implied warranty cause of action, the trial court did not indicate a specific implied warranty, instead noting "[i]ncidental damages from a breach of implied warranty may be recovered."

After the charge, Marick noted its exception to the breach of implied warranty of habitability language. Marick acknowledged the implied warranty of habitability issue was a "small one" that was "buried in other charges." After deliberating, the jury requested the trial court "provide the jury charge for breach of implied warranty of workmanlike service and [the trial court's] charge for breach of fiduciary duty." The court repeated these charges at the jury's request. After the court's recharge on the law, Marick again objected to the implied warranty of

habitability reference. The trial court noted the error, but found there was no injury to Marick because the term was only mentioned one time in the section.

We agree with the trial court's assessment. The jury charge only included the phrase breach of implied warranty of habitability once; it did not define the concept or give any elements for it with respect to a separate cause of action. Further, the jury specifically requested the trial court recharge the issue of breach of warranty of workmanlike service, not mentioning the warranty of habitability. While inclusion of the phrase was error, we find Marick has failed to establish any prejudice resulting from the trial court's passing references to the breach of warranty of habitability in this case.

3. Breach of Fiduciary Duty

Marick argues the trial court gave an erroneous jury charge on the breach of fiduciary duty cause of action, which essentially converted breach of fiduciary duty into a strict liability cause of action. Based on the trial court's erroneous breach of fiduciary duty charge, Marick also asserts the trial court erred by not giving its requested charge on the business judgment rule. The HOA asserts the breach of fiduciary duty claim presented in this case is controlled by our supreme court's decision in *Concerned Dunes West Residents v. Georgia-Pacific Corporation*, 349 S.C. 251, 562 S.E.2d 633 (2002). We agree with the HOA.

In *Dunes West*, a developer created a planned unit development (PUD) governed by recorded covenants and restrictions. *Id.* at 254, 562 S.E.2d at 635. During development, the developers constructed roads and drainage systems. *Id.* Subsequently, the developer discovered significant repairs to the roads and drainage systems would be necessary. *Id.* at 255, 562 S.E.2d at 635. Before repairing the issues, the developer sold the remaining undeveloped portions to a buyer. *Id.* Prior to consummating the sale, the developer deeded the roads and other common areas within the development to the property owners association (POA). *Id.* Pursuant to the covenants, the POA was responsible for maintaining all common areas within the PUD. *Id.* at 255, 562 S.E.2d at 636. The POA later sued the developer to recover the costs to repair the roads and other common areas. *Id.*

The court noted,

> the developer of a planned unit development . . . owes a fiduciary duty to the property owners association and its

> members, much like that owed by promoters of a corporation to investors. As such, the developer has a responsibility to insure that the common areas are in good repair at the time they are conveyed to the property owners association or to provide the association with funds sufficient to effectuate any needed repairs to those areas.

Id. at 256, 562 S.E.2d at 636. "The developer of a PUD owes a duty to the POA to turn over common areas that are not substandard and that are in good repair. Failure to do so subjects the developer to liability for bringing the common areas up to standard." *Id.* at 257, 562 S.E.2d at 637. Under this legal framework the court found the developer liable to the POA for the road construction defects. *Id.*

Here, the trial court instructed the jury "The developer owes a fiduciary duty to ensure that the common areas of the development are in good proper repair at the time the developer relinquished control of the homeowners association over to the homeowners."

Marick asserts, "The charge given by the [trial] [c]ourt is not an accurate statement of the law of South Carolina, and it incorrectly expresses and implies that such a duty by a developer is akin to strict liability for defects, whether latent or patent." Marick argues "there was no evidence that Thoennes or the other members of the HOA Board[] had any knowledge of unrepaired defects at the Project at the time control of the HOA Board was transferred to the homeowners in 2007." Marick also argues the trial court should have instead charged the jury that "the conduct of the directors should be judged by the 'business judgment rule'; and absent a showing of bad faith, dishonesty, or incompetence, the judgment of the directors will not be set aside by judicial action."

The trial court properly instructed the jury regarding the fiduciary duty a developer owes to an HOA when it controls the HOA. The HOA presented evidence that Marick knew about water infiltration issues, and even attempted to fix them prior to turning the HOA over to the homeowners. Because the circuit court properly charged the jury according to our supreme court's holding in *Dunes West*, we affirm.

B. DIRECTED VERDICT MOTIONS

"When reviewing a trial court's ruling on a directed verdict motion, this court will reverse if no evidence supports the trial court's decision or the ruling is controlled by an error of law." *Burnett v. Family Kingdom, Inc.*, 387 S.C. 183, 188, 691 S.E.2d 170, 173 (Ct. App. 2010). "When reviewing the trial court's decision on a motion for directed verdict, this court must employ the same standard as the trial court by viewing the evidence and all reasonable inferences in the light most favorable to the nonmoving party." *Id.* "The trial court must deny a directed verdict motion where the evidence yields more than one inference or its inference is in doubt." *Id.*

1. Breach of Implied Warranty of Workmanlike Service

"In constructing a home, a builder warrants that the home is fit for its intended use as a dwelling, that the home is constructed in a workmanlike manner, and that the home is free of latent defects." *Fields v. J. Haynes Waters Builders, Inc.*, 376 S.C. 545, 562, 658 S.E.2d 80, 88 (2008).

Marick argues it was entitled to a directed verdict on the breach of implied warranty claim because "[t]here was no evidence presented that Marick constructed the defective exteriors of the units." The HOA notes it did not sue Marick seeking to hold it vicariously liable for Bostic; rather, it sued Marick "for its own negligence and breaches of warranty with respect to the significant work it did in Phase 1 of Stoneledge." The HOA explains it has "not contended that Marick is a warrantor of Bostic's work."

Several homeowners testified they notified the Marick board members regarding issues with their units. The HOA also presented evidence that Marick pulled building permits detailing $1.4 million in construction necessary to complete the units in Phase 1 and perform repairs; some of this work included completing buildings from the foundation stage. This evidence was sufficient to overcome Marick's motion for a directed verdict and raised a question of fact for the jury to decide. Accordingly, we affirm.

2. Proximate Cause

"Negligence is not actionable unless it is a proximate cause of the injury." *Madison ex rel. Bryant v. Babcock Ctr., Inc.*, 371 S.C. 123, 146, 638 S.E.2d 650, 662 (2006). "[P]roximate cause is the efficient, or direct, cause[;] the thing which brings about the injuries complained of." *Hughes v. Children's Clinic, P. A.*, 269 S.C. 389, 398, 237 S.E.2d 753, 757 (1977). "The defendant's negligence does not

have to be the sole proximate cause of the plaintiff's injury; instead, the plaintiff must prove the defendant's negligence was at least one of the proximate causes of the injury." *Madison*, 371 S.C. at 147, 638 S.E.2d at 662. "Normally, proximate cause is a question of fact for the jury, and it may be proved by direct or circumstantial evidence." *J.T. Baggerly v. CSX Transp., Inc.*, 370 S.C. 362, 369, 635 S.E.2d 97, 101 (2006).

Marick acknowledges the existence of "limited evidence that any repairs made by Marick were defective and proximately caused damages." However, Marick argues the trial court erred in failing to grant it a partial directed verdict on the negligence claim because the extent of its liability for construction defects was $250,000. The HOA asserts it presented evidence of Marick's "failure to comply with the code in performance of over $1.4 million worth of completion work; its extensive, failed efforts to repair waterproofing on the porches and decks and foundation; and its disregard of open and obvious deficiencies" its superintendent saw but did not repair, which led to damages.

The HOA's forensic engineer, Derek Hodgin testified he examined the units in Stoneledge and found a number of issues. On his first inspection of Stoneledge, Hodgin found issues with water intrusion on the decks and porches, flashing issues, and siding issues. Hodgin also testified he discovered a significant amount of damage to paneled subfloors and floor framing caused by water intrusion. Finally, Hodgin noted there were inappropriately constructed fire-rated walls which he could observe in an unfinished unit inspection.

Hodgin analyzed the plans and permits pulled in this case and determined Marick used out of date building codes when it applied for twenty-six building permits in 2005, although "there [was] really no substantial or substantive difference between the two codes . . . for any of the issues" in this case. He also noted several problems with the amount of detail on the plans, and stated the builders should have contacted the architect to clarify those points.

Finally, Hodgin testified the homeowner's reports of water intrusion should have put Marick on notice to sufficiently investigate to determine the source of the water intrusion. According to Hodgin, to completely fix the issues Stoneledge faces, it would require the removal of all the exterior wall material, and its subsequent reapplication using proper flashing and waterproofing details.

We acknowledge several witnesses testified the exteriors of the homes were already constructed when Marick took over at Stoneledge. We also note the

HOA's expert testified a large portion of the damages would not have been any different had Marick done nothing to attempt repair. The HOA's expert testified,

> Certain things wouldn't change at all. The need for fire-rated walls to be correct would not change. The need for every window to be removed and reset with proper flashing would not change. The waterproofing of the foundation walls would not change. The balcony reconstruction, I don't think would change. There may have been -- you may have had some framing to salvage in the balconies in 2004. I don't know. But other than that it would be same fix.

However, Hodgin also testified Marick had a duty to properly investigate issues and make repairs as the subsequent general contractor when it knew of problems.

Marick's expert testified the repairs identified by the HOA's expert which were attributable to Marick would cost $250,000 to repair. The record does not indicate that the HOA's expert broke down his damages opinions between Bostic and Marick.

Mindful of our standard of review, we find evidence in the record to support the jury's determination that Marick was the proximate cause of Stoneledge's damages, and those damages exceeded $250,000. The most apparent evidence supporting the jury's decision are the permits for construction Marick requested, at least one of which was to completely construct a new unit. While the HOA's expert may not have taken time to delineate which damages were due to Bostic's negligence and which damages were due to Marick's negligence, we find there was evidence to support the jury's verdict. Therefore, we affirm the trial court's decision declining to grant directed verdict.

C. CLOSING ARGUMENT

"Closing arguments must be confined to evidence in the record and reasonable inferences therefrom." *O'Leary-Payne v. R.R. Hilton Head, II, Inc.*, 371 S.C. 340, 352, 638 S.E.2d 96, 102 (Ct. App. 2006) (quoting *State v. Huggins*, 325 S.C. 103, 107, 481 S.E.2d 114, 116 (1997)). A trial court is allowed broad discretion in dealing with the range and propriety of closing argument to the jury. *Id.* (quoting *State v. Condrey*, 349 S.C. 184, 195-96, 562 S.E.2d 320, 325 (Ct. App. 2002)).

Ordinarily, the trial court's rulings on such matters will not be disturbed. *Id.* (quoting *State v. Patterson*, 324 S.C. 5, 17, 482 S.E.2d 760, 766 (1997)).

Marick argues the trial court improperly restricted its closing argument regarding the HOA's expert witness. Marick asserts there was no need to use the deposition during the trial because the expert admitted the content of his previous deposition testimony in a different case, and impeachment was therefore not necessary.

Marick made only conclusory statements and quoted the discussion between counsel and the court during the closing argument, without any citation to supporting authority. Therefore, this issue has been abandoned. *See Glasscock, Inc. v. U.S. Fidelity & Guar. Co.*, 348 S.C., 76, 81, 557 S.E.2d 689, 692 (Ct. App. 2001) ("South Carolina law clearly states that short, conclusory statements made without supporting authority are deemed abandoned on appeal and therefore not presented for review.").

D. AMALGAMATION (Single Business Enterprise Theory)

Marick argues the trial court's decision to amalgamate its interests with IMK was erroneous, unsupported by the evidence, and "created a multitude of problems involving the jury charges (or lack thereof), the verdict form and both judgments entered by the trial court."[2]

The amalgamation of interests theory was first addressed in South Carolina in *Kincaid v. Landing Dev. Corp.*, 289 S.C. 89, 344 S.E.2d 869 (Ct. App. 1986); however, our supreme court only formally recognized amalgamation—or the "single business enterprise theory"—as a method of piercing the corporate form in the recent case of *Pertuis v. Front Roe Restaurants, Inc.*, 423 S.C. 640, 817 S.E.2d 273 (2018). In *Pertuis*, the court summarized the doctrine as follows:

> where multiple corporations have unified their business operations and resources to achieve a common business purpose and where adherence to the fiction of separate

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[2] Plaintiffs also sued Marick and Rick Thoennes—Marick's principal and license holder—directly for their active fault. It appears that only Larry Lollis, a passive investor in IMK through Integrys Keowee Development, was actually impacted by the trial court's amalgamation of the interests with respect to the breach of fiduciary duty claim. Lollis, Cox, and Integrys Keowee are not parties to the appeal.

> corporate identities would defeat justice, courts have refused to recognize the corporations' separateness, instead regarding them as a single enterprise-in-fact, to the extent the specific facts of a particular situation warrant.

Id. at 652-53, 817 S.E.2d at 279. Noting there is nothing "remotely nefarious" in forming corporations for the purpose of shielding shareholders from individual liability, our supreme court reasoned that amalgamation "requires a showing of more than the various entities' operations are intertwined"; rather, it requires "further evidence of bad faith, abuse, fraud, wrongdoing, or injustice resulting from the blurring of the entities' legal distinctions." *Id.* at 655, 817 S.E.2d at 280-81.

In this case, although the trial court lacked the benefit of our supreme court's decision in *Pertuis*, we agree it failed to conduct any meaningful analysis supporting an amalgamation of interests. Nevertheless, our review of the record reveals evidence of a unified operation between Marick and the amalgamated parties as well as evidence of self-dealing that resulted from a blending of their business enterprises.

The threshold amalgamation issue "is an assessment of whether these entities actually operate as a single business enterprise, and thus should be treated as a single entity." *Id.* at 650, 817 S.E.2d at 278. Here, there was testimony Integrys Keowee and Marick were corporately affiliated under the umbrella of IMK, passed corporate funds directly between one another, and allowed individual members to operate as dual agents without distinction as to who they represented. Specifically, Integrys Keowee managing shareholder Bill Cox testified IMK was created to hold title to the Stoneledge project. "Marick Home Builders was to provide the construction at their cost, and [Integrys Keowee] provided the investment. And we did the books for IMK. And the agreement was we would split the profits." Cox was a managing member of both Integrys Keowee and IMK; Integrys Keowee and Marick each owned 50 percent of IMK. IMK had no business other than the development of Stoneledge.

Cox was also a partner in Integrys Holdings, a software company. Some of the Stoneledge salespeople—representatives of IMK—were housed in the Integrys Holding office, which "made it easy for them to use our email." According to Cox, these sales reps were not IMK owners or employees, but "contractors of IMK." Marick would primarily supervise these sales people, but they were contracted through IMK, working out of the office of the Integrys Holdings shareholders.

Other evidence was presented to establish that Marick and IMK shared responsibility for the management of Stoneledge's sales team.

Rick Thoennes' own testimony further established the joint nature of the Stoneledge enterprise. In attempting to explain how homeowners would report a defect with their unit, Thoennes stated:

> It depends on which hat I had on that particular day. I've been—Mr. Lyles said I sold them. Somebody else said I built them, and somebody else said I'm a director on the Board. . . . So I guess it depends on which hat I had. . . . I didn't have the pleasure of being able to say, I'm a director now. At seven o'clock, I'm a contractor. At eight o'clock, I'm a marketing person. I didn't have that luxury.

In the eyes of the HOA members, IMK, Marick, and the individual investor parties serving on the HOA board were one and the same. Stoneledge property owner Robert White testified, "I.M.K., to me, in terms of the faces of the folks that were part of I.M.K. were Rick Thoennes and his son and Tim Roberson." White and his wife communicated with IMK regarding their "quite hefty list of punch list items."

Further, Thoennes, as Marick's principal and license holder[3], had at least constructive knowledge of the pervasive construction defects that plagued the project, but was nevertheless directly involved in IMK and Marick's marketing and sale of the units. Given that Marick's and IMK's profits were entirely dependent on IMK's ability to sell the units, their operations were clearly in pursuit of a common business purpose, albeit to the detriment of the HOA members. Accordingly, we find evidence supports the trial court's single business enterprise ruling.

E. ELECTION OF REMEDY

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[3] Rick Thoennes and his son, Rick III, started Marick home builders together. When Marick Home Builders ceased operations and became insolvent in 2009, Thoennes and his son started a new home building corporation, M Group. Rick Thoennes was the license holder for both Marick Home Builders and M Group.

"Election of remedies involves a choice between different forms of redress afforded by law for the same injury or different forms of proceeding on the same cause of action." *Taylor v. Medenica*, 324 S.C. 200, 218, 479 S.E.2d 35, 44 (1996). "It is the act of choosing between inconsistent remedies allowed by law on the same set of facts." *Id.* "Its purpose is to prevent double recovery for a single wrong." *Id.* "Where a plaintiff presents two causes of action because he is uncertain of which he will be able to prove, but seeks a single recovery, he will not be required to elect." *Adams v. Grant*, 292 S.C. 581, 586, 358 S.E.2d 142, 144 (Ct. App. 1986).

Marick asserts the trial court erred in failing to require the HOA to elect a remedy because "[a]ll of the damages awarded to the [HOA] by the jury arise from the same set of facts and are not distinct to different causes of action." The HOA argues "everyone including Marick, [the HOA], and the trial court agree that the damages [the HOA] requested at trial, essentially the cost of repair, was the remedy [the HOA] sought. [The HOA] sought no other remedy . . . . Thus there was nothing for [the HOA] to elect."

Immediately after the jury returned its verdict, the HOA asked the trial court if the damages award was meant to be cumulative. The trial court stated, "Well, the way the Defendants have been treating it, yes, it is cumulative . . . ." Marick did not object to the trial court's ruling that the damages would be cumulative or ask the trial court to inquire as to the jury's intent behind the multiple awards.

Marick's failure to object to this ruling renders its election of remedies argument unpreserved. The trial court ruled that the damages the jury awarded for each of the causes of action would be added together, and that the HOA was entitled to damages for each of those causes of action. Marick failed to object to the court's decision or request the court ask the jury what its intent was in how it awarded damages. Accordingly, Marick is unable to argue on appeal the court's decision was in error. *See Allegro v. Scully*, 400 S.C. 33, 49 n.9, 733 S.E.2d, 114, 123 n.9 ("If a jury verdict form is ambiguous or unclear, the jury should be returned to the jury room in order to clarify or conform the verdict to its intent before the jury is excused.").

F. SET OFF

Section 15-38-50 of the South Carolina Code (2005) provides that, "[w]hen a release . . . is given in good faith to one of two or more persons liable in tort for the same injury or the same wrongful death: (1) . . . it reduces the claim against the

others to the extent of any amount stipulated by the release or the covenant, or in the amount of the consideration paid for it, whichever is the greater . . . ."

"[W]hen a prior settlement involves compensation for the same injury for which the jury awarded damages, the right to setoff arises as an operation of law." *Smith v. Widener*, 397 S.C. 468, 473, 724 S.E.2d 188, 191 (Ct. App. 2012). However, when the settlement involves compensation for an injury different from the one tried to verdict, there is no set off as a matter of law. *Hawkins v. Pathology Assocs. of Greenville, P.A.*, 330 S.C. 92, 114-15, 498 S.E.2d 395, 407 (Ct. App. 1998). When the settlement "is argued to involve two claims, one of which involves the same injury as the claim tried to verdict and one of which does not, the circuit court must make the factual determination of how to allocate the settlement between" the claims. *Smith*, 397 S.C. at 473, 724 S.E.2d at 191.

At trial, the HOA requested the jury return a verdict for $6,309,197 for the full amount required to bring the damaged buildings up to the quality at which they were marketed. After deliberations, the jury returned a verdict in favor of the HOA for a total of $5,000,000-$3,000,000 on the negligence cause of action against Marick and Bostic, $1,000,000 on the breach of implied warranty cause of action against Marick and Bostic, and $1,000,000 for the breach of fiduciary duty cause of action against Thoennes and other directors.

After the jury returned its verdict, the trial court held an additional proceeding to apportion fault among the defendants. The jury apportioned 40% of fault to Marick on the negligence claim and 70% of fault to Marick on the breach of implied warranty claim. The jury was then dismissed.

The trial court held a post-trial hearing on several motions after releasing the jury. Among those motions was a motion for setoff. During the hearing on the motion for setoff, the HOA requested the court reform the jury's verdict to reflect that each cause of action supported the $5,000,000 cumulative verdict. After several motions for reconsideration, the trial court entered judgment against Marick as follows: (1) for negligence- $857,635.29; (2) for breach of implied warranty- $2,144,088.23. The trial court entered judgment against Rick Thoennes for $2,144,088.23 for breach of fiduciary duty.

Initially, Marick asserts the trial court erred in entering judgment as detailed above because "the damages awarded and the apportionment provided do not correlate with the evidence." Essentially, Marick argues the trial court's final entry of judgment does not correlate with the jury's verdict. We agree.

It appears the trial court amended the jury's verdict to find that each cause of action independently supported a $5 million verdict. In doing so, the trial court invaded the province of the jury. *See Joiner v. Bevier*, 155 S.C. 340, __, 152 S.E.2d 652, 657 (1930) ("It is [the judiciary's] duty to enforce a verdict, not to make it."). Therefore, we find the jury's verdict, and its allocation of damages to the three separate causes of action should be reinstated.

The question then becomes how the court should allocate the setoff Marick and Thoennes are entitled to based upon the settlement the HOA received prior to trial. Thoennes' fiduciary duty to the HOA was the result of his position on the Board of the HOA. Based on the record, it does not appear any Board members settled with the HOA prior to trial. Therefore, none of the settlement proceeds should be set off against Thoennes' liability for breach of fiduciary duty because none of the settlement proceeds would have included any amount for damages resulting from a breach of fiduciary duty. Accordingly, Thoennes is responsible for the $1 million award for breach of fiduciary duty, subject to any claims he may have for contribution from any other defendants.

The remaining $4 million verdict should be set off by the amount of the prior settlements. After deducting the value of the settlements, this would leave a $2,144,088.23 judgment to allocate between the negligence and breach of implied warranty causes of action. Because the jury awarded $3 million to the negligence cause of action and $1 million to the breach of implied warranty cause of action, we believe it would be proper to allocate three-fourths of the remaining judgment to the negligence cause of action and the remaining one-fourth to the breach of implied warranty cause of action. This allocation would mean $1,608,066.17 would be allocated to the negligence cause of action and $536,022.06 would be allocated to the breach of implied warranty cause of action.

Applying the apportionment statute and the apportionment amounts the jury determined at trial, Marick would therefore be responsible for $643,226.47 for the negligence claim and $536,022.06 for the breach of implied warranty claim, subject to any claims it may have against Bostic for contribution. *See* S.C. Code Ann. § 15-38-15 ("In an action to recover damages resulting from . . . damage to property . . . if indivisible damages are determined to be proximately caused by more than one defendant, joint and several liability does not apply to any defendant whose conduct is determined to be less than fifty percent of the total fault for the indivisible damages . . . . A defendant whose conduct is determined to be less than

fifty percent of the total fault shall only be liable for that percentage of the indivisible damages determined by the jury or trier of fact.").

CONCLUSION

Accordingly, we affirm in part, reverse in part, and remand for entry of judgment consistent with this opinion.

HUFF and McDONALD, JJ., concur.

THE STATE OF SOUTH CAROLINA
In the Court of Appeals

RECEIVED
OCT 29 2018
SC Court of Appeals

APPEAL FROM OCONEE COUNTY
Court of Common Pleas

Alexander S. Macaulay, Presiding Judge Seventh Judicial Circuit

Case No. 2015-000392

Stoneledge at Lake Keowee Owners' Association, Inc.; C. Dan Carson; Jeffrey J. Dauler; Joan W. Davenport; Michael Furnari; Donna Furnair; Jessy B. Grasso; Nancy E. Grasso; Robert P. Hayes; Lucy H. Hayes; Ty Hix; Jennifer D. Hix; Paul W. Hund, III; Ruth E. Isaac; Michael D. Plourde; Mary Lou Plourde; Carol C. Pope; Steven B. Taylor; Bette J. Taylor; and Robert White, Individually and on Behalf of all other similarly situated, Respondents,

v.

IMK Development Co., LLC; Keowee Townhouses, LLC; Ludwig Corporation, LLC; SDI Funding, LLC; Medallion at Keowee, LLC; Integrys Keowee Development, LLC; Marick Home Builders, LLC; Bostic Brothers Construction, Inc.; Miller/Player & Associates; Bradford D. Seckinger; John Ludwig; William Cox; Larry D. Lollis; Rick Thoennes; M Group Construction and Development, LLC; Mel Morris; Joe Bostic; Jeff Bostic; Clear View Construction, LLC; Michael Franz; MHC Contractors; Miguel Porras Choncoas; Builders First Source-Southeast Group; Mike Green; Southern Concrete Specialties; Carl Compton d/b/a Compton Enterprize a/k/a Compton Enterprises; Gunter Heating & Air; All Pro Heating, A/C & Refrigeration, LLC; Coleman Waterproofing; Heyward Electrical Services, Inc.; Tinsley Electrical, LLC; Hutch N Son Construction, Inc.; Upstate Utilities, Inc.' Southern Basements; Carl Catoe Construction, Inc; T.G. Construction, LLC; Delfino Construction; Francisco Javier Zarate d/b/a Zarate Construction; Alejandro Avalos Cruz; Herberto Acros Hernandez; Martin Hernandez-Aviles; Francisco Villalobos Lopez; Ambrosio Martinez-Ramirez; Ester Moran Mentado; Socorro Castillo Montel; MJG Construction and Homebuilders, Inc. d/b/a MJG Construction; KMAC of the Carolinas, Inc.; Eufacio Garcia; Everado Jarmamillio; Garcia Parra Insulation, Inc.; J&J Construction; Jose Nino; Jose Manuel Garcia; Eason Construction, Inc.; Vincent Morales d/b/a Morales Masonry and Miller/Player & Associates, Defendants

Of Defendants, Marick Home Builders, LLC and Rick Thoennes .....Appellants,

PETITION FOR REHEARING OF APPELLANTS MARICK HOME BUILDERS, LLC AND RICK THOENNES

Appellants Marick Home Builders, LLC and Rick Thoennes petition for rehearing of this case pursuant to Rule 221, SCACR. For reasons set forth in the Petition below, and also in the legal and factual arguments of the Appellants, Appellants respectfully submit that the opinion in this case misapprehends the law and overlooks matters in the Record.

I. JURY CHARGES

As the Court correctly pointed out "a trial court must charge the correct and current law." *Stevens v. CX Transport, Inc.* 415 S.C. 182, 197, 781 SE. 2nd 534, 542 (2005). Further, "when the Appellate Court reviews alleged errors in the jury charge, it 'must consider the court's jury charges as a whole in light of the evidence and issues presented at trial.'" *Id. Keyton Xrel Foster v. Greenville Hospital System*, 334 S.C. 488, 497, 514 SE. 2nd 570, 575 (1999)).

A. Liability Charge

The trial court failed to charge the jury on the proper elements of negligence for a subsequent owner for original construction defects and similar limitations for breach of the implied warranty of workmanlike service. South Carolina precedent makes it clear that a subsequent purchaser of a project cannot be liable for the existing work of a predecessor builder. In Roundtree Villas Ass'n, Inc. v. 4701 Kings Corp., 282 S.C. 415, 423, 321 S.E. 2d 46 (1984), the South Carolina Supreme Court held that the defendant, which took over a project and undertook to repair existing defects, had a common law duty to use due care in making the repairs, but "may only be held liable for any damages proximately caused by the alleged negligent repair, but not for any original damages proximately caused by the negligence of the [original] Builder, Architect or Contractor." (emphasis added). Because the trial court in Roundtree Villas failed to properly charge the jury as to the law governing the Defendant's liability for negligent repair, the Supreme Court reversed and ordered a new trial as to the alleged

negligent repairs only. In the present case, the Court's failure to charge the jury as to the holding in Roundtree as requested by Defendants is prejudicial error to Defendants as more fully stated below.

B. Breach of Implied Warranty of Habitability Charge

Both this Court and the Homeowner's Association agree that the trial court committed error by charging the Breach of the Implied Warranty of Habitability. The charge included a sentence that stated "an implied warranty is one which is presumed to be included in every sale, whether the Defendant actually stated the promise or not." (R.p. 1946; R.p. 1968-R.p. 1969.) The Appellate Court further recognized that the jury, while deliberating, requested the trial court to provide the jury charge again. (R.p. 1946; R.p. 1968-R.p. 1969.) The trial court again repeated the charge, which included the same language. Therefore, the trial court instructed the jury erroneously once during the original charge, but then again during a specific request from the jury – which was not buried in other charges. This was after Co-Defendant, Bostic made an argument during its closing statement that Marick sold 70% of the units and Bostic only sold 30% of the units.

Bostic's counsel argued that Marick sold 70% of the units and therefore should be liable for 70% of the damages – which the jury in fact did:

> Now, as far as the allocation, the second allocation that y'all are going to have to have on the breach of warranties, the breach of warranty of workmanlike service, here's the way I think you need to look at it. All the testimony in the record says that Bostic sold/completed ten of these units. That makes them twenty-seven percent liable for that million dollar number. And I think that's fair, just and reasonable. You put us down for the ones that we sold. You put Marick down for the ones that they sold. And I think that is a fair, just and reasonable award.

(R.p. 1988.)

In this case the Appellant repeatedly requested the trial court to charge the current and correct law in a complicated, multiparty, multi week case and considering the court's jury charge as a whole in light of evidence and issues presented at trial, and the lack of clarification on that charge the jury clearly was not adequately instructed on the law South Carolina. As the Appellate Court stated it would have been helpful to include the language from Roundtree Villas in the charge and certainly would have provided more clarification to the jury about the various liabilities of all of the Defendants in this complicated multiparty case especially in light of the erroneous jury charges regarding the breach of implied warranty of habitability, the jury's request to read the implied warranty habitability charge, and Co-Defendants use of the erroneous charge of the breach of implied warranty of habitability to get exactly the result that was argued during the apportionment portion of trial.

Clearly, based on Co-Defendant's jury argument and two separate instances of erroneous jury charges, one at the request of the jury, the jury relied on the sale language suggested during Co-Defendant's closing argument during apportionment to attribute 70% of the breach of implied warranty of workmanlike service to Marick claim on the jury verdict form. If the court had read the suggested language from Roundtree and not wrongfully charged the jury, it could not have made that error. Therefore, taken as a whole the compounded errors were significant and prejudicial.

II. DIRECTED VERDICT MOTIONS

1. Breach of Implied Warranty of Workmanlike Service

Partial directed verdict should have been granted to Marick and Thoennes on the Breach of the Implied Warranty of Workmanlike Service. The only evidence relied upon by Respondent and the Appellate Court to formulate its opinion were misstated permits. No evidence was

introduced that Marick constructed foundations, waterproofings, deck design or construction, siding and window installation which is the vast majority of the damages in the case. In fact, HOA's expert testified that the repair scope from Bostic's defective construction prior to 2005 would be the same today except that there could potentially be differences in the allowances made for the damaged O.S.B. sheathing and framing which rested overtime. Id. at R.p. 987, lines 4-21. HOA's expert Hodgin testified to the following regarding the scope of repair for Bostic if Marick never came on site.

> Certain things wouldn't change at all. The need for the fire-rated walls to be correct would not change. The need for every window to be removed and reset with proper flashing would not change. The waterproofing of the foundation walls would not change. The balcony reconstruction, I don't think would change. There may have been -- you may have had some framing to salvage in the balconies in 2004. I don't know. But other than that, it would essentially be the same fix.

R.p. 1117, line 21-R.p. 1139, line 21.

John Folk prepared an estimate of repair for the HOA based upon Hodgin's scope of repair and testified the damage to the O.S.B. sheathing and framing would cost two hundred and fifty thousand dollars ($250,000.00) to repair. See R.p. 1207, lines 14-21.

Nowhere in the record or evidence, other than misstated permits, is there evidence supporting a cause of action for Implied Warranty of Workmanlike Service against Marick because Marick did not perform the original construction and therefore cannot be liable for it.

2. **Proximate Cause**

The Appellate Court Opinion states that Marick's expert testified the repairs identified by the HOA's expert which were attributed to Marick would cost $250,000 repair. This is a misstatement of the record. It was the HOA's experts that stated that the repairs he identified which were attributable to Marick would be sheathing and framing and would only cost $250,000. Both Derek Hodgins and John Folk were HOA experts who testified the scope of

repair necessary in 2010 was only $250,000 more than what would have been necessary if they fixed Bostic's work in 2005.

Therefore, as stated by the Appellate Court's Opinion there was no evidence that Marick's breach of the duty to investigate or repair would have caused any additional damages over $250,000. Further, this court's statement that the HOA's expert did not break down damages attributable to each Defendant is incorrect. In fact, Mr. Hodgins, HOA's expert did break down the damages between Bostic and Marick when he testified that the scope of repair resulting from the failed inspections or failure to act more quickly resulted in only rotted framing - which would cost approximately $250,000.00 according to the HOA's cost expert.

III. Breach of Fiduciary Duty

Appellant requests clarification on the breach of fiduciary duty ruling related to amalgamation, setoff, and the verdict and its applicability to Marick Homebuilders. The court found that there was a breach of fiduciary duty and stated "Marick knew about water infiltration issues, and even attempted to fix them prior to turning the HOA over to the homeowners." (R.p. 24-25, R.p 26-35) The court further stated the breach of fiduciary duty against Marick is affirmed. However, Marick was not on the board, was not on the breach of fiduciary duty jury verdict form, and therefore cannot be liable for breach of fiduciary duty if the jury did not in fact find Marick responsible for breach of fiduciary duty. This coupled with the amalgamation issue (below) makes it unclear whether Marick is responsible for a judgment for breach of fiduciary duty or if only Rick Thoennes is responsible for breach of fiduciary duty as he was the only one of these two Appellants to appear on the jury verdict form for that cause of action.

IV. Amalgamation[1]

[1] Unless the court has amalgamated Rick Thoennes with Marick under the Business Enterprises Theory.

The Court states that the Circuit Court "failed to conduct a meaningful analysis supported amalgamation of interest." However, the Court cannot amalgamate a board member with a corporation. Appellant has argued that the amalgamation and/or single business purpose analysis must be performed multiple times at multiple levels. Specifically, Bill Cox and Larry Lollis were members of IK. IK was a member of IMK. Bill Cox and Larry Lollis had nothing to do with, no ownership interest in, did not share offices with, and did not conduct the work of Marick Homebuilders or Rick Thomas. IK and its members Bill Cox and Larry Lollis had no affiliation with Marick Homebuilders other than through their joint ownership of IK which shared joint ownership of IMK. To conduct the analysis the court must find that there was amalgamation of interests between Marick Homebuilders and IK and amalgamation or business enterprise between Rick Thomas, Larry Lollis, and Bill Cox. There was no testimony or evidence that Bill Cox, Larry Lollis, and Rick Thoennes shared office space, telephones, joint employees, or unified their business operations and resources.

Mr. Thoennes testimony, which is cited in the opinion, was in response to his roles as a general contractor building new units in Phase II, a general contractor repairing units in Phase I, a board member for the entire development, and a liaison to either get the development to repair the roof, fund the homeowner's association, or fix new units and punchlist items for the new units that were constructed. Mr. Thoennes's testimony is misinterpreted to mean that he was acting as the financing arm of IMK or a representative of IK at any time.

South Carolina has no cases which amalgamate a corporation with an individual. The trial court improperly created new law in ruling that the individuals were amalgamated with the corporate entities. Applying Pertuis v. Front Roe Restaurants, Inc., 423 S.C. 640, 655, 817 S.E.2d 273, 280–81 (2018), reh'g denied (Aug. 16, 2018) the court describes the newly adopted

business enterprise theory describes a situation where "corporations" are combined. It does not speak to individuals.

Further, even applying Pertuis, the single business enterprise theory requires a showing of more than the various entities' operations are intertwined. Combining multiple corporate entities into a single business enterprise requires further evidence of bad faith, abuse, fraud, wrongdoing, or injustice resulting from the blurring of the entities' legal distinctions. Pertuis v. Front Roe Restaurants, Inc., 423 S.C. 640, 655, 817 S.E.2d 273, 280–81 (2018), reh'g denied (Aug. 16, 2018). There was no evidence of bad faith, abuse, fraud, wrongdoing, or injustice resulting from the blurring of the entities' legal distinction. The record is very clear that Marick did the building and IK performed the financial arm to develop Stoneledge. Marick and IK were completely foreign companies operating independently before combining resources to develop Stoneledge under a jointly held corporation: IMK. There was nothing nefarious about the relationship in the record or even suggested during the trial. The elements present in Pertrus were not present such as commingling funds or avoidance of corporate obligations. Therefore, even under the new Business Enterprise Theory IMK, IK, and Marick should not have been amalgamated or found to be engaged in business practices such that they are all the same company.

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October 25, 2018

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Of Defendants, Marick Home Builders, LLC and Rick Thoennes .....Appellants,

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PROOF OF SERVICE

I certify that I have served the Petition for Rehearing of Appellants Marick Homes Builders, LLC and Rick Thoennes by depositing a copy of it in the United States Mail, First Class postage prepaid, on October 25, 2018, addressed to Respondents' attorneys of record, Robert T. Lyles, Jr., Esquire, Lyles & Lyles, LLC, PO Box 773, Charleston, SC 2940.

Stephanie Echols
Paralegal to Jason M. Imhoff

October 25, 2018

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October 25, 2018

The Honorable Jenny Abbott Kitchings
Clerk, South Carolina Court of Appeals
Post Office Box 11639
Columbia, SC 29211

Re: Stoneledge at Lake Keowee Owners' Association, Inc., et al. vs. IMK Development Co., LLC, et al. vs. Michael Franz, et al.
Appellate Case No: 2015-000392

Dear Ms. Kitchings,

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Thank you for your assistance in this matter.

Sincerely,

The Ward Law Firm, PA

Jason M. Imhoff

JMI/ssc
Enclosures
cc(w/encl.): Robert T. Lyles, Jr., Esquire

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OF WHOM STONELEDGE AT LAKE KEOWEE OWNERS' ASSOCIATION IS THE.....RESPONDENT

V.

IMK DEVELOPMENT CO., LLC, KEOWEE TOWNHOUSES, LLC, LUDWIG CORPORATION, LLC, SDI FUNDING, LLC, MEDALLION AT KEOWEE, LLC, INTEGRYS KEOWEE DEVELOPMENT, LLC, MARICK HOME BUILDERS, LLC, BOSTIC BROTHERS CONSTRUCTION, INC., MILLER/PLAYER & ASSOCIATES, BRADFORD D. SECKINGER, JOHN LUDWIG, WILLIAM COX, LARRY D. LOLLIS, RICK THEONNES, M GROUP CONSTRUCTION AND DEVELOPMENT, LLC, MEL MORRIS, JOE BOSTIC, JEFF BOSTIC, CLEAR VIEW CONSTRUCTION, LLC, MICHAEL FRANZ, MHC CONTRACTORS, MIGUEL PORRAS CHONCOAS; BUILDERS FIRST SOURCE-SOUTHEAST GROUP, MIKE GREEN, SOUTHERN CONCRETE SPECIALTIES, CARL COMPTON D/B/A COMPTON ENTERPRIZE A/K/A COMTON ENTERPRISES, GUNTER HEATING & AIR, ALL PRO HEATING, A/C & REFRIGERATION, LLC, COLEMAN WATERPROOFING, HEYWARD ELECTRICAL SERVICES, INC., TINSLEY ELECTRICAL, LLC, HUTCH N SON CONSTRUCTION, INC., UPSTATE UTILITIES, INC., SOUTHERN BASEMENTS, CAROL CATOE CONSTRUCTION, INC., T.G. CONSTRUCTION, LLC, DELFINO CONSTRUCTION, FRANCISCO JAVIER ZARATE D/B/A ZARATE

CONSTRUCTION, ALEJANDRO AVALOS CRUZ, HERBERTO ACROS HERNANDEZ, MARTIN HERNANDEZ-AVILES, FRANSICO VILLALOBOS LOPEZ, AMBROSIO MARTINEZ-RAMIREZ, ESTER MORAN MENTADO, SOCORRO CASTILLO MONTEL, MJG CONSTRUCTION AND HOMEBUILDERS, INC., D/B/A MJG CONSTRUCTION; KMAC OF THE CAROLINAS, INC,EUFACIO GARCIA, EVERADO JARMAMILLIO, GARCIA PARRA INSULATION, INC., J&J CONSTRUCTION, JOSE NINO, JOSE MANUEL GARCIA, EASON CONSTRUCTION, INC., VINCENT MORALES D/B/A MORALES MASONRY AND MILLER/PLAYER & ASSOCIATES, DEFENDANTS

OF WHOM MARICK HOME BUILDERS, LLC AND RICK THOENNES ARE THE.....APPELLANTS

RESPONDENT'S PETITION FOR REHEARING

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Attorneys for Marick Home Builders, LLC & Rick Thoennes

Pursuant to Rule 221(a) of the South Carolina Appellate Court Rules, Respondent hereby files this Petition for Rehearing.

Stoneledge at Lake Keowee Owners' Association, Inc. ("Stoneledge") respectfully requests a rehearing of Opinion No. 5600 and/or the issuance of a new opinion on the issues outlined herein.

Argument

I. The Court of Appeals Erred By Re-Allocating the Jury's Cumulative Verdict of a Single Damage

a. *The Trial Judge Had Discretion with Respect to the Award of Damages and was in the best position to understand the nature of the claims, defenses and evidence concerning damages.*

In this case, Stoneledge sought recovery of one, single damage which was the cost to repair the buildings. The jury determined that that damage was $5,000,000 (less than the total claimed by Stoneledge). That single damage, the cost to repair, was the measure of damages for all of the causes of action asserted by Stoneledge against all of the Defendants. Despite the form of the jury verdict, the trial judge knew and understood that only one damage has been claimed and proven which is why, as noted by the Court of Appeals, he held that the jury verdict was a "cumulative award". The Court of Appeals correctly held that this finding was unchallenged by the Defendants and is the law of the case.

Despite acknowledging the cumulative nature of the award, the Court of Appeals made two mistakes. First it disregarded the trial court's post-trial amendment of the verdict, applying the entire verdict to each of the three causes of action, which accurately reflected that there was a single damage and that the verdict was cumulative. In doing so

the Court of Appeals arbitrarily allocated the verdict as specific damages for specific causes of action. Second, the Court of Appeals then improperly, and arbitrarily applied settlement sums to parts of the verdict, which has already been determined was cumulative, thereby violating the law which compels set off to all of the damages.

The Court of Appeals held that the single, cumulative damages award of $5,000,000 should be allocated among the causes of action, as the jury determined. The problem with this is that the jury's allocation was itself arbitrary as there was no evidence that would support a finding of particularized damages for the individual causes of action. There was no evidence that Stoneledge suffered distinct damages proximately caused by negligence and others proximately caused by a breach of warranty and other particular damages caused by a breach of fiduciary duty. Because there was no evidence of that, the allocation of the damages to specific causes of action by the jury, and by the Court of Appeals, was arbitrary. As noted by the trial judge, and by the Court of Appeals, there was only one, cumulative damage suffered by Stoneledge. The trial judge understood that and understood the falsity of the jury's attempt to parse out the damage among causes of action, which is what led to his post-trial amendment of the verdict form.

Importantly, his post-trial amendment of the verdict did not usurp the authority of the jury or change the jury's verdict. He simply applied the jury's findings, based upon his extensive observation of the trial and the evidence presented, and correctly applied their verdict, $5,000,000, as the cumulative award for a single damage that it was. See, *Vinson v. Hartley*, 342 S.C. 389, 477 S.E. 2d 715 (SC App 1996).

There was no clear error in this instance and the trial judge's post-trial amendment of the verdict form, to properly reflect the law of the case; a cumulative award for one damage, should not have been reversed.

II. The Court of Appeals Erred as a matter of law in failing to properly apply the set-off to the entire jury verdict.

In its opinion, after arbitrarily re-allocating the verdict among the causes of action, the Court of Appeals only applied the set-off to $4,000,000 of the $5,000,000 award, refusing to apply it to the $1,000,000 "verdict" for breach of fiduciary duty. This was in error and is contrary to the statutory and common law of set-off.

It is the law of the case that the damages awarded by the jury were "cumulative" and it is undisputed that all of the damages "arose out of the same factual scenario", meaning the design, construction and sale of defective buildings. As noted, there was no evidence that the damages were anything other than the cost to repair and no evidence that there were particular damages associated with any of the particular causes of action. The measure of damages for each cause of action is precisely the same; the cost to repair.

The law of set-off is clear and is articulated by the Court of Appeals in *Smith v. Widener*, 397 S.C. 468, 724 S.E. 2d 188 (SC App 2012):

> [T]here can be only one satisfaction for an injury or wrong." *Hawkins v. Pathology Assocs. of Greenville, P.A.*, 330 S.C. 92, 113, 498 S.E.2d 395, 407 (Ct.App.1998) (internal quotation marks omitted). A settlement by a joint tortfeasor "reduces the claim against the others to the extent of any amount stipulated by the release or the covenant." S.C.Code Ann. § 15–38–50(1) (2005). Therefore, before entering judgment ***472** on a jury verdict, the court must reduce the amount of the verdict to account for any funds previously paid by a settling defendant, so long as the settlement funds were paid to compensate the same plaintiff on a claim for the same injury. *Hawkins,* 330 S.C. at 113, 498 S.E.2d at 406–07. When the settlement is for the same injury, the nonsettling defendant's right to a setoff arises by operation of law. *Ellis v. Oliver,* 335 S.C. 106, 112, 515 S.E.2d 268, 271– 72 (Ct.App.1999).

Id. at 190. *See also, Vortex Sports & Entm't, Inc. v. Ware*, 378 S.C. 197, 209, 662 S.E.2d 444, 451 (Ct. App. 2008).

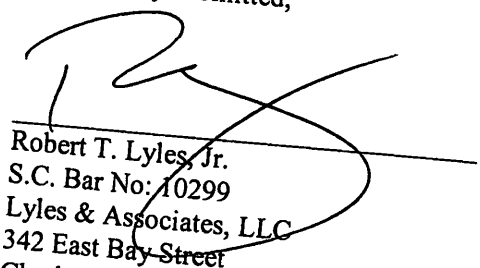
If the verdict is to be artificially re-allocated among the causes of action, which Stoneledge believes is not proper, the set-off ($2,855,911.77) should have been applied to the entire cumulative verdict ($5,000,000) for a net verdict of $2,144,088.23. While disagreeing with the Court of Appeals reallocation of the verdict, if the verdict is reallocated as the jury allocated it the set-off, reallocated verdict should have been $1,286,452.94 for negligence, $428,817.65 for breach of warranty and $428,817.65 for breach of fiduciary duty. With the apportionment, that results in verdicts against Bostic Marick and Thoennes as follows:

Bostic:	Negligence (100%) — $1,286,452.94
	Breach of Warranty (30%) — $128,645.30
	Total: $1,415,098.24
Marick:	Negligence (40%) — $514,581.17
	Breach of Warranty(100%) — $428,817.65
	Total: $943,398.82
Thoennes:	Breach of Fiduciary Duty — $428, 817.65

CONCLUSION

For the forgoing reason, the Court of Appeals should reconsider its opinion and affirm the Trial Court's proper amendment of the verdict form to accurately reflect the jury's cumulative verdict for one damage among all causes of action and apply the set-off equally. Alternatively, the Court of Appeals should apply the set-off proportionally to all causes of action.

Respectfully submitted,



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Charleston, South Carolina

October 25, 2018

THE STATE OF SOUTH CAROLINA

In the Court of Appeals

APPEAL FROM THE OCONEE COUNTY

Court of Common Pleas

RECEIVED
OCT 25 2018
SC Court of Appeals

The Honorable Alexander S. Macaulay

Appellate Case No. 2015-000392

STONELEDGE AT LAKE KEOWEE OWNERS' ASSOCIATION, INC., C. DAN CARSON, JEFFREY J. DAULER, JOAN W. DAVENPORT, MICHAEL FURNARI, DONNA FURNARI, JESSY B. GRASSO, NANCY E. GRASSO, ROBERT P. HAYES, LUCY H. HAYES, TY HIX, JENNIFER D. HIX, PAUL W. HUND, III, RUTH E. ISAAC, MICHAEL D. PLOURDE, MARY LOU PLOURDE, CAROL C. POPE, STEVEN B. TAYLOR, BETTE J. TAYLOR, AND ROBERT WHITE, INDIVIDUALLY AND ON BEHALF OF ALL OTHERS SIMILARLY SITUATED, PLAINTIFFS,

OF WHOM STONELEDGE AT LAKE KEOWEE OWNERS' ASSOCIATION IS THE.....RESPONDENT

V.

IMK DEVELOPMENT CO., LLC, KEOWEE TOWNHOUSES, LLC, LUDWIG CORPORATION, LLC, SDI FUNDING, LLC, MEDALLION AT KEOWEE, LLC, INTEGRYS KEOWEE DEVELOPMENT, LLC, MARICK HOME BUILDERS, LLC, BOSTIC BROTHERS CONSTRUCTION, INC., MILLER/PLAYER & ASSOCIATES, BRADFORD D. SECKINGER, JOHN LUDWIG, WILLIAM COX, LARRY D. LOLLIS, RICK THEONNES, M GROUP CONSTRUCTION AND DEVELOPMENT, LLC, MEL MORRIS, JOE BOSTIC, JEFF BOSTIC, CLEAR VIEW CONSTRUCTION, LLC; MICHAEL FRANZ, MHC CONTRACTORS, MIGUEL PORRAS CHONCOAS; BUILDERS FIRST SOURCE-SOUTHEAST GROUP, MIKE GREEN, SOUTHERN CONCRETE SPECIALTIES, CARL COMPTON D/B/A COMPTON ENTERPRIZE A/K/A COMTON ENTERPRISES, GUNTER HEATING & AIR, ALL PRO HEATING, A/C & REFRIGERATION, LLC, COLEMAN WATERPROOFING, HEYWARD ELECTRICAL SERVICES, INC., TINSLEY ELECTRICAL, LLC, HUTCH N SON CONSTRUCTION, INC., UPSTATE UTILITIES, INC., SOUTHERN BASEMENTS, CAROL CATOE CONSTRUCTION, INC., T.G. CONSTRUCTION, LLC, DELFINO CONSTRUCTION, FRANCISCO JAVIER ZARATE D/B/A ZARATE

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OF WHOM MARICK HOME BUILDERS, LLC AND RICK THOENNES ARE THE.....APPELLANTS

PROOF OF SERVICE

I certify that I have served the Respondent's Petition for Rehearing on counsel for the Appellants by depositing a copy in the United States Mail, First Class postage prepaid, this 25th day of October, 2018, addressed to the following:

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October 25, 2018

VIA HAND-DELIVERY

V. Claire Allen, Deputy Clerk
The South Carolina Court of Appeals
1220 Senate Street
Columbia, SC 29201

RECEIVED
OCT 25 2018
SC Court of Appeals

Re: Stoneledge v. IMK Dev. (Marick/Thoennes)
Appellate Case No. 2015-000392

Dear Ms. Allen:

Enclosed please find the original and seven (7) copies each of Respondent's Petition for Rehearing and Proof of Service regarding the above-referenced matter, along with this firm's check in the amount of $50.00 to cover the required filing fee. I would appreciate your filing the Petition and returning one (1) file-stamped copy to me in the envelope which is also enclosed for your convenience.

Should you have any questions concerning the enclosed, please do not hesitate to give me a call.

Thank you, and with kindest regards, I remain

Very truly yours,

LYLES & ASSOCIATES, LLC

Robert T. Lyles, Jr.

RTL/cw
Enclosures
cc: Jason M. Imhoff, Esquire

Stoneledge at Lake Keowee Owners' Association, Inc.; C. Dan Carson; Jeffrey J. Dauler; Joan W. Davenport; Michael Furnari; Donna Furnari; Jessy B. Grasso; Nancy E. Grasso; Robert P. Hayes; Lucy H. Hayes; Ty Hix; Jennifer D. Hix; Paul W. Hund, III; Ruth E. Isaac; Michael D. Plourde; Mary Lou Plourde; Carol C. Pope; Steven B. Taylor; Bette J. Taylor; and Robert White, Individually and on Behalf of all others similarly situated, Respondents,

v.

IMK Development Co., LLC; Keowee Townhouses, LLC; Ludwig Corporation, LLC; SDI Funding, LLC; Medallion at Keowee, LLC; Integrys Keowee Development, LLC; Marick Home Builders, LLC; Bostic Brothers Construction, Inc.; Miller/Player & Associates; Bradford D. Seckinger; John Ludwig; William Cox; Larry D. Lollis; Rick Thoennes; M Group Construction and Development; LLC; Mel Morris; Joe Bostic; Jeff Bostic; Clear View Construction, LLC; Michael Franz; MHC Contractors; Miguel Porras Choncoas; Builders First Source-Southeast Group; Mike Green; Southern Concrete Specialties; Carl Compton d/b/a Compton Enterprize a/k/a Compton Enterprises; Gunter Heating & Air; All Pro Heating; A/C & Refrigeration, LLC; Coleman Waterproofing; Heyward Electrical Services, Inc.; Tinsley Electrical, LLC; Hutch N Son Construction, Inc.; Upstate Utilities, Inc.; Southern Basements; Carl Catoe Construction, Inc.; T.G. Construction, LLC; Delfino Construction; Francisco Javier Zarate d/b/a Zarate Construction; Alejandro Avalos Cruz; Herberto Acros Hernandez; Martin Hernandez-Aviles; Francisco Villalobos Lopez; Ambrosio Martinez-Ramirez; Ester Moran Mentado; Socorro Castillo Montel; MJG Construction and Homebuilders, Inc. d/b/a MJG

Construction; KMAC of the Carolinas, Inc.; Eufacio Garcia; Everado Jarmamillio; Garcia Parra Insulation, Inc.; J&J Construction; Jose Nino; Jose Manuel Garcia; Eason Construction, Inc.; Vincent Morales d/b/a Morales Masonry and Miller/Player & Associates, Defendants,

Of Which Marick Home Builders, LLC and Rick Thoennes are the Appellants.

Appellate Case No. 2015-000392

ORDER

After careful consideration of the petitions for rehearing, the Court is unable to discover that any material fact or principle of law has been either overlooked or disregarded, and hence, there is no basis for granting rehearing. Accordingly, the petitions for rehearing are denied.

C.J.

J.

J.

Columbia, South Carolina

FILED
December 13, 2018

cc:
Jason Michael Imhoff, Esquire
Chad McQueen Graham, Esquire
Robert T. Lyles, Jr., Esquire
Carl Reed Teague, Esquire