SECTION 07 54 19
POLYVINYL-CHLORIDE (PVC) ROOFING

SPEC WRITER NOTES:
1. Delete text between // _____ // not applicable to project. Edit remaining text to suit project.
2. Follow National Roofing Contractors Association "The NRCA Roofing Manual" recommendations for design criteria.
3. Slopes: Do not use on slopes over 1/10 (1 inch per 12 inches). Provide 1/50 (1/4 inch per 12 inches) minimum slope to drains without any "Gutters" (no slopes between drains). NO EXCEPTIONS TO MINIMUM SLOPE. Slope crickets 1/50 (1/4 inch per 12 inches).
4. Coordinate with plumbing requirements for roof drains and drain locations at low points and mid span where maximum deflection occurs. Do not put drains at columns or on slopes. Coordinate with insulation to provide sumps at drains.
5. Coordinate details and systems used to provide code required fire rated roofing system.
6. Adhered system is preferred over mechanically fastened system.
7. Coordinate with Section 07 22 00, ROOF AND DECK INSULATION. Decrease R-value 5 percent when mechanical fasteners are used through insulation to compensate for parallel heat flow.
9. Do not use over polystyrene, urethane, or wood fiberboard insulation under membrane.
10. Do not use over bituminous materials where direct contact occurs, including grease, oil, or other substances not compatible with PVC. Use thin layer of insulation, slip sheet or separator sheet depending upon method of attachment or felt back sheet when minimum amount of asphalt occurs.
11. Terminate base flashings minimum 200 mm (8 inches) above roof surface including curb for building expansion joints.
12. Do not put expansion joints at roof surface level.
13. Do not use "pitch pocket" or "sealant pockets" in lieu of base flashings and cap flashings.
14. This specification is for use over concrete, cellular insulating concrete decks, or insulation. Insert additional text when installed directly to other

decks or insulation systems not specified in Section 07 22 00, ROOF AND DECK INSULATION.
15. Do not use pipe boots that provide less than 200 mm (8 inch) height above roof.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyvinyl chloride (PVC) sheet roofing // adhered // mechanically fastened // to insulated // concrete // metal // roof deck.

1.2 RELATED REQUIREMENTS

SPEC WRITER NOTE: Update and retain references only when specified elsewhere in this section.

A. Non-Flooring Adhesives and Sealants VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Preparation of Existing Membrane Roofs and Repair Areas: Section 07 01 50.19, PREPARATION FOR REROOFING.

C. Substrate Board, Vapor Retarder, Roof Insulation, and Cover Board: Section 07 22 00, ROOF AND DECK INSULATION.

D. Roof Membrane Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

1. FX-1-01(R2006) - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
2. RP-4 2013 - Wind Design Standard for Ballasted Single-ply Roofing Systems.

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):

1. 7-10 - Minimum Design Loads for Buildings and Other Structures.

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

1. 90.1-13 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ASTM International (ASTM):

1. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
2. C140/C140M-15 - Sampling and Testing Concrete Masonry Units and Related Units.
3. C578-15b – Specification for Rigid, Cellular Polystyrene Thermal Insulation.
4. C936/C936M-15 - Solid Concrete Interlocking Paving Units.
5. C1371-15 - Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
6. C1549-09(2014) - Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
7. D751-06(2011) – Test Methods for Coated Fabrics.
8. D4263-83(2012) - Indicating Moisture in Concrete by the Plastic Sheet Method.
9. D4434/D4434M-12 - Poly (Vinyl Chloride) Sheet Roofing.
10. E96/E96M-15 - Water Vapor Transmission of Materials.
11. E408-13 - Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
12. E1918-06(2015) - Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
13. E1980-11 - Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

F. Cool Roof Rating Council (CRRC):
   1. 1-15 - Product Rating Program.

G. Florida Department of Business and Professional Regulation (FL):
   1. Approved - Product Approval.

H. National Roofing Contractors Association (NRCA):
   1. Manual-15 - The NRCA Roofing Manual: Membrane Roofing Systems.

I. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog.

J. UL LLC (UL):
   1. 580-06 - Tests for Uplift Resistance of Roof Assemblies.
   2. 1897-15 - Uplift Tests for Roof Covering Systems.

K. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
   1. DOC PS 1-09 - Structural Plywood.
   2. DOC PS 2-04 - Performance Standard for Wood-Based Structural-Use Panels.

L. U.S. Environmental Protection Agency (EPA):

SPEC WRITER NOTE: Energy Star Version 2.3 is in effect until June 30, 2017. Version 3.0 becomes effective July 1, 2017.

1. Energy Star - ENERGY STAR Program Requirements for Roof Products // Version 2.3. // Version 3.0. //

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at the Project site minimum 30 days before beginning Work of this section.

SPEC WRITER NOTE: Edit participant list to ensure entities influencing outcome attend.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. // Architect/Engineer. //
   c. // Inspection and Testing Agency. //
   d. Contractor.
   e. Installer.
   f. // Manufacturer's field representative. //
   g. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof specialties, roof accessories, utility penetrations, rooftop curbs and equipment, lightning protection, and // _____ //.

SPEC WRITER NOTE: Edit meeting agenda to incorporate project specific topics.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Inspecting and testing.
   i. Other items affecting successful completion.
   j. Pull out test of fasteners.
   k. Material storage, including roof deck load limitations.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Roofing membrane layout.

SPEC WRITER NOTE: Retain paragraph below for mechanically fastened membrane.

2. Roofing membrane fastener pattern and spacing.
3. Roofing membrane seaming and joint details.
4. Roof membrane penetration details.
5. Base flashing and termination details.
6. Paver layout.
7. Paver anchoring locations and details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Minimum fastener pull out resistance.
3. Installation instructions.
4. Warranty.

SPEC WRITER NOTE: Retain paragraph below when retaining requirement for use of Federally-mandated products under Quality Control Article above.

5. Product Data for Federally-Mandated Bio-Based Materials: For roof materials, indicating USDA designation and compliance with definitions for bio-based products, Rapidly Renewable Materials, and certified sustainable wood content.

D. Sustainable Construction Submittals:

SPEC WRITER NOTE: Retain sustainable construction submittals appropriate to product.

1. Solar Reflectance Index (SRI) for roofing membrane.
2. Low Pollutant-Emitting Materials:

a. Show volatile organic compound types and quantities.

3. Energy Star label for roofing membrane.

E. Samples:
   1. Roofing Membrane: 150 mm (6 inch) square.
   2. Base Flashing: 150 mm (6 inch) square.
   3. Fasteners: Each type.
   4. Roofing Membrane Seam: 300 mm (12 inches) square.

F. Certificates: Certify products comply with specifications.
   1. Fire and windstorm classification.

SPEC WRITER NOTE: Retain paragraph below for Florida and Gulf coast projects.

   2. High wind zone design requirements.
   3. Energy performance requirements.

G. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer, including supervisors // with project experience list //.
   2. Manufacturer's field representative // with project experience list //.

H. Field quality control reports.

SPEC WRITER NOTE: Retain paragraph below for reroofing projects.

I. Temporary protection plan. Include list of proposed temporary materials.

J. Operation and Maintenance Data:
   1. Maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
   2. Regularly installs specified products.
   3. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. // Project Experience List: Provide contact names and addresses for completed projects. //
   4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.

B. Manufacturer's Field Representative:

1. Manufacturer's full-time technical employee or independent roofing inspector.
2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

A. Comply with NRCA Manual storage and handling requirements.

B. Store products indoors in dry, weathertight facility.

C. Store adhesives according to manufacturer's instructions.

D. Protect products from damage during handling and construction operations.

E. Products stored on the roof deck must not cause permanent deck deflection.

1.9 FIELD CONDITIONS

A. Environment:

SPEC WRITER NOTE: Coordinate installation temperature with available adhesives. Solvent based adhesives can be used at lower temperatures.

1. Product Temperature: Minimum 4 degrees C (40 degrees F) and rising before installation.
2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.10 WARRANTY

SPEC WRITER NOTE: Always retain construction warranty. FAR includes Contractor's one year labor and material warranty.

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

SPEC WRITER NOTE:
1. Specify extended manufacturer's warranties for materials only.
2. Contracting Officer's Representative must approve specification of a manufacturer's warranty.

B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.

SPEC WRITER NOTE: Specify customarily available warranty period for specified products.

1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Roofing System: // Adhered // Mechanically fastened // roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards // vapor retarders // pavers // copings // edge metal // and // walkway pads //.

2.2 SYSTEM PERFORMANCE

A. Design roofing system meeting specified performance:

1. Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings.

SPEC WRITER NOTE: Specify actual loads for project if not indicated on the Drawings.

a. Uplift Pressures:

1) Corner Uplift Pressure: // _____ // kPa/sq. m (// _____ // psf).

2) Perimeter Uplift Pressure: // _____ // kPa/sq. m (// _____ // psf).

3) Field-of-Roof Uplift Pressure: // _____ // kPa/sq. m (// _____ // psf).

SPEC WRITER NOTE: Retain one or more paragraphs below for compliance with: a. Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings incorporated in

Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management, dated January 24, 2007.
b. Energy Policy Act of 2005 (EPA 2005).
c. Energy Independence and Security Act of 2007 (EISA 2007).
d. LEED mandate.
e. Conformance with locally-applicable requirements.

2. Energy Performance:

SPEC WRITER NOTE: Retain paragraph below for Energy Star compliance.

a. EPA Energy Star Listed for low-slope roof products.

SPEC WRITER NOTE: Retain paragraph below for LEED heat island effect (roof) credit compliance.

b. ASTM E1980; Minimum 78 Solar Reflectance Index (SRI).

SPEC WRITER NOTE: Retain paragraph below for California Energy Commission (CEC) Title 24 compliance.

c. CRRC-1; Minimum 0.70 initial solar reflectance and minimum 0.75 emissivity.

SPEC WRITER NOTE: Typically retain below for VA new construction and reroofing projects in ASHRAE Climate Zones 1 through 3 and elsewhere where cool roof technology is cost-effective.

d. Three-Year Aged Performance: Minimum 0.55 solar reflectance tested in according to ASTM C1549 or ASTM E1918, and minimum 0.75 thermal emittance tested in according to ASTM C1371 or ASTM E408.
   1) Where tested aged values are not available:
      a) Calculate compliance adjusting initial solar reflectance according to ASHRAE 90.1.
      b) Provide roofing system with minimum 64 three-year aged Solar Reflectance Index calculated according to ASTM E1980 with 12 W/sq. m/degree K (2.1 BTU/h/sq. ft.) convection coefficient.

2.3 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Provide roof system components from one manufacturer.

C. Sustainable Construction Requirements:

SPEC WRITER NOTE:
1. Retain paragraph below when complying with Federal Guiding Principles IV from Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings incorporated in Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management, dated January 24, 2007, Enhance Indoor Environmental Quality - Biobased Content Requirement. Requirement differs from related requirements in LEED definitions.
2. Indicate project goals for percentages of bio-based, rapidly-renewable, and certified sustainable wood products in Section 01 00 00, GENERAL REQUIREMENTS.

1. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

SPEC WRITER NOTE:
1. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS includes comprehensive product list setting VOC limits for low-emitting materials.
2. Retain subparagraphs applicable to products specified in this section.

2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:

   a. Non-flooring adhesives and sealants.

2.4 PVC ROOFING MEMBRANE

SPEC WRITER NOTE:
1. Type III and Type IV are available with or without fabric backing. Type II

is available without fabric backing, only.
2. Use fabric-backed sheet for adhered systems to cellular insulating concrete, structural concrete, or when re-roofing over other incompatible substrates where the manufacturer recommends a fabric backing for separation.
3. Use sheets without fabric backing when adhering to rigid insulation boards and cover boards.
4. Do not use PVC sheet in ballasted applications. Use Type II for adhesive applications only.
5. Use adhered systems over cover boards on new VA construction unless other application is specifically approved by VA.

A. PVC Sheet: ASTM D4434/D4434M, // Type II - reinforced // Type III - fabric reinforced // or // Type IV - fabric reinforced //.
   1. Backing: // Without fabric backing // With fabric backing //.
   2. Thickness: // 1.5 mm (60 mils) // 2.0 mm (80 mils) //.

SPEC WRITER NOTE: PVC is available in white, gray, tan, and other colors. Confirm color selection meets energy performance requirements.

   3. Color: See Section 09 06 00, SCHEDULE OF FINISHES.

B. Additional Properties:
   1. Water Vapor Permeance, ASTM E96/E96M: Minimum 8 ng/Pa/s/sq. m (0.14 perms) (Water Method).

2.5 MEMBRANE ACCESSORY MATERIALS

A. Flashing Sheet: Manufacturer's standard; same material, type, reinforcement, thickness, and color as roofing membrane.

SPEC WRITER NOTE: Solvent based adhesives may be required for roofing installation in cold climates.

B. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.

C. Splice Lap Sealant: Manufacturer's standard for exposed lap edge, matching roof membrane color.

D. Bonding Adhesive: Manufacturer's standard, // water // solvent // based, to suit substrates.

E. Termination Bars: Manufacturer's standard, stainless steel or aluminum, 25 mm wide by 3 mm thick (1 inch wide by 1/8 inch thick) factory drilled for fasteners.

F. Battens: Manufacturer's standard, galvannealed or galvanized steel, 25 mm wide by 1.3 mm thick (1 inch wide by 0.05 inch thick) factory punched for fasteners.

G. Pipe Compression Clamp:

1. Stainless steel drawband.
2. Worm drive clamp device.

H. Fasteners: Manufacturer's standard coated steel with metal or plastic plates to suit application.

I. Protection Sheet: UV-resistant fabric and weight recommended by roofing manufacturer for installation under pavers.

J. Miscellaneous Accessories: Provide other accessories required by manufacturer for complete, watertight installation.

2.6 ROOF PAVERS

SPEC WRITER NOTE:
1. Ensure pavers are detailed showing size and shape.
2. Do not exceed 600 mm square (24 inches square) for non-interlocking units with approximate weight of 23 kg (50 lbs.) each.
3. Pavers require 73 kg/sq. m (15 lbs./sq. ft.) minimum for fire rating.
4. Interlocking pavers are preferred over non interlocking pavers.
5. Use interlocking type that have been tested in a wind tunnel for wind uplift.
6. Do not use light weight aggregate pavers.
7. Retain ribbed bottom surface when pavers are installed directly on roof membrane.

A. Roof Pavers: Precast, normal weight, // interlocking // non-interlocking // concrete units // with ribbed bottom surface for drainage //.

1. Weight: Minimum 73 kg/sq. m (15 lbs./sq. ft.).
2. Size: As indicated on drawings.
3. Compressive Strength: ASTM C140; Minimum (8,000 psi).
4. Water Absorption: ASTM C936; Maximum 5 percent.
5. Freeze Thaw: ASTM C67; Maximum 1 percent mass loss.

2.7 ACCESSORIES

A. Temporary Protection Materials:

1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify substrate suitability for product installation with roofing installer and roofing inspector present.

SPEC WRITER NOTE: Require firestopping verification for fire rated roof assemblies.

1. Verify roof penetrations are complete, secured against movement, // and firestopped //.
2. Verify roof deck is adequately secured to resist wind uplift.
3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

B. Correct unsatisfactory conditions before beginning roofing work.

3.2 PREPARATION

A. Complete roof deck construction before beginning roofing work:

1. Install curbs, blocking, edge strips, nailers, and other components to which roofing membrane and base flashing are attached.
2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.
3. Document installation of related materials to be concealed before installing roofing work.

B. Dry out wet substrate surfaces // including roof deck flutes //. Apply materials to dry substrates, only.

C. Broom clean roof decks. Remove dust, dirt and debris.

D. Remove projections capable of damaging roofing materials.

E. Concrete Decks, except Insulating Concrete:

1. Test concrete decks for moisture according to ASTM D4263 before installing roofing materials.
2. Prime concrete decks. Keep primer back 100 mm (f4our inches) from precast concrete deck joints.

3. Allow primer to dry before application of bitumen.

F. Insulating Concrete Decks:

1. Allow deck to dry out minimum five days after installation before installing roofing materials.
2. Allow additional drying time when precipitation occurs before installing roofing materials.

G. Existing Membrane Roofs and Repair Areas:

1. Comply with Section 07 01 50.19 PREPARATION FOR REROOFING.

3.3 TEMPORARY PROTECTION

A. Install temporary protection at end of each day's work, when work is halted indefinitely, and when precipitation is imminent. Comply with approved temporary protection plan.

B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.

C. Temporarily seal exposed insulation surfaces within roofing membrane.

1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.
2. Direct water away from work. Provide drainage, preventing water accumulation.
3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.

D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.

1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.

E. Remove sandbags and store for reuse.

3.4 INSTALLATION, GENERAL

A. Install products according to manufacturer's instructions // and approved submittal drawings //.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with NRCA Manual installation requirements.

SPEC WRITER NOTE: The code requires roof coverings on fully adhered or mechanically fastened non-ballasted roofs to be tested according to UL 580 or UL 1897.

C. Comply with // UL 580 // UL 1897 // for uplift resistance.

D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with PVC.

3.5 ROOFING INSTALLATION

A. Install membrane perpendicular to long dimension of insulation boards.

B. Begin membrane installation at roof low point and work towards high point. Lap membrane shingled in water flow direction.

C. Position membrane free of buckles and wrinkles.

D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas.

1. Allow 30 minutes for membrane to relax before proceeding.
2. Lap edges and ends minimum 50 mm (2 inches).
3. Heat weld or solvent weld laps. Apply pressure to develop full adhesion with minimum seam strength according to ASTM D4434/D4434M.
4. Check seams to ensure continuous adhesion and correct defects.
5. Finish seam edges beveled bead of sealant.
6. Finish seams same day as membrane is installed.
7. Anchor membrane perimeter to roof deck and parapet wall as indicated on drawings.

E. Membrane Perimeter Anchorage:

1. Install batten with fasteners at perimeter of each roof area, curb flashing, expansion joints and similar penetrations on top of roof membrane as indicated on drawings.
2. Space fasteners maximum 300 mm (12 inches) on center, starting 25 mm (1 inch) from ends.
3. When battens are cut round corners and eliminate sharp corners.
   a. Stop batten where batten interferes with drainage. Space ends of batten 150 mm (6 inch) apart.
4. Cover batten with 150 mm (6 inch) wide roof membrane strip; heat or solvent weld to roofing membrane and seal edges.

5. At // gravel stops, // fascia-cants, // turn roofing membrane down over front edge of blocking or nailer. Secure roofing membrane to vertical portion of nailer with fasteners spaced maximum 150 mm (6 inches) on center.
6. At parapet walls, intersecting building walls and curbs, secure roofing membrane to structural deck fasteners 150 mm (6 inches) on center or as shown in NRCA Manual.

F. Adhered System Installation:
1. Apply bonding adhesive in quantities required by roofing membrane manufacturer.
2. Fold sheet back on itself after rolling out and coat bottom side of roofing membrane and top substrate with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's instructions, roll roofing membrane into adhesive minimizing voids and wrinkles.
4. Repeat for other half of sheet.
5. Cut voids and wrinkles to lay flat. Clean and patch cut area.

G. Mechanically Fastened System Installation:
1. Secure roofing membrane to structural deck with fasteners through battens to achieve specified wind uplift performance.
   a. Drill pilot holes for fasteners installed into cast-in-place concrete. Drill hole minimum 10 mm (3/8 inch) deeper than fastener penetration.
2. When fasteners are installed within membrane laps, locate battens minimum 13 mm (1/2 inch) from edge of sheets.
3. Where fasteners are installed over roofing membrane after seams are welded, cover fasteners with minimum 175 mm (7 inch) diameter PVC membrane cap centered over fasteners. Where battens are used cover batten with minimum 175 mm (7 inch) wide PVC strip centered over batten. Weld cap to roofing membrane and finish edges with lap sealant.

3.6 FLASHING INSTALLATION

A. Install flashings on same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.

SPEC WRITER NOTE:
1. Ensure roof drain flashing details are shown on drawings with sump to depress notched clamping ring below roof surface.
2. Offset drains in sump to side of steel beams so drain is not above low point when roof slope terminates on top of beam.

B. Flashing Roof Drains:

1. Install roof drain flashing according to roofing membrane manufacturer's instruction.
   a. Install metal drain flashing in asphalt roof cement, holding cement back from edge of metal flange.
   b. Do not allow roof cement to contact PVC roofing membrane.
   c. Adhere roofing membrane to metal flashing with bonding adhesive.
2. Turn metal drain flashing and roofing membrane down into drain body. Install clamping ring and strainer.

SPEC WRITER NOTES:
1. See NRCA Manual for base flashing details.
2. Use with metal cap flashing.
3. Do not use "pitch pocket" or "sealant pocket" construction detail.
4. Coordinate with sheet metal work to provide metal cap flashing for base flashing on curbs and walls and penetrations. Use surface mounted reglets on existing walls.
5. Do not terminate base flashing or membrane edge exposed on top of parapet walls or in reglets on horizontal or sloped wash surface.
6. Terminate only under cap flashings or coping covers except gravel stops and for draw bands on pipe boots.
7. Use 200 mm (8 inch) minimum height for base flashing.

C. Installing Base Flashing and Pipe Flashing:

1. Install flashing sheet to pipes, walls and curbs to minimum 200 mm (8 inches) height above roof surfaces and extend roofing manufacturer's standard lap dimension onto roofing membranes.
   a. Adhere flashing with bonding adhesive.
   b. Form inside and outside corners of flashing sheet according to NRCA Manual.
   c. Form pipe flashing according to NRCA Manual.

d. Lap ends roofing manufacturer's standard dimension.

e. Weld flashing sheets together, and weld flashing sheets to roofing membranes. Finish exposed edges with lap sealant.

2. Anchor top of flashing to walls and curbs with fasteners spaced maximum 150 mm (6 inches) on center. Use surface mounted fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.

3. Apply sealant to top edge of flashing.

D. Installing Building Expansion Joints:

SPEC WRITER NOTES:
1. Do not put expansion joints at roof membrane level.
2. Design joints to be installed on curbs minimum 200 mm (8 inches) high especially at walls.
3. Detail expansion joint.

1. Install base flashing on curbs as specified.

2. Coordinate installation with // metal expansion joint cover // roof expansion joint system //.

3. Install flexible tubing 1-1/2 times width of joint centered over joint. Cover tubing with flashing sheet adhered to base flashing and lapping base flashing roofing manufacturer's standard dimension. Finish edges of laps with lap sealant.

E. Repairs to Membrane and Flashings:

1. Remove sections of roofing membrane and flashing sheets that are creased, wrinkled, or fishmouthed.

2. Cover removed areas, cuts and damaged areas with patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Weld patch to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

3.7 FLEXIBLE WALKWAYS

SPEC WRITER NOTES:
1. Use manufactured walkway pad for walkways over roof areas which do not have paver walkways between equipment.
2. Clearly indicate on roof plan PVC walkways.

A. Walkway Pad: PVC walkway pad with slip resistant surface and molded channels on the underside for water drainage.

3.8 PAVER INSTALLATION

SPEC WRITER NOTES:
1. Use pavers in the following locations as a minimum:
a. At working and access areas of equipment requiring servicing.
b. At equipment having discharges detrimental to roof membrane, under gooseneck discharges from kitchens and chemical exhausts.
c. At landing points for hatches, ladders, and doors entering roof level.
2. Confirm that walkways and pavers are shown on drawings.
3. Specify pavers and anchorage for pavers when weight of pavers does not meet requirements for wind velocities according to ANSI/SPRI RP-4.
4. Pavers without interlocking connectors require strapping together and edge clamps when pavers do not provide minimum weight for wind uplift resistance.
5. Use mechanical strapping to create perimeter anchor, at penetrations, cuts at valleys, over drains, and where partial or cut units occur.
6. Detail strapping, perimeter restraints, edge clamps and location of strapping. Do not anchor through base flashing or into cants.
7. Interlocking connectors:
a. Use 400 mm (16 inches) on center minimum spacing of connectors.
b. Decrease spacing to 300, 200, or 100 mm (12, 8, or 4 inches) on center for greater wind velocities.

A. Saw cut or core drill pavers for cut units.

B. Apply protection sheet over roof membrane. Overlap and install additional layers as recommended by roofing manufacturer.

C. Install pavers with butt joints in running bond with minimum one half-length units at ends.
   1. Stagger end joints; generally locate joints near midpoint of adjacent rows, except where end joints occur in valleys. Miter end joints to fit in valleys.
   2. Cut to fit within 13 mm (1/2 inch) of penetrations.

D. Install interlocking connectors in channel units for complete tie in of units, including cut units. Use corner spacings for distance of 1200 mm

(4 feet) or more around roof drains, penetrations, and other vertical surfaces in field of roof area.

1. Space connectors at // _____ // mm (// _____ // inches) on center at corners for 3 m (10 foot) square area.
2. Space connectors at // _____ // mm (// _____ // inches) on center at perimeter for 1800 mm (6 foot) wide strip.
3. Space connectors at // _____ // mm (// _____ // inches) on center in field.
4. Install pavers under the perimeter retainer as shown.

E. Install strapping where shown.

1. Limit strap lengths to maximum of 9 m (30 feet).
2. Install straps at corner connection to perimeter retainer at approximate 45 degree angle at approximate 3 to 3.6 m (10 to 12 feet) from corner.
3. Install straps on both sides of valleys, hips, and ridges, with cross straps spaced maximum 1200 mm (4 feet) on center between the end straps.
4. Install straps at perimeter of penetrations more than two paves in width or length.
5. Anchor straps to each paver with two fasteners per unit.
6. Pre-drill holes for fasteners in pavers.

3.9 FIELD QUALITY CONTROL

SPEC WRITER NOTES: Section 01 45 29, TESTING LABORATORY SERVICES includes VA provided testing for large projects and contractor provided testing for small projects. Coordinate testing responsibility.

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

SPEC WRITER NOTE: ANSI/SPRI FX-1 sets testing frequency as 10 tests for first 4,650 sq. m (50,000 sq. ft.) and five tests for each additional 4,650 sq. m (50,000 sq. ft.). Specify frequency to suit project conditions.

1. Fastener Pull Out Tests: ANSI/SPRI FX-1; one test for every 230 sq. m (2,500 sq. ft.) of deck. Perform tests for each

combination of fastener type and roof deck type before installing roof insulation.

a. Test at locations selected by Contracting Officer's Representative.
b. Do not proceed with roofing work when pull out resistance is less than manufacturer's required resistance.
c. Test Results:
    1) Repeat tests using different fastener type or use additional fasteners achieve pull out resistance required to meet specified wind uplift performance.
    2) Patch cementitious deck to repair areas of fastener tests holes.

SPEC WRITER NOTE: Select one or both of following two paragraphs based upon project requirements. VA may elect to perform or hire roofing inspector. VA may also elect to require contractor to retain roofing inspector, either as qualified representative of manufacturer or independent third party inspector.

2. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.
3. Probe seams to detect marginal welds, voids, skips, and fishmouths.
4. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.
5. Cut one sample for every 450 m (1500 feet) of seams.
6. Cut samples perpendicular to seams.
7. Failure of samples to pass ASTM D751 test will be cause for rejection of work.
8. Repair areas where samples are taken and where marginal bond, voids, and skips occur.
9. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.

B. Manufacturer Services:
1. Inspect initial installation, installation in progress, and completed work.
2. Issue supplemental installation instructions necessitated by field conditions.

3. Prepare and submit inspection reports.
4. Certify completed installation complies with manufacturer's instructions and warranty requirements.

3.10 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed roofing surfaces. Remove contaminants and stains // to comply with specified solar reflectance performance //.

3.11 PROTECTION

A. Protect roofing system from // traffic and // construction operations.
   1. Protect roofing system when used for subsequent work platform, materials storage, or staging.
   2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.

B. Loose lay temporary insulation board overlaid with plywood or OSB.
   1. Weight boards to secure against wind uplift.

C. Remove protection when // no longer required // when directed by Contacting Officer's Representative //.

D. Repair damage.

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