

Application Guidelines for Thermoplastic Roofing Systems

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Disclaimer

SPRI has prepared these generic specifications for use only as a guideline. The guide is not intended to be used verbatim as an actual specification. Specifc installation instructions and procedures for each particular job must be obtained from the manufacturer supplying the materials. SPRI, its members and employees do not warrant that this standard is proper and applicable under all conditions.

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1.0 General

1.01 Description

- A. This guideline describes typical application methods for thermoplastic single-ply roofing membranes. The SPRI manufacturer/supplier shall be contacted for specific information about particular products and systems.
- B. These membranes are applicable for new roofing, replacement, and recovering on substrates that have been accepted by the SPRI manufacturer/supplier.

1.02 Scope

The roofing contractor shall furnish and install a thermoplastic roofing membrane as described in this guideline and in accordance with the requirements of the SPRI manufacturer/supplier.

1.03 Quality Assurance

- A. The roofing system shall be installed by a contractor authorized by the SPRI manufacturer/supplier.
- B. There shall be no deviations from the SPRI manufacturer/supplier's specifications or the approved shop drawings without the prior written approval of the SPRI manufacturer/supplier.
- C. Applicable code/insurance requirements shall be identified by the owner or his representative.
- D. Upon completion of the installation, an inspection may be required by a representative of the SPRI manufacturer/supplier to determine that the visible elements of the roofing system have been installed in accordance with the SPRI manufacturer/supplier's specifications, details and approved changes.

1.04 Submittals

- A. Shop drawings required by the project specifications shall be accepted by the SPRI manufacturer/supplier prior to submittal.
- B. The contractor shall submit written verification from the SPRI manufacturer/supplier that he/she is an authorized applicator.
- C. The contractor shall verify that the specifications for the roofing project are in accordance with the recommendations of the SPRI manufacturer/ supplier.
- D. The contractor shall submit evidence that the system to be installed meets specified code/insurance requirements.

1.05 References

- A. Flexible Membrane Roofing: A Professional's Guide to Specifications, SPRI.
- B. ANSI/SPRI WD-1, Wind Design Standard Practice for Roofing Assemblies.
- C. ANSI/SPRI RP-4, Wind Design Standard for Ballasted Single-Ply Roofing Systems.
- D. SPRI Application Guidelines for Fasteners Used with Flexible Membrane Roofing Systems.
- E. Loss Prevention Data Sheet 1-49, "Perimeter Flashing." Factory Mutual Systems.
- F. ANSI/SPRI ES-1, Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.
- G. SPRI, Guidelines for the Fabrication of Seams of Thermoplastic Roofing Membranes Using Hot Air Welding Procedures.

1.06 Delivery, Storage & Handling

A. Materials shall be delivered in their original, unopened containers.

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- B. Packaging shall be clearly labeled with the manufacturer/supplier's name, product name, and other identifying information as appropriate.
- C. All materials shall be properly stored and protected as recommended by their manufacturers/suppliers.
- D. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Precautions outlined on containers or provided by the manufacturer/supplier shall be followed.
- E. All materials shall be protected from damage.
- F. Materials damaged in handling or storage shall not be used without the authorization of the manufacturer/supplier.
- G. Material Safety Data Sheets available from the manufacturer/supplier shall be available at the job site at all times.

1.07 Job Conditions

- A. If waste products, petroleum, grease, oil, solvents, mineral oil or other contaminants come into contact with the roofing system, the SPRI manufacturer/supplier shall be contacted for protection or repair requirements.
- B. Roofing materials shall not be installed during periods of precipitation. Some membranes may be installed under certain adverse weather conditions (temperature, moisture, humidity, etc.); the contractor shall consult with the manufacturer/supplier as certain precautions may apply.
- C. Each day's roofing work shall be completed in accordance with the SPRI manufacturers/supplier's specifications including flashings, terminations, and surfacing.
- D. When the roofing contractor will not be the primary contractor: The roofing contractor shall advise the general contractor concerning potential damage to the membrane and the precautions to be taken to avoid such damage during construction.

When the roofing contractor will be the primary contractor: The roofing contractor shall take precautions necessary to avoid damage to the membrane during construction.

- E. When staging material on the roof and during application, the contractor or specifier shall ensure that overloading of the deck and structure does not occur.
- F. For projects requiring removal of the existing roof system: Only as much existing roofing and insulation as can be replaced and made watertight the same day shall be removed.
- G. The substrate shall be suitable to receive the thermoplastic membrane.
- H. Any deteriorated deck or flashing substrate which is discovered shall be promptly reported to the architect or owner.
- I. The roofing contractor or specifier shall investigate all existing roof drain lines. Non-functioning drains shall be reported to the owner's representative prior to job start.
- J. The contractor shall conform to all OSHA, EPA and other pertinent safety requirements.
- K. Installation of a thermoplastic membrane system over an existing coal tar pitch or resaturated built-up roof may require that special precautions be included in the design and application. The SPRI manufacturer/supplier shall be contacted for additional design information.
- L. When expanded or extruded polystyrene insulation is proposed: The membrane and insulation shall be compatible or special precautions may be required. The SPRI manufacturer/supplier shall be contacted for additional design information.
- M. PVC membranes shall not be installed in direct contact with any bituminous products or materials containing bitumens or derivatives thereof, unless specifically accepted by the SPRI manufacturer/supplier. With specific PVC systems adhered with hot asphalt, the asphalt shall be kept from contacting the exposed surface of the sheet.

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1.08 Warranty

Various warranty types may be available from the SPRI manufacturer/supplier. Consult the SPRI manufacturer/supplier for durations and terms available.

2.0 Products

2.01 General

All components of the roofing system shall be manufactured, supplied or accepted by the SPRI manufacturer/supplier.

2.02 Membrane

- A. The roofing membrane shall be provided in a thickness recommended by the SPRI manufacturer/supplier for the intended application.
- B. It is advisable to prevent chemical contaminants from coming into direct contact with the roofing membrane. If resistance to specific chemicals is required, contact the SPRI manufacturer/supplier for recommendations.

2.03 Components

- A. Flashings
 - 1. Membrane flashings
 - 2. Coated or laminated metal flashings
 - 3. Prefabricated flashings
- B. Bonding Adhesive
- C. Sealant/Caulking
- D. Seaming Components
 - 1. Solvent welding solution and equipment
 - 2. Hot air welding equipment
- E. Lap Sealant
- F. Daily Seal
- G. Mechanical Termination: metal, plastic, rubber, beveled wood, or plates and screws
- H. Surface Mounted Reglet: corrosion resistant material
- I. Foam Rod Stock
- J. Separation Layer
- K. Vapor or Air Retarder
- L. Insulation
- M. Sheet Metal: aluminum, galvanized steel, stainless steel, copper
- N. Sheet Metal Fasteners: annular ring nails or screws compatible with specified sheet metal material
- O. Membrane/Insulation Fasteners and Plates: conforming to the performance requirements defined in the SPRI Application Guidelines for Fasteners Used with Flexible Membrane Roofing Systems
- P. Batten Strips
- Q. Thermal Barrier: as required by code/insurance requirements
- R. Wood Nailers: #2 or better lumber
- S. Roof Walkways: pads, wood planks, coatings, or weather-resistant concrete roofing pavers
- T. Ballast: Refer to ANSI/SPRI RP-4 Wind Design Standard for Ballasted Single-ply Roofing Systems
- U. Protective Mat: when using rough surface paver blocks, crushed stone, or a protected membrane system.

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3.0 Execution

3.01 Pre-Job

The primary contractor shall conduct a pre-roofing conference before any work begins, so all parties involved in the roofing system construction, or who may work on or through the roofing system, understand their obligations with respect to the roofing membrane.

3.02 Substrate Inspection/Approval

- A. A proper substrate (as defined by the SPRI manufacturer/supplier) shall be provided to receive the roofing system. The roofing contractor shall notify the owner or architect in writing of any defects in the substrate. Work shall not proceed until the substrate has been repaired or replaced.
- B. The roof surface shall be free of standing water, ice, snow or other forms of moisture.
- C. Slope
 - 1. [Steep slopes may require additional design considerations. The SPRI manufacturer/supplier shall be consulted for more information.]
 - 2. For ballasted systems: The roof slope shall be a maximum of 2 inches per horizontal foot.

3.03 Substrate Preparation

- A. For existing graveled surfaces: Loose gravel shall be removed. If necessary, accumulations of bitumen or other irregularities shall be scratched and removed so as to produce a flat, smooth surface. Insulation boards shall lay flat forming a continuous plane from one board to another.
- B. All areas of wet insulation shall be removed and replaced.
- C. Surfaces on which the thermoplastic membrane is to be applied shall be compatible, clean, smooth, free of fins, sharp edges, loose and foreign material, such as oil, grease and bitumen.
- D. Building codes may require a thermal barrier between the roof deck and some roof insulations.
- E. The SPRI manufacturer/supplier's specifications for substrate preparation shall be satisfied prior to membrane application.
- F. The design professional shall determine the necessity for and the placement of the vapor retarder within the roof system assembly.

3.04 Wood Nailers

- A. Treated wood nailers shall be installed at the perimeter of the entire roof and around roof projections and penetrations as specified on project drawings and in accordance with the requirements of the SPRI manufacturer/supplier.
- B. Nailers shall be securely anchored to the deck to resist the minimum force of 100 lbs. per linear foot. [Loss prevention Data Sheet 1-49, "Perimeter Flashing" (Factory Mutual Systems.) contains recommendations for spacing and size of fasteners.]
- C. The thickness of the nailer shall be such that the top of the nailer is flush with the surface to which the membrane is to be applied.

3.05 Insulation

- A. Insulation shall be installed according to the insulation manufacturer/ supplier's instructions.
- B. Insulation shall be adequately supported to sustain normal roof traffic without damage.
- C. Insulation material shall be installed in parallel courses with end joints staggered and adjacent boards butted together with no joint gaps greater than ¼ inch.
- D. Multiple layers of insulation shall be installed when thermal efficiency is desired. When more than one layer of insulation is used, all joints between layers shall be offset.

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- E. Where field trimmed, insulation shall be fitted tightly around roof protrusions and terminations.
- F. Insulation Attachment:
 - When insulation is to be mechanically fastened: Only fasteners, stress plates, and fastening patters accepted for use by both the roofing membrane and insulation manufacturers/suppliers shall be used. Fastening patterns which meet applicable code/insurance requirements shall be utilized.
 - When insulation is to be adhered: Only adhesive accepted by both the roofing membrane and insulation manufacturers/ suppliers shall be used.
- G. Tapered insulation boards shall be installed in accordance with the insulation manufacturers/supplier's shop drawings.
- H. No more insulation shall be applied than can be covered with the roof membrane by the end of the day or the onset of inclement weather.
- I. In protected membrane configurations, the manufacturer's recommended ballasting system shall be immediately installed after laying of the insulation and the required fabric filter layer.

3.06 Fasteners

- A. Fasteners shall be driven perpendicular to the work surface
- B. The fastener assembly (distribution plates, batten bars, and fasteners) shall be installed so as to avoid abrasion or any type of damage to the membrane.
- C. The fastener manufacturer's recommendations shall be followed for:
 - 1. fastener suitability for specific applications.
 - proper drill bit for drilling correct hole size (diameter and depth) into concrete, light weight concrete, gypsum and cementitious/wood fiber decks, when pre-drilling is required.
 - minimum depth of embedment into the deck to achieve required resistance to pull-out. Typical minimum depths of embedment are 1 ¼ inches for structural concrete, ¾ inch for steel and 1 inch for wood.
 - 4. fastener length to provide proper fastening to deck.
 - 5. installation tools.
- D. Fasteners that are improperly installed shall be removed or corrected. Improper installation may be characterized as:
 - 1. Overdriven: Fastener is driven to the point that it is causing the stress distribution surface to become concave or deformed. [Excessive driving may cause failure by disengaging or stripping out the fastener threads from the deck.]
 - 2. Underdriven: Fastener head is not properly seated on the stress distribution surface.
 - 3. Snapped: Fastener breaks under the driving load
 - 4. Bent: Fastener is bent to the point that it adversely affects the installation.
 - 5. Not Engaged: Fastener is improperly located or of insufficient length.

3.07 Separation Layer/Slip Sheet

If required, the separation layer shall be installed directly over the substrate. Care shall be taken to ensure that the separation layer is installed with adequate side and end laps.

3.08 Metal Flashings

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If required by the SPRI manufacturer/supplier, coated or covered metal shall

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be installed. Such flashings shall be located at the perimeter of the entire roof and around such other roof projections and penetrations as specified on the project drawings, and shall be fastened to the wood nailer as required by the SPRI manufacturer/supplier.

3.09 Membrane Installation

- A. Placement
 - 1. Adhered Membranes One part Adhesive
 - a. All loose debris shall be swept from the substrate. The substrate shall be dry before continuing.
 - b. The first membrane sheet shall be positioned over the substrate without stretching.
 - c. For contact adhesives, the membrane sheet shall be folded across its width (narrow dimension) so that half the underside is exposed. For wet lay-in adhesives, the membrane sheet shall be folded back across its length (long dimension) so that half of the underside is exposed. The fold shall be smoothed to eliminate wrinkles and buckles.
 - d. The bonding adhesive shall be stirred for a minimum of 5 minutes, scraping the sides and bottom of the can to ensure complete dispersion of solids.
 - e. Bonding adhesive used in a contact application shall be applied evenly (without globs or puddles) with a plastic core short nap paint roller to the exposed membrane sheet and the substrate. Bonding adhesives used in a wet lay-in application shall be applied to the substrate only. Contact the system supplier for specific bonding adhesive recommendations and coverage rates.
 - f. The bonding adhesive may be spray applied, but back-rolling is typically required to ensure 100 percent coverage. The system supplier should be consulted for recommendations.
 - g. The contact adhesive shall be allowed to dry until it is tacky but will not string or stick to a dry finger touch. The wet lay-in adhesive shall not be allowed to dry.
 - h. The membrane shall be rolled over the coated substrate taking care to avoid forming wrinkles.
 - i. The adhered half of the membrane shall be brushed down with a soft bristle push broom to achieve maximum contact.
 - j. The loose half of the membrane shall be folded back and the application procedure repeated.
 - k. Adjoining membrane sheets shall be installed in a similar manner, overlapping edges a minimum of 3 inches or a dimension required by the system manufacturer/supplier.
 - I. The overlap shall be shingled so as not to restrict water flow.
 - m. The field splicing procedure shall be completed following the system supplier's recommendations and the SPRI guidelines for the fabrication of field splices using liquid and tape adhesives or hot air welding.
 - 2. Adhered Systems Two-Part Polyurethane Adhesives
 - a. All loose debris shall be swept from the substrate. The substrate shall be dry before continuing.
 - b. The first membrane sheet shall be positioned over the substrate without stretching.
 - c. The membrane sheet shall be folded back across its width (narrow dimension) so that half the underside is exposed. The fold shall be smoothed to eliminate wrinkles and buckles.

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- d. The polyurethane adhesive shall be spray-applied or applied in beads/ribbons to the substrate only. The adhesive shall be continuously sprayed onto the substrate so that the resultant foam will rise to an approximate ¼ to ¼ inch thickness. Adhesive shall be applied as required by the manufacturer/supplier to the substrate, depending upon the location on the roof (field, perimeter or corner areas) and the exposure conditions of the building. Consult the system supplier for specific requirements.
- e. The adhesive shall be allowed to rise for a sufficient amount of time as required by the manufacturer/supplier. The string/body time will vary depending upon environmental conditions such as temperature and humidity.
- f. The membrane shall be placed over the foamed adhesive and shall be immediately rolled with a 100 to 150 pound roller to ensure embedment into the foam.
- g. The loose half of the membrane shall be folded back and the application procedure repeated.
- h. Adjoining membrane sheets shall be installed in a similar manner, overlapping edges a minimum of 3 inches or a dimension required by the system supplier.
- i. The overlap shall be shingled so as not to restrict water flow.
- j. The field splicing procedure shall be completed following the system supplier's recommendations and the SPRI guidelines for the fabrication of seams using hot air welding.
- 3. Mechanically Attached System Through the Membrane Attachment Method
 - a. All loose debris shall be swept from the substrate. The substrate shall be dry before continuing.
 - b. The membrane sheet(s) shall be positioned over the substrate without stretching. A minimum overlap of 3 inches shall be provided. Consult the system supplier for specific sheet and splice width information. Only as many sheets as can be field spliced in one day shall be positioned.
 - c. The overlap shall be shingled so as not to restrict water flow.
 - d. The field splicing procedure shall be completed following the system supplier's recommendations and the SPRI guidelines for the fabrication of seams using hot air welding.
 - e. Bars, plates or other attachment devices shall be positioned over the membrane following the fastening and layout requirements of the system supplier.
 - f. The bars, plates or other attachment devices shall be stripped in using flashing or membrane as directed by the system supplier.
- 4. Mechanically Attached Systems Under the Membrane Attachment Method
 - a All loose debris shall be swept from the substrate. The substrate shall be dry before continuing.
 - b Plates, bars, strips or other attachment devices shall be positioned across the substrate and fastened to the deck as directed by the system supplier.
 - c The membrane sheet(s) shall be positioned over the substrate and attachment devices without stretching. A minimum overlap of 3 inches shall be provided. Consult the system supplier for specific sheet and splice width information. Only as many sheets as can be field spliced in one day shall be positioned.
 - d The overlap shall be shingled so as not to restrict water flow.

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- e Attach the membrane to the plates, bars, strips or other attachment device as directed by the system supplier.
- f The field splicing of adjoining membrane sheets shall be completed following the system supplier's recommendations and the SPRI guidelines for the fabrication of seams using hot air welding
- 5. Mechanically Attached Systems In-Splice Attachment Method
 - a All loose debris shall be swept from the substrate. The substrate shall be dry before continuing.
 - b The appropriate width membrane sheet(s) shall be positioned along the perimeter of the roof without stretching. A minimum overlap of 5 inches shall be provided. Consult the system supplier for specific sheet and splice width information.
 - c The appropriate width membrane sheet shall be positioned in the field of the roof using the same overlap as referenced above.
 - d The overlap shall be shingled so as not to restrict water flow.
 - e One edge of the membrane sheet shall be secured to the structural deck using fastening plates or bars and mechanical fasteners placed within the field splice. The fastening device shall be located within ½ inch of the inside splice edge on heat welded splices. Typical spacing of fasteners is either 6 or 12 inches on center. Consult the system supplier for specific requirements on fastener spacing.
 - f The adjoining membrane sheet edge shall be overlapped and fastened at the opposite edge as described above.
 - g Work shall continue progressively across the roof area, fastening only as many membrane sheets as can be field spliced in one day.
 - h The field splicing of adjoining membrane sheets shall be completed following the system supplier's recommendations and the SPRI guidelines for the fabrication of seams using hot air welding
- 6. Ballasted Membranes
 - a. All loose debris shall be swept from the substrate. The substrate shall be dry before continuing.
 - b. The membrane sheets shall be positioned over the substrate without stretching. A minimum overlap of 3 inches or of a dimension required by the system supplier shall be provided.
 - c. The overlap shall be shingled so as not to restrict water flow.
 - d. The field splicing procedure shall be completed following the system supplier's recommendations and the SPRI guidelines for the fabrication of seams using hot air welding.
 - e. The membrane shall be ballasted by the end of the day, following the ANSI/SPRI RP-4 Wind Design Guide for Ballasted Roofing Systems.
 - f. Care must be taken during the application of ballast to prevent damage to either the membrane or insulation. Heavily traveled areas during the ballasting operation must be protected by using plywood runways or other such protection.
- B. Membrane Termination/Securement
 - 1. Securement shall be provided at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, etc.
 - 2. Securement shall be provided at any angle change where the slope or

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combined slopes exceed(s) two inches in one horizontal foot.

- 3. Mechanical securement shall meet the pull-out strengths required by the SPRI manufacturer/supplier.
- 4. All membrane termination fasteners shall be sealed in accordance with the SPRI manufacturer/supplier's requirements.

3.10 Flashings

- A. Base Flashing
 - 1. The longest pieces of flashing material which are practical shall be used. All flashing and terminations shall be performed in accordance with the manufacturer/supplier's applicable details.
 - 2. Flashing shall not be applied over existing thru-wall flashings or weep holes.
 - When using flashing on a vertical surface, the flashing shall be secured before the seam between the flashing and the main roof sheet is completed.
 - 4. The flashing membrane shall extend the prescribed distance onto the main roof sheet beyond the mechanical securement.
 - Care shall be taken to ensure that the flashing does not bridge more than ½ inch where there is a change of direction (e.g. where the parapet meets the roof deck).
 - 6. The top of the installed flashings shall be fastened under metal counterflashing, coping cap, or using a termination bar, metal reglet, etc.
- B. Penetrations
 - 1. All penetrations (pipes, supports, soil stacks, cold vents, etc.) passing through the roofing membrane shall be flashed in accordance with the SPRI manufacturer/supplier's specifications.
 - 2. The flashing seal shall be made directly to the penetration passing through the roofing membrane.
 - 3. Existing flashing shall be removed where required. [Where the new flashing is terminated to an intermediate element (metal flashing, masonry, insulation, surface treatment, etc.) which itself could fail and admit moisture beneath the membrane, FAILURE OF THAT ELEMENT TO REPEL MOISTURE MAY BE BEYOND THE LIMITS OF THE FLEXIBLE MEMBRANE ROOFING SYSTEM.]
 - 4. When bonding or sealing directly to metal, the manufacturer/supplier's details shall be consulted for the use of metal primer.
 - 5. Pre-molded or prefabricated flashings shall be used where their installation is recommended by the SPRI manufacturer/supplier. Pre-welded pipe flashings shall not be cut or patched. Pre-molded pipe flashing flanges shall not be overlapped.
 - 6. Pipe Clusters and Unusual Shapes
 - a. Clusters of pipes and other penetrations which cannot be sealed with membrane or prefabricated flashing shall be sealed by surrounding them with pourable sealer.
 - b. Penetration pans shall be installed, flashed, and filled with pourable sealer as shown in the manufacturer's published details.
 - c. Penetration pans shall not be used where pre-molded, prefabricated, or field fabricated flashings are possible.
 - 7. Roof Drains
 - a. Existing flashing and asphalt shall be removed in preparation for sealant and membrane.
 - b. A smooth, clean finish shall be provided on the mating surfaces

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between the clamping ring and the drain base.

- c. Insulation shall be tapered around the drain to prevent the membrane from bridging and to provide a smooth transition from the roof surface to the drain clamping ring.
- d. The seal between the membrane and the drain base shall be provided by sealant under constant, even compression from the drain clamping ring. The sealant shall be as specified by the SPRI manufacturer/supplier.
- e. The contractor shall consult the SPRI manufacturer/supplier's published details for the various methods of installation.
- C. Fascia

Fascia shall be fabricated from membrane-coated metal or other acceptable metal and shall be fastened to the wood nailer as required by the SPRI manufacturer/supplier and ANSI/SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.

- D. Gravel Stops For Ballasted Systems
 - Gravel stops shall be fabricated from membrane-coated metal or other acceptable metal, and shall be fastened to the wood nailer as required by the SPRI manufacturer/supplier.
 - Joints in the gravel stop shall be sealed as required by the SPRI manufacturer/supplier.

3.11 Walkways

A. Walkways shall be provided where specified:

[Walkway systems shall be installed at all traffic concentration points (e.g. roof hatches, access doors, rooftop ladders, etc.) regardless of traffic frequency. Walkways shall be provided in areas receiving regular traffic (once or more per month) to service rooftop units or where a passageway over the surface is required.]

B. Walkways shall not be installed over flashings or field seams.

3.12 Daily Seal

The contractor shall ensure that water does not flow beneath the completed sections of the new roofing system. Daily Seal shall be provided on a daily basis and at the onset of inclement weather. Daily Seal shall be removed prior to resumption of work. The integrity of the daily seal is sole responsibility of the roofing contractor. Any membrane contaminated by sealing material shall be cleaned or removed.

3.13 Membrane Repair

If the roof is under warranty, contact the system supplier. If not under warranty, consult the <u>SPRI/NRCA Manual of Roof Inspection, Maintenance, and</u> Emergency Repair of Existing Single-Ply Roof Systems. SPRI Application Guidelines for Thermoplastic Roofing Systems