Roofing Products International, Inc.

57460 Dewitt Street ▪ Elkhart, Indiana 46517-1078
Phone (574) 293-9096 ▪ Fax (574) 294-3450
800-628-2957 ▪ Web site: www.roofingproductsint.com

ROOFING PRODUCTS INTERNATIONAL GREEN ROOF SYSTEM GUIDE
for
RPI ROYAL EDGE EPDM and RPI RE-FLEX TPO

TABLE OF CONTENTS

1.01 General 2
1.02 Applicability 3
1.03 Quality Assurance 6
1.04 System Design Guidelines 8
1.05 Structural Deck 12
1.06 Insulation.....14
1.07 Insulation Attachment 15
1.08 Membrane Securement Options For Single-Ply Systems 16
1.09 Membrane And Flashing Splices 16
1.10 Flashings.....17
1.11 Application Of Royal Edge EPDM Green System Components 18
1.12 Products 20

1.01 GENERAL

A. DESCRIPTION

1. Royal Edge Green roofing Systems utilize one of the following membranes fully adhered to an approved substrate:

   - Royal Edge Non-Reinforced EPDM membrane
   - Royal Edge Reinforced EPDM membrane
   - RPI Re-Flex TPO membrane

2. Membrane thickness must be .060 mil to qualify for Royal Edge Green Roof warranties. Refer to Section1.04, of this Design Guide, for specific requirements.

3. Adjoining sheets of EPDM membrane are spliced together using 3" wide Royal Edge Seam Tape/Royal Edge Seam Tape Primer. The seam is then stripped in (enveloped) with Royal Edge six (6") inch Cover Tape/Royal Edge Seam Tape Primer installed over the seam.

4. RPI Re-Flex Heat Welded TPO membrane is spliced together with a minimum 1-1/2" wide hot air weld with a reinforced Re-Flex TPO membrane installed over the seams and heat welded along all edges.

5. System components are dependent upon desired planting types and installation schedule, structural load limitations, and the climate region of the project. These components may include:

   - Root barriers
   - Extruded polystyrene insulation/polyisocyanurate insulation
   - Water retention mats
   - Drainage boards
   - Drainage gravel
   - Filter fabrics
   - Vegetated growth medium

B. GREEN ROOF DEFINITIONS

1. Intensive (Deep) Green Roof Systems

A planting system of greater depth (soil depth greater than10") that requires regular maintenance, such as watering, fertilizing and mowing/weeding. A variety of plants are available including sod grass, annual or perennial flowers, shrubs and even small trees. This system typically requires a structural concrete roof deck to support the larger dead load. An irrigation system may be utilized in these assemblies, as required. The anticipated saturated weight for intensive green roof assemblies is generally greater than 60 pounds per square foot.

2. Semi-Intensive (Medium Depth) Green Roof Systems

A medium depth planting system (soil depth of 6" to10") where recommended plants include sedums, herbs, grasses and other vegetation which can grow in this depth of media. In temperate climates, non-irrigated systems can be provided without difficulty; however drip, mist or spray irrigation systems may be required to support more diverse plant types or for installations in semi-arid climates. The anticipated saturated weight for Semi-Intensive green assemblies is generally greater than 40 pounds per square foot.

3. **Extensive (Shallow) Green Roof Systems**

A shallow planting system (soil depth of 2" to 6”) ideally suited for areas that will receive little maintenance. Recommended plants include sedums, herbs and grasses. The anticipated saturated weight for Extensive Green Roof system assemblies above the waterproofing membrane is generally greater than 15 pounds per square foot.

1.02 APPLICABILITY

A. GENERAL:

1. Royal Edge Green Roof Systems are applicable for commercial and industrial roofing applications.
2. Requirements of this manual outline the minimum requirements for a Royal Edge Green Roof warranty.
3. Roofing Products International Green Roof Systems may not be applicable, without special consideration, if subject to local, regional, or national building code requirements or testing agency restrictions. It is the building owner or his design professional’s responsibility to consult with the controlling code agency official(s) to determine specific structeral load requirements.

B. CONSULTATION:

Contact Roofing Products International with questions concerning design requirements.

C. DESIGN:

1. **Roofing Products International** recommends that a design professional be consulted to assure proper design,installation, and conformance to building codes, etc.
   - **(a)** The building owner or his design professional should be consulted to ensure structural conditions are sufficient to support the anticipated load of the completed roof installation.
   - **(b)** Statements in this design guide are provided in good faith with the expectation that a design professional be consulted prior to any job decisions being made.
   - **(c)** The design professional should review the proposed system assembly for its applicability on each project.
   - **(d)** Roofing Products International does not review or calculate dew point analyses and does not accept responsibility for damage due to recurrence rate or location of dew point. Although not all projects require a vapor retarder, a design review must be considered for all projects to determine if a vapor retarder may be necessary.
   - **(e)** Provide a thermal barrier, if necessary, to meet local building code requirements.
2. The project designer should specify and moniter the affect of loads on the structure/decking during the loading/staging of materials as a part of system installation. The project designer should make the Roofing Products International Registered Applicator aware of structural load limitations.

D. CONDITIONS:

1. The following conditions require special consideration and may not be warrantable. Roofing Products International recommends that a design professional be involved in the design process. For additional assistance, contact Roofing Products International

   - Substrates that do not provide adequate fastener or adhesion pullout resistance
   - Buildings with high interior humidity such as spas and swimming pools
   - Roof decks that do not provide adequate fastener pullout resistance or load capabilities
   - Cold storage and freezer facilities
   - Cold storage facilities constitute a special condition. A designer familiar with cold storage construction and vapor migration should be consulted in the design of the roof system

2. Pullout Tests: Due to the variety of physical conditions that can affect pullout resistance, RPI recommends that on-site tests be conducted by an independent testing laboratory, the manufacturer's representative, or the roofing contractor to determine actual pullout values.

   The following deck types are those which may not provide sufficient pullout resistance:
   - Steel decks thinner than 22 gauge
   - Concrete less than 3000 psi
   - Any other substrate that does not have a published pullout capacity greater than the minimum required for the applicable roof system.

   The sections of the substrate where windlift or deck integrity is in question should be used for pull testing. On site verification of pulltest capacity must be confirmed prior to system installation. Test areas must include corners and perimeters. The minimum number of pullout test required is as follows:

Roof Size	Number of Pull-Out Tests
Less Than 10,000 sq. ft.	6
10,000 - 50,000 sq. ft	10
50,000 - 100,000 sq. ft.	20

E. MOLD:

The formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to, the presence of spores and nutrient sources, moisture, temperatures, climatic conditions, relative humidity, and heating/ventilating systems and their maintenance and operating capabilities. Roofing Products International shall not be responsible for any claims, repairs, restoration or damages relating to the presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or any similar pathogen in any building or in the air, soil, or water entering the building.

F. WARRANTY

1. GENERAL:

(a) Parameters of this specification outline the **minimum** requirements for a Royal Edge Green Roof Assembly Warranty. Local code and insurance requirements may require specific system enhancements or changes.

(b) A 30-year Membrane Only Warranty is available on commercial buildings and applies only to products marketed or supplied by RPI. The membrane system is defined as membrane, flashings, adhesives, sealants and other RPI products utilized in this installation.

2. RPI MEMBRANE ONLY AND LABOR AND MATERIALS WARRANTY QUALIFICATIONS:

- The roof must be installed according to the current RPI Fully Adhered Specifications for Green Roof Assemblies. A water flood test must be conducted prior to the intallation of overburden materials.
- The RPI roof system must be installed by a current RPI Registered Applicator.
- Upon request by the approved RPI Registered Applicator, an inspection will be conducted by a RPI Technical Representative to ascertain that the membrane roofing system has been installed according to RPI specifications.

The inspection must be coordinated prior to the installation of all green roof assembly components above the Royal Edge Membrane System.

3. The RPI Registered Applicator must notify RPI at least three weeks in advance of the applicable inspection dates for coordination purposed.

4. Access for warranty service for Green Roof Assemblies:
It shall be the owner's responsibility to expose the membrane assembly in the event warranty service is required. All costs associated with the removal and replacement of overburden(soil, plants, and other green roof assembly materials) are the responsibility of the building owner.

5. LIMITATIONS:

- RPI will not warrant Royal Edge roof system tie-ins to other roof systems not warranted by RPI.
- RPI Membrane and Labor and Material warranties do not extend beyond the Royal Edge EPDM waterproofing membrane or cover installation or maintainance of the overburden materials supplied by others.

6. CONDITIONS:

(a) Certain situations and conditions beyond the control of RPI or the RPI Registered Applicator may restrict or limit the application and warrantablility of the RPI membrane system. Any variation from the original submittal requirements must be approved by RPI.

(b) RPI Green Roof Systems are not to be installed under the following conditions:

- RPI Green Roof Systems must be new construction or a complete tear-off to the structural deck.
- Recovering an existing roof system is not an acceptable alternative to removing existing roof components.
- Roofs where structural conditions are insufficient to support the load of the completed roof installation and other anticipated loads as identified by the building owner or the design professional.
- Roofing applications for single-family residences.

1.03 QUALITY ASSURANCE

A. JOB SITE CONSIDERATIONS:

1. Protect all of the staged RPI roof system components including the completed areas of the roof system from damage, Including, but not limited to:
   - Damage that may result from other trades during the continued construction process
   - Discharges from such as petroleum products, greases, oils (mineral and vegetable), animal fats and other byproducts, which may come in contact with the membrane
   - Maintain separation and protect RPI roof system components from direct contact with continuous heat sources when the in-service temperature is in excess of 180 °F (82 °C)
   - Asphalt, coal tar, oil base or plastic roof cements, and re-saturated roof products are not to be used in direct contact with the waterproofing components of the RPI Green Roof System
2. Store all RPI products in the original unopened containers and protect from weather.
3. Flood testing or other leak detection means is required to check the waterproof integrity of the membrane system prior to installing any above membrane components (overburden).
4. Insulation must be properly stored and protected from ignition sources, moisture and damage.

B. SAFETY:

1. Material Safety Data Sheets (MSDS) must be available at all times. All safety regulations recommended by OSHA and other agencies having jurisdiction are to be followed.
2. Do not allow fumes from adhesive solvents and asphalt products to be drawn into the building during installation through rooftop intakes or other entry points.
3. Keep all adhesives, sealants and cleaning materials away from ALL ignition sources (i.e., flames, fire, sparks,welders, etc.). Do not smoke while using these materials.
4. Consult container labels, Material Safety Data Sheets and Technical Information Sheets for specific safety instructions for all products used on the project.
5. Cold weather application:
   - **(a)** When the outside temperature is below 40 °F (4.4 °C), certain combinations of temperature and humidity may cause condensation on the surface of solvent-based adhesives and primers. If this condition occurs, discontinue the application. When the ambient air conditions no longer cause condensation on adhesive surfaces, re-apply additional adhesive or primer and proceed.
   - **(b)** Adhesives, sealants, and asphalt roll-goods should remain in a heated environment between 60 °F and 80 °F (15.5 °C and 26.6 °C) a minimum of 24 hours before installation. Do not apply direct heat to adhesives and sealants.
   - **(c)** Materials should be used within two hours of removal from a heated storage area. If materials are not used within that time period, they should be returned to the heated

storage area until the temperature of the material returns to the temperature of the heated storage area. Typically this is 24 hours.

(d) The consistency of sealants, adhesives and primers will begin to thicken as the temperature drops. To minimize this, the following is recommended:

- Start work with sealants, adhesives and primers that have been stored between 60 °F and 80 °F (15.5 °C and 26.7 °C). Insulated heated boxes may be helpful
- Complete test areas to determine if conditions will cause problems such as condensation with the application of the material
- Stop the operation or change to another warm container when material becomes too thick to properly apply
- Do not use heat guns or open flames to dry or warm adhesives and primers
- If using water-based bonding adhesive, temperatures must be at least 40 °f (4.4 °c) and rising for the material to apply and perform as designed. Longer drying times should be expected for lower temperatures and higher humidity

C. SUBMITTALS:

1. All RPI warranty application documentation must be sumitted to and approved by RPI Technical prior to installation.
2. A detailed dimensioned layout of all field splices and flashings shall be included along with the project submittals (shop drawing and request for warranty).

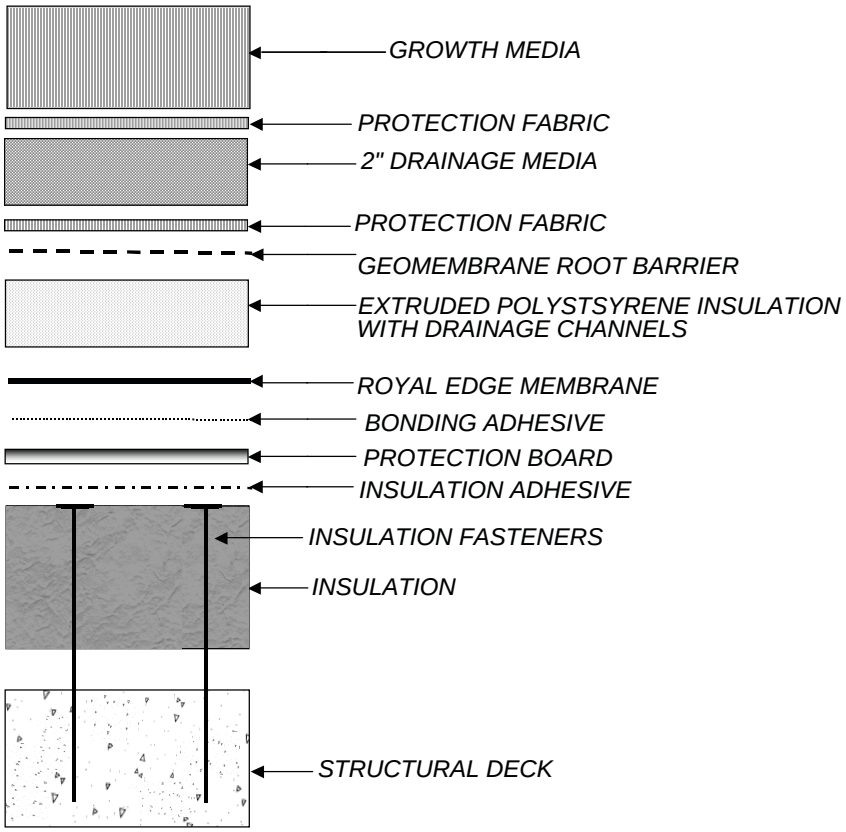
1.04 SYSTEM DESIGN GUIDELINES

A. INTENSIVE (DEEP) SYSTEM:

1. A proper substrate must be installed beneath the waterproofing membrane. This can be accomplished with the use of adhesives or fasteners to secure the roof insulation. The protection board must be set in adhesive or asphalt as the underlayment for the membrane.
2. The membrane must be a Royal Edge .060-mil EPDM or a Re-Flex .060 TPO membrane installed as a fully adhered system.
3. A layer of minimum 2” (5.cm) thick extruded polystyrene insulation with drainage channels is used above the membrane to facilitate drainage and protect the membrane against puncture.
4. A root barrier consisting of 40-mil non-reinforced geomembrane is installed above the insulation and covered with protection fabric and a layer of drainage gravel a minimum of 2” (5.cm) in thickness.

   Note: A layer of drainage board may be used as a substitute to the drainage gravel and protection fabric used beneath the growth media and above the root barrier.
5. A second layer of protection fabric will be required above the gravel prior to the installation of the growth media.l

INTENSIVE (DEEP) GREEN ROOF SYSTEM



B. SEMI-INTENSIVE (MEDIUM DEPTH) SYSTEM:

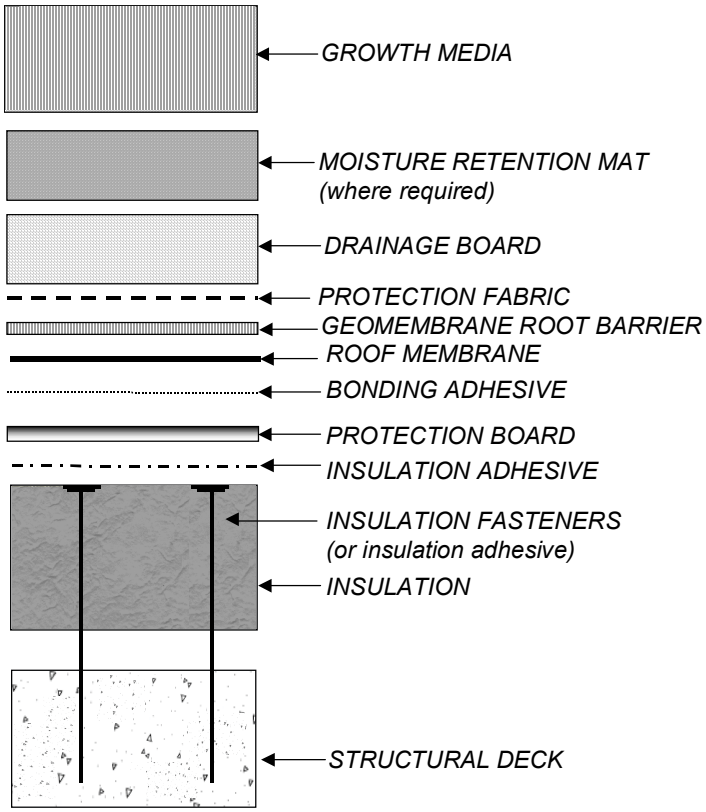
1. A proper substrate shall be installed beneath the waterproofing membrane. Secure the substrate with approved adhesives or fasteners. A protection board shall be ahered over the substrate using an approved adhesive or asphalt as the underlayment for the membrane.

2. To qualify for a Royal Edge Green System warranty, the installation assembly requires the use of either a .060-mil Royal Edge EPDM or a .060-mil Royal Edge TPO membrane, installed as a fully adhered system.

3. A layer of protection fabric is installed above the membrane and covered with a root barrier, consisting of 40-mil non-reinforced geomembrane, and a drainage board.

4. The growth media can be placed either directly onto the drainage board or over a moisture retention mat.

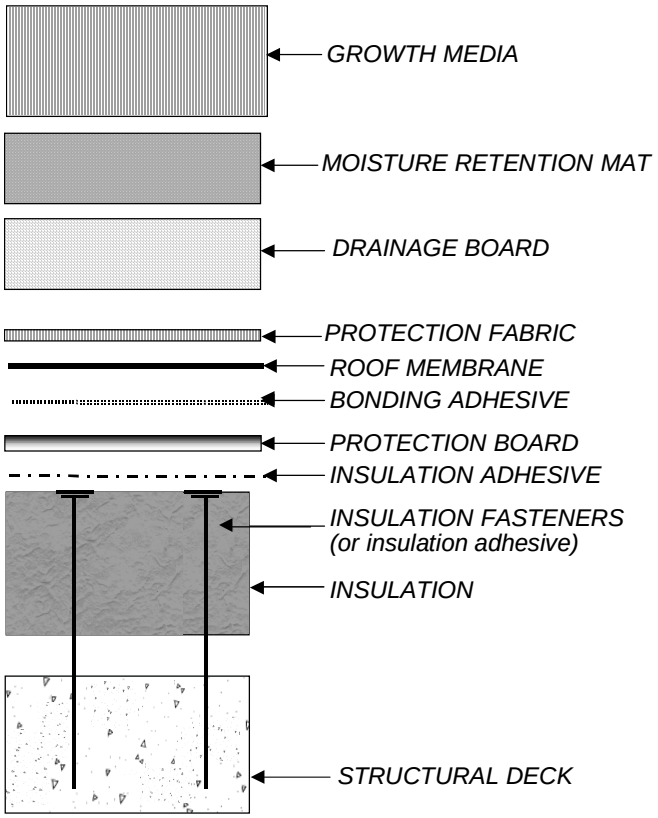
SEMI-INTENSIVE (MEDIUM DEPTH) GREEN ROOF SYSTEM



C. EXTENSIVE (SHALLOW) SYSTEM:

1. A proper substrate shall be provided beneath the membrane. This can be accomplished with the use of adhesives or fasteners to secure the roof insulation. The protection board shall be set in adhesive or asphalt as the underlayment for the membrane.
2. For 10 or 15-year warranties, the membrane shall be a 60-mil RubberGard EPDM or an UltraPly TPO adhered to the protection board.
3. For 20-year warranted systems, a 90-mil Platinum EPDM or a 80-mil UltraPly TPO membrane is required and installed in an adhered fashion.
4. A layer of protection fabric is installed above the membrane and covered with a drainage board and a moisture retention mat.
5. The growth media shall be placed directly onto the moisture retention mat.

EXTENSIVE (SHALLOW) GREEN ROOF SYSTEM



D. SYSTEM WARRANTY REQUIREMENTS:

Assembly Materials	Extensive Assembly Shallow Media/Assembly Depth		Simple Intensive Medium Media/Assembly Depth		Intensive Assembly Deep Media/Assembly Depth	
1* Approximate weight of material above membrane	approx. 12 pounds per square foot		approx. 25 pounds per square foot		approx. 25 pounds per square foot	
Approximate Saturation Weight of Overburden Material Above Membrane	increasing from 15 lbs. per sq. ft.		increasing from 40 lbs. per sq.		increasing from 60 lbs. per sq. ft.	
Growth Media	**Required** 2" to 6" of Depth		**Required** 6" to10" of Depth		**Required** over 10" of Depth	
Moisture Retention Mat	**Required**		Optional		Optional	
Protection Fabric	Optional		Optional		**Required** 16 oz/yd^2	
Drainage Media	Optional		Optional		Required	
Drainage Board	**Required**		**Required**		Optional	
Protection Fabric	**Required** 10-15 year 16 oz/yd^2	20 year 16 oz/yd^2	Optional		**Required** 16 oz/yd^2	
Root Barrier	Optional		**Required**		**Required**	
Protection Fabric	Optional		**Required** 16 oz/yd^2		Optional	
Extruded Polystyrene	Optional		Optional		**Required** Minimum 2"	
Protection Board	**Required**		**Required**		**Required**	
Insulation	Optional		Optional		Optional	
Substrate	See Section 1.05					
Warranty Term	10-15 year	20 year	10-15 year	20 year	10-15 year	20 year
Royal Edge EPDM Waterproofing Membrane	.060 mil Royal Edge Reinforced EPDM	.060 mil Royal Edge Non-reinforced EPDM	.060 mil Royal Edge Reinforced EPDM	.060 mil Royal Edge Non-reinforced EPDM	.060 mil Royal Edge Reinforced EPDM	.060 mil Royal Edge Non-reinforced EPDM
RPI Re-Flex TPO Waterproofing Membrane	.060 mil Re-Flex TPO	.060 mil Re-Flex TPO	.060 mil Re-Flex TPO	.060 mil Re-Flex TPO	.060 mil Re-Flex TPO	.060 mil Re-Flex TPO

1* Typical wet soil weighs approximately100 lbs per cubic foot. Some mixes of growth media consisting of various types of lightweight growing media such as layers of lightweight substrate made up of sand, pumice, and compost can weigh only 60 lbs/sf when fully saturated. It is the design professionals responsibility to determine the actual weight of the system and to perform a thorough analysis of the roof structure.

1.05 STRUCTURAL DECK

A. GENERAL:

1. The RPI Royal Edge Green Roof System performance is dependent upon a suitable substrate to perform its intended function.
2. Proper structural decking shall be provided by the building owner.
3. The building owner or his design professional must ensure that the building structure is investigated by a registered engineer to assure its ability to withstand the total weight of the specified roofing system, as well as construction loads and live loads, in accordance with all applicable codes. The building owner or his design professional must also designate the maximum allowable weight and location for material loading and storage on the roof.

   (a) The substrate to which the RPI roof system is installed must be:
   - Structurally Sound
   - Smooth
   - Flat
   - Clean
   - Dry
   - Free of sharp edges, burs, or foreign materials that could damage the material

   (b) For Extensive (Shallow) systems, any roof deck capable of withstanding the roof loading may be accepted.

   (c) For Semi-Intensive (medium depth) and Intensive (deep) systems, concrete roof decks are recommended due to the increased weight of the roof assembly when the system is at its maximum saturated weight capacity.

   (d) Defects in the roof deck must be reported and documented to the building owner or his design professional for assessment. The Firestone authorized roofing applicator shall not proceed unless the defects are corrected.
4. The building owner or his design professional is responsible for ensuring that all moisture has been removed and/or wet substrate has been removed and replaced in a re-roofing application.

B. PULLOUT REQUIREMENTS:

1. Substrates for membrane / Insulation attachment are required to provide sufficient pullout resistance for the fasteners and the roof system.
2. The minimum pullout resistances for specific systems are as follows:

   (a) Insulation mechanically attached to deck requires a fastener pullout of 300 lbs.

   (b) See the Technical Information Sheet for the specific insulation adhesive when the insulation is adhered to the deck.
3. Pullout Tests: Due to the variety of physical conditions that can affect pullout resistance, RPI recommends that on-site pull tests be conducted by an independent testing laboratory, the fastener manufacturer's representative or the roofing contractor, to determine actual pullout values. The following deck type are those which may not provide sufficient pullout resistance:
   - Steel decks thinner than 22 gauge
   - Concrete less than 3000 psi

- Plywood or oriented strand board less than 1/2” thickness.
- Wood plank less than 3/4” thickness.
- All poured or pre-cast gypsum, cementitious wood fiber and lightweight concrete decks.
- Existing masonry or brick.
- Any other substrate that does not have a published pullout capacity greater than the minimum required for the applicable roof system

C. VAPOR RETARDER:

1. To control moisture, a vapor retarder may be necessary to protect certain roofing components when high interior humidity is of concern.
2. The need for a vapor retarder, as well as the type, placement and location of a vapor retarder should be determined by the building owner or his design professional. The list
3. Assure that the method of attachment of the roof system and of the vapor retarder

D. DRAINAGE AND SLOPE:

Proper and adequate drainage of water from the roof membrane surface is required to assure the long-term performance of the roof membrane. A minimum roof slope of 1/8” per foot (1%) is recommended for the roof system.

E. WOOD NAILERS:

1. For new construction projects, wood nailers must be kiln-dried (Southern Pine, Douglas Fir) structural grade #2 or better. For re-cover projects and new construction projects where a poured-in-place deck will be used, wood nailers must be pressure treated for rot resistance, #2 or better lumber. Asphaltic or creosote-treated lumber is not acceptable. Lumber treated with other wood preservatives such as Pentachlorophenol, Copper Naphthenate or Copper 8-quinolinolate will adversely affect the membrane when in direct contact and are, therefore, unacceptable.
2. Wood nailers are required at the following locations:
   - All roof edges
   - At all other locations as required by RPI specifation details
   - Wood nailers must totally support all sheet metal flanges
3. The building owner or his design professional must specify a wood nailer attachment system that will resist a minimum force of 200 lb per foot in any direction. Approved fasteners are required for all re-roofing applications. For further clarification, please refer to Factory Mutual Loss Prevention Data Sheet 1-49.

F. EXPANSION JOINTS:

1. Roof expansion joints must be located to accommodate movements caused by thermal expansion and building structural movement.
2. A design professional should be consulted to determine the need and requirments for an expansion joint.
3. Consideration for the installation of expansion joints, should be given under the following conditions:
   - Where expansion or contraction joints are provided in the building structural system.
   - Where structural framing elements such as joists, rafters, purlins, or steel decking change direction.
   - Where different types of roof decks such as concrete and steel abut each other.
   - Where additions are connected to existing buildings.
   - At junctions where interior heating conditions change such as a heated space abutting and unheated space.
   - Where movement between vertical walls and the roof deck is anticipated.
   - Note: The conditions above may not be all inclusive. Other conditions may exist in which expansion joints should be considered.

1.06 INSULATION

A. GENERAL:

1. Insulation provides an acceptable substrate for the proposed roof system as well as insulation for the building.
2. Roofing fasteners and adhesives approved for use with RPI membrane roofing systems are acceptable for Royal Edge green roof systems
   - **(a)** It is acceptable to combine fastener and adhesive attachment methods in multi-layer applications of insulation. The protection board must be adhered to a suitable substrate.
   - **(b)** Refer to RPI technical specifications for installation and fastening requirements.
3. Refer to RPI Specification Manual for approved insulation.
4. Insulation thickness requirements may vary for code compliance.
5. Where tapered insulation is less than 1.0” minimum thickness, the insulation must be fastened at a minimum rate of one (1) fastener and plate per two (2) square foot. If possible, install the tapered insulation first, followed by the flat stock.
6. On metal decks, the edges of insulation boards running parallel with the deck should be supported by the top flange. Edges of insulation boards running parallel with the deck should be supported by the top flange.

B. PROTECTION BOARD:

1. Warranted RPI Royal Edge Green Roofing Systems require a minimum of 1/2” DensDeck Prime™ or 5/8" water resistant gypsum board as a protection board.
2. The protection board must be adhered to the appropriate substrate. Mechanical fasteners are not an acceptable method for the attachment of the protection board.

1.07 INSULATION ATTACHMENT

Refer to RPI Specification Manual for approved roofing fasteners and adhesives for appropriate roofing substrates. It is acceptable to combine fastener and adhesive attachment methods in multi-layer applications.

A. MECHANICAL ATTACHMENT:

1. The insulation must be installed in accordance with the fastening rate and pattern for the applicable system, as shown on the Technical Information Sheet for the selected insulation.
2. Fastening rates and patterns may vary for code compliance. Refer to the RPI Specification Manual or contact RPI Technical Services.
3. Insulation must be fastened with approved fasteners and insulation plates.
4. The top layer of protection board must be adhesive-attached. Mechanical attachment of the protection board directly beneath the membrane is not acceptable for RPI Green Roof Systems.

B. ASPHALT ATTACHMENT:

1. Hot steep asphalt (ASTM D 312 Type III or Type IV) may be used to attach the insulation and the protection board beneath the roof system.
2. When using hot asphalt for attachment:
   - **(a)** The insulation must be no larger than 4' X 4' boards.
   - **(b)** Stagger all insulation joints from adjoining boards.
3. The following substrates may be used with asphalt attachment of insulation and the protection board:
   - **(a)** Poured-in-Place or pre-cast structural concrete decks which have been primed at a rate of 1-1/2 to 2 gallons per 100 square feet with an ASTM D 41 asphalt primer.
   - **(b)** Mechanically attached base sheets that have been fastened in accordance with RPI requirements.
   - **(c)** Mechanically attached insulation that has been fastened in accordance with RPI requirements.
4. Assure compliance to all building codes when using hot asphalt.
5. Assure that all health and safety measures are followed when installing hot asphalt to protect the installers as well as occupants of the building.

C. ADHESIVE ATTACHMENT:

1. Adhesives approved for use in RPI roof systems.
   - **(a)** The insulation must be no larger than 4' X 4'.
   - **(b)** Adhesives must be applied, and insulation installed in accordance with the adhesive manufacturer installation specification for RPI roof systems.

1.08 MEMBRANE SECUREMENT OPTIONS FOR SINGLE-PLY SYSTEMS

A. GENERAL:

1. The RPI Green Roof System membrane must be bonded to the approved substrate with RPI Bonding Adhesive or Water-Based Bonding Adhesive appropriate for the membrane.
2. Compliance with all installation criteria is required for the issuance of a RPI warranty.
3. Additional attachment requirements may be necessary to comply with the local building code.

B. BASE TIE-INS AND MEMBRANE TERMINATIONS:

All base tie-ins and membrane terminations must be attached to substrates which will resist a minimum of 200 lbf. force in any direction.

1.09 MEMBRANE AND FLASHING SPLICES

A. ROYAL EDGE EPDM:

1. Field and Flashing Lap Splices:
   - **(a)** Complete all lap splices using RPI 3" Seam Tape, followed by the application of RPI 5" Cover Tape flashing over the completed splice.
   - **(b)** Refer to RPI details for information regarding specific requirements.
2. Perimeter Base Flashings:
   - **(a)** Refer to RPI details for information regarding specific requirements.
3. Curb Flashings:

   Curb flashings must be completed according to RPI Fully Adhered Specifications using Royal Edge EPDM Uncured Flashing and Tape products. For curbs that require a mechanical fastener, the membrane may be attached at the vertical surface (angle change) using a metal batten strip and the appropriate fastener. The curb batten must be flashed using RPI Royal Edge EPDM Membrane and 3" Royal Edge Seam Tape, followed by the application of Royal Edge 5" Cover Tape over the splice.
4. All additional flashing and splicing requirements contained in the RPI Specifications must be strictly followed.

1.10 FLASHINGS

A. GENERAL:

1. Walls, curbs, skylights and all other penetrations through the membrane must be flashed in accordance with RPI published specifications/details for Royal Edge EPDM.
2. Refer to the system application and detail sections. Extended warranties may require special flashing applications.

B. WALL/CURB FLASHING MATERIALS AND REQUIREMENTS:

1. Walls, curbs, skylights and all other penetrations through the membrane must be flashed in accordance with RPI published specifications and details for the Royal Edge EPDM.
2. All existing flashing must be removed prior to the application of new flashing. New membrane flashing must not conceal weep holes or cover existing throughwall counterflashing.
3. In areas where metal counterflashing is used as the vertical termination, the counterflashing must be sealed with a high grade rubber caulking to prevent moisture migration behind the new wall flashing.
4. Install surface mounted reglets and compression bar terminations directly to the wall surface. Royal Edge Water Cut-Off Mastic and Royal Edge Termination Bar must be installed under all metal counterflashings used as vertical wall terminations.
5. Vertical field splices at walls, curbs, etc., must be overlaid with Royal Edge Cover Tape in the same fashion as the field splices.
6. Royal Edge Uncured Tape Flashing must be applied at angle changes, t-joints, and to flash inside/outside corners, vent pipes, scuppers and other unusually shaped penetrations where the use of a premolded Royal Edge product is not practical.
7. When working in cool temperatures, a heat gun may be used to warm the Royal Edge Uncured Flashing; allowing the flashing to be more flexible and formed.

C. ROOF DRAINS:

1. On roof gardens with deeper growth media, drains should be covered with a perforated “drain viewing box” with removable lid (at the growth media surface) for inspection purposes.
2. 1-1/2” nominal diameter rounded river washed gravel is applied around the “viewing box” (minimum 12” in width) to promote drainage.
3. On Extensive(Shallow) and some Semi-Intensive(shallow to medium soil depth) Royal Edge Green System assemblies, standard cast iron compression ring clamping drains may be used with1-1/2”nominal diameter round river washed gravel applied around the drain sump area(minimum12”inwidth), however; for drainage “drain-viewing boxes” are recommended.

1.11 APPLICATION OF ROYAL EDGE GREEN ROOF SYSTEM COMPONENTS

A. GENERAL:

1. Limit traffic over completed roof membrane sections to essential personnel only.
2. Heavily traveled areas (staging areas, corridors used to transport roof components) must be protected using ½" thick plywood or other sheathing.

B. WATER TEST:

1. Before the installation of the components above the membrane of a Royal Edge Green Roof System, a water test is strongly advised to ensure the waterproof integrity of the membrane system.
2. After the membrane and flashings have been in place approximately 24 hours, plug drains and provide necessary barriers to contain water.
3. "Flood" membrane surface with water to a depth of 2" for a period of 24 hours.
4. Inspect for leaks and repair membrane if defects are found. Re-test after repairs have been made.
5. Sweep the surface of the membrane to remove all debris and loose or foreign material.

C. PROTECTION FABRIC:

1. Extend protection fabric up walls, curbs, etc. to the height of the top of the growth media layer.
2. Provide a minimum 2" side, and end overlap on each of the layers of the protection fabric
3. Under windy conditions, provide temporary ballast to prevent wind disturbance. It is recommended to install the additional "above roof components" over the protection fabric soon after its placement to ensure the protection fabric remains in position.

D. EXTRUDED POLYSTYRENE INSULATION: (FOR INTENSIVE ROYAL EDGE GREEN ROOF SYSTEMS)

1. Install loose laid insulation directly over the membrane with all joints tightly butted.
2. Extend insulation up walls, curbs, etc. to the height of the top of the growth media layer.

E. ROOT BARRIER:

1. The root barrier is loose-laid, with adjacent sheets overlapped a minimum of 2" in preparation for splicing.
2. Splicing surfaces shall be clean. Dirt/contaminants shall be removed from splice areas with specified membrane cleaner.
3. Specified membrane cleaner must be used to remove surface oxidation on the root barrier surface when the material has been exposed to the elements for 7 days. Apply membrane cleaner with a clean white rag. Prior to heat welding, wipe the surface of the root barrier with a clean, dry, white rag to remove all cleaner residues.

4. Extend root barrier up walls, curbs, etc. to the height of the top of the growth media layer.

F. DRAINAGE BOARDS:

1. On Intensive (deep) applications, drainage board may be used as a substitute to the 2” drainage gravel and protection fabric used beneath the growth media and above the root barrier
2. Place drainage board panels so water flows with the overlap, not against it.
3. Install the drainage panels with the fabric side facing upward. The first panels should be positioned with the flanged edge facing uphill.
4. Extend drainage boards up walls, curbs, etc. to the height of the top of the growth media layer.

G. MOISTURE RETENTION MAT:

1. Required for Extensive (shallow) systems; optional for Semi-Intensive (medium depth) systems.
2. Unroll moisture retention mat and loose lay over the drainage board overlapping side and end laps a minimum of 2”.
3. Under windy conditions, provide temporary ballast to prevent wind disturbance. It is recommended to install the growth media over the moisture retention mat soon after its placement to prevent ensure mat remains in position.
4. Extend the moisture retention mat up walls, curbs, etc. to the height of the top of the growth media layer.

H. DRAINAGE GRAVEL:

1. On Intensive (deep) systems, a minimum 2” thick layer of drainage gravel shall be installed over the protection fabric (which is installed over the root barrier and extruded polystyrene insulation above the membrane).
2. Drainage gravel shall be leveled and overlaid with protection fabric prior to placement of the growth media.
3. Note: On Intensive (deep) applications, drainage board may be used as a substitute to the drainage gravel and the protection fabric used beneath the growth media and above the root barrier.

I. GROWTH MEDIA/PLANTING:

1. Spread engineered soil mixes to the specified depth, plus 15%. Dispense to locations in a manner that will not overload the structure.
2. Thoroughly soak soil with water using a sprinkler or hand sprayer.
3. Plant vegetation in accordance with the landscape architect/designer plans and instructions for the intended soil and climate.

1.12 PRODUCTS

A. INSULATION (OPTIONAL, INSTALLED BETWEEN PROTECTION BOARD AND STRUCTURAL DECK):

1. Isocyanurate roof insulation,1.0" minimum thickness, approved for use in Royal Edge Systems
2. Tapered Isocyanurate roof insulation approved for use in Royal Edge roof systems.
3. DensDeck1/4”(6.3mm)minimum thickness.

B. PROTECTION BOARD (REQUIRED):

1. DensDeck Prime ½”(12.7mm) minimum thickness

C. MEMBRANE:

Green System	Extensive Shallow Assembly		Semi-Intensive Medium Assembly		Intensive Deep Assembly	
Warranty Period	10- 15 year	20 year	10- 15 year	20 year	10- 15 year	20 year
Royal Edge EPDM Membrane	.060 mil ROYAL EDGE Reinforced EPDM	.060 mil ROYAL EDGE Non-reinforced EPDM	.060 mil ROYAL EDGE Reinforced EPDM	.060 mil ROYAL EDGE Non-reinforced EPDM	.060 mil ROYAL EDGE Reinforced EPDM	.060 mil ROYAL EDGE Non-reinforced EPDM
Re-Flex TPO	.060 mil	.060 mil	.060 mil	.060 mil	.060 mi	.060 mil

D. EXTRUDED POLYSTYRENE:

1. Extruded Polystyrene Insulation – Dow Roofmate or Foamular 404/604, a minimum 40/60-psi compressive strength, moisture resistant, closed cell polystyrene foam insulation with drainage channels along board edges to promote drainage at the membrane level. Installed directly over the roof membrane in Intensive Greening (deep) garden assemblies. Available in 2’ x 8’ board sizes with a thickness of 1” to 4”.

E. PROTECTION FABRIC:

1. Polypropylene non-woven needle punched fabric, stabilized to resist soil chemicals, mildew, and insects and is non-biodegradable.

Property	Test	Unit	Typical Value
Weight			16 oz/yd^2 (380 gram/m^2)
Puncture Resistance	ASTM D 4833	Lbs (kN)	235 (1.05)
Mullen Burst	ASTM D 3786	Psi (kPa)	750 (5,167)
Elongation	ASTM D 4682	%	50
Thickness	ASTM 5199	Mils (mm)	150 (3.8)

F. ROOT BARRIER:

1. Used in Intensive (deep) and Semi-Intensive (medium depth) Roof Systems.
   (a) A non-reinforced geomembrane: A non-reinforced polyethylene sheet specifically formulated for use in below grade applications to resist root growth and soil bacteria.

G. DRAINAGE BOARD:

1. High impact polystyrene core with “cups” and pierced holes allowing water retention and drainage. A non-woven polypropylene filter fabric is bonded to the retention side of the molded core to prevent passage of particles into the water reservoirs. Designed to retain water in Extensive and Semi-Intensive green roof systems while allowing excess water to the drainage system. Installed over protection fabric.

Property	Test Method	Units	Typical Value	
CORE				
Thickness	ASTM D 1777	in (mm)	.40 (10.16)	
Compressive Strength	ASTM D 1621	Psf (kPa)	15,000 (718)	
Reservoir Capacity	TCM-0207	In^3/ ft^3	10 (1,775)	
Percolation Flow Rate (1 punched Hole/ft^2)	TCM-G0163	Gpm/ft^2 (l/min/m^2)	0.141 (0.503)	
Retention Performance	TCM-G0163	%	31	
Percolation Flow Rate (2 punched Hole/ft^2)	TCM-G0163	Gpm/ft^2 (l/min/m^2)	0.197 (0.704)	
Retention Performance	TCM-G0163	%	18.3	
Percolation Flow Rate (2 punched Hole/ft^2)	TCM-G0163	Gpm/ft^2 (l/min/m^2)	0.237 (0.847)	
Retention Performance	TCM-G0163	%	17	
Fabric			Woven	Nonwoven
Apparent Opening Size	ASTM D 4751	US Standard Sieve (mm)	40 (0.42)	70 (0.21)
Water Flow Rate	ASTM D 4491	Gpm/ft^2 (l/min/m^2)	145 (5,907)	140 (5,698)
Grab Tensile Strength	ASTM D 4632	Lbs (kN)	365 (1.62)	100 (0.45)

H. DRAINAGE MEDIA:

Granular Drainage Media – Drainage gravel applied in Intensive (deep) systems to a minimum depth of 2”.

I. MOISTURE RETENTION MAT:

A nominal 24.3 oz/yd^2, 0.3” (7.9 mm) thick mat with a density of 6.46 lbs/ft^3 (103 Kg/m^3) consisting of needle-punched, recycled synthetic fibers designed to retain moisture in Extensive Greening and Simple Intensive Greening Roof Gardens.

J. GROWTH MEDIA:

Growth media soils should be a mixture of mineral and organic soil components and shall be selected by the landscape architect/designer or other appropriate landscape professional for the intended vegetation.

K. VEGETATION:

Sedums, grasses, herbs, flowers, shrubs, small trees, etc., to be selected by the landscape architect/designer or other appropriate landscape professional and intended for the type (Intensive, Semi-Intensive or Extensive) and soil selected.

L. LANDSCAPE ITEMS:

1. Individual concrete plaza pavers – 2' x 2' x 2" thick precast concrete pavers weighing a minimum of 18 psf with a minimum compressive strength of 6500 psi.
2. Paver Pedestals – Rubber paver pedestals to elevate the surface of the pavers above the roof membrane and promote positive drainage and protection from freeze/thaw.
3. Stone Ballast – Nominal 1-1/2" diameter rounded water worn gravel which conforms with ASTM D448, gradation size #4, applied at a minimum of 10 pounds per square foot.
4. Other – Products such as concrete curbs, landscape lumber (wood timbers, etc.) or other desired landscape products suitable for this application. Used as borders and as transitions between Extensive, Semi-Intensive and Intensive Green Roof areas.