

GUIDE SPECIFICATIONS

**SECTION 07120
LOW PROFILE GREEN ROOF-ROOFSCAPE
RAM-TOUGH 250 DM-PMR
HOT FLUID APPLIED WATERPROOFING**

PART 1 - GENERAL

1.00 GENERAL

The general conditions, special conditions, applicable portions of Division 1 and requirements for general construction and subtrades form a part of this specification.

1.01 RELATED SECTIONS

- Section 02050 Demolition
- Section 02945 Landscaping
- Section 03300 Concrete
- Section 04100 Masonry
- Section 06100 Carpentry
- Section 07600 Sheet Metal
- Section 07710 Roofing Accessories
- Section 07900 Caulking & Sealants

Edit to Project Requirements

1.02 SCOPE

The Work includes supplying all materials, labor and equipment to complete the installation of the Fluid Applied Waterproofing System for the following areas:

The Green Roof-Roofscapes and elsewhere as shown.

1.03 QUALIFICATIONS

The Waterproofing System shall be installed only by an Applicator approved and licensed by the Manufacturer. Polymerized bitumen, reinforcing sheet and all other major Greenroof-Roofscape components shall be supplied through the same firm to insure single-source responsibility. Materials supplied for installation may be tested by an independent laboratory for compliance with published physical properties and these specifications.

1.04 SUBMITTALS

- A. Submit Manufacturer's written approval or license of applicator for installation of the herein specified Waterproofing System.
- B. Submit Manufacturer's sample Ten Year Labor and Material System Warranty and Manufacturer's Intent to Warranty Certification for this project.
- C. Submit most recent copy of Manufacturer's literature applicable to products and specifications to be used, as specified herein, including applicable flashing details.
- D. Submit three sheet samples approximately 8 x 10 inches or alternately 3 units, that are representative of the following products;

Select Components Utilized

- | | |
|---|---|
| <ul style="list-style-type: none">• Membrane Reinforcement• Membrane Flashing• Root Barrier• Aeration Mat• Drain Boxes• Vent Pipe Flashing• Filter Fabric | <ul style="list-style-type: none">• Protection Course• Drainage Mat• Moisture Retention Mat• Root Stabilization Mat• Metal Curbing• Paver Pedestals• Insulation |
|---|---|
- E. Submit three samples of elastomeric bitumen.
 - F. Submit evidence of Manufacturers history of production for the system specified herein. A minimum of fifteen (15) years experience is required. Documentation shall include job lists with project size, Architect of record, installing Applicator, telephone numbers and contact names.
 - G. Submit, in duplicate, certification from the primary Manufacturer, properly attested by a corporate officer, stating that all materials being supplied comply with the specifications and requirements of the contract documents, including conformance with all federal, state and local building codes including United States Code Section 41:10, Subsections a-d, popularly known as the "Buy American Act".

1.05 QUALITY ASSURANCE

- A. All the materials specified herein are cited as a minimum standard of quality and shall not preclude consideration of equal or superior materials. All suggested "equivalent materials" or other substitutions are to be submitted to the Architect for consideration a minimum of ten (10) days prior to the bid date. Submittal shall include all evidence of compliance or superiority of material from the proposed substitute Manufacturer. If accepted by the Architect, an addendum will be issued to all bidders for their consideration of the proposed substitute Manufacturer. Determination of equivalency of all substitutions shall rest exclusively with the Architect and such decision shall be final.
- B. Manufacturer of Greenroof-Roofscapes shall submit information on the entire assembly in the form of published literature, detailed specifications and project specific details.
- C. All component products incorporated into the Greenroof-Roofscapes shall be supplied by or approved by the membrane manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials under provisions of General Conditions Section.
- B. Deliver materials to jobsite on pallets. Package labels shall indicate material name, production date and product code.
- C. Store materials in dry, protected areas in an upright position. Control temperature of storage areas in accordance with Manufacturer's instructions. Protect moisture sensitive materials with breathable tarps on sides and top surfaces.

1.07 PROJECT CONDITIONS

- A. Follow local, state and federal regulations, safety standards and codes. When a conflict exists use the stricter requirement.
- B. Do not apply waterproofing materials unless proper bitumen application temperatures (approximately 350° F-400° F) can be maintained, or when moisture in any form (i.e. rain, dew, ice, frost, snow, etc.) is present on the deck. Do not heat bitumen above 400° F.
- C. Ensure deck is structurally sound to support the live and dead load requirements of the waterproofing system and sufficiently rigid to support construction traffic.
- D. Sequencing and Scheduling: The Work shall be scheduled in the construction sequence so that designated complete contiguous areas can be installed and completed, including overlay elements and wear courses, before other construction trades are allowed in the area. Prior to starting the Work, all drains shall be operative and all deck projections, sleeves and all other penetrations shall be installed, in place and operative.

1.08 REGULATIONS COMPLIANCE

It shall be the Applicator's responsibility to ensure that all applicable permits are obtained prior to the start of the Work.

1.09 WARRANTY

Supplier of the Greenroof-Roofscapes System shall furnish its standard Ten Year Warranty for labor and materials, including the membrane, membrane flashings, protection course, drainage medium, insulation and all other Green Roof components supplied by the manufacturer.

The system warranty shall also include two year warranty of planting survivability of eighty percent of the initial installation density for approved plantings. The two year planting warranty shall be extendable under a service and maintenance agreement.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

The Barrett Company, Wilmington, DE (800/647-0100) or Architect approved equal.

2.02 MATERIALS

A. Waterproofing Membrane:

- 1. Hot Polymeric Waterproofing: **ram-Tough 250** SBS Kraton® fluid-applied modified bitumen shall have inert mineral stabilizer and a minimum 10% recycled tire rubber content. Material shall comply with the following specifications:

<u>TEST</u>	<u>CGSB 37-GP-50M REQUIREMENTS</u>	<u>TYPICAL TEST RESULT</u>
Flash Point, °C	Min. 260	327
Penetration, 0.1 mm	Max. 110 @ 25°C Max. 200 @ 50°C	83 165
Flow, mm	Max. 3	0.5
Toughness, J	Min. 5.5	11.7
Ratio of Toughness, J/N to Peak Load Adhesion	Min. 0.040	0.059
Water Vapor Permeance ng/Pa.s.m_	Max. 1.7	0.39
Water Absorption, g	Loss 0.18 Gain 0.35	0.22+
Crack Bridging @ -25°C	No delamination No loss adhesion No cracking	No delamination No loss adhesion No cracking

Heat Stability @ 200°C Penetration, 0.1 mm	Max. 110 @ 25°C Max. 200 @ 50°C	80 155
Low Temp Flex @ -25°C	No delamination No loss adhesion No cracking	No delamination No loss adhesion No cracking
Viscosity, s @ 200°C	Min. 2 Max. 15	5

2. Uncured Neoprene Flashing Sheet: **ram Flash 327 HDR Sheet**, shall comply with the following minimum specifications:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thickness	ASTM D-412	60 Mils
Thickness Tolerance, %	ASTM D-412	±10
Tensile Strength min, psi	ASTM D-412	1500
Elongation, Ultimate min, %	ASTM D-412	250
Hardness, Curometer, A Tear resistance min,	ASTM D-2240	60 ±10
Brittleness Temperature, max	ASTM D-746	-30 F
Flame Resistance	ASTM C-542	Must not propagate flame
Resistance to Heat Aging Properties after 70 h at 212°F Hardness increase max.	ASTM D-573	+ 10
Resistance to Oil Aging Change in Volume, max after 70 h Immersion in ASTM Oil #3 at 212°F	ASTM D-471	+ 80%
Resistance to Water Change in Mass, max, after 7 days Immersion at 158°F	ASTM D-471	+ 10%
Water Vapor Permeance (perms)	ASTM E-96	.07

3. Ply Sheet: Poly-Felt 125 VP spunbond polyester fabric, non-needlepunched, heat set with resin binder, shall comply with the following minimum specifications:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Basis Weight	ASTM D-3776	60 GR/M ²
Grab Tensile/lb	ASTM D-4830	34/lb. MD 32/lb. CD
Elongation/%	ASTM D-4830	37 MD 42 CD
Trapezoid Tear/lb.	ASTM D-4830	14 MD 12 CD
Ames Thickness	ASTM D-1777-64	9.5 mils
Fatigue Life	ASTM D-8B	10,000 cycles

Choose one of the following Protection Courses/Root Barrier

ram-201 – light duty, insulated assembly
ram-203 – medium duty, insulated assembly
ram-200 – heavy duty, required with non-insulated assembly
ram-306 – aggressive root resistant, for insulated or non-insulated assemblies

4. Protection Course: **ram 201**, shall comply with the following minimum specifications:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thickness	ASTM D-412	1.1 mm min.
Weight	ASTM D-461	Min 25 lbs. / 100 SF

- A. Protection Course: **ram 203**, shall comply with the following minimum specifications:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thickness	ASTM D-412	2.2 mm min.
Weight	ASTM D-461	Min 50 lbs. / 100 SF

B. Protection Course: **ram-200** shall comply with the following minimum specifications:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thickness	ASTM D-412	3.0 mm min.
Weight	ASTM D-461	Min.77 lbs. / 100SF
Breaking Strength	ASTM D-412	MD 119 lbs. / in. XD 88 lbs. / in.
Elongation	ASTM D- 412	50%

C. Protection Course: **ram-306** shall comply with the following minimum specifications:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thickness	ASTM D-412	4.0 mm min.
Weight	ASTM D-461	105 lbs. / 100SF
Breaking Strength	ASTM D-412	MD 119 lbs. / in. XD 88 lbs. / in.
Elongation	ASTM D - 412	50%

Choose one of the following Secondary Root Barriers

5.A. Root Barrier: ram-20, 20 mil Polyethylene sheeting.

B. Root Barrier: ram-40, 40 mil HDPE sheeting.

Insulation is recommended but not required. If compressive loads in excess of 60 pounds per square inch are anticipated, specify Dow Styrofoam High Load, 100 pounds compressive strength per square inch.

- 6 Insulation: Insulation board shall be CFC-free,dense, rigid, extruded polystyrene insulation meeting the following properties.

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thermal Conductivity @ 75° F	ASTM C-518	0.20 K
Compressive Strength, min.	ASTM D-1621	60 lbs.
Flexural Strength, min.	ASTM C-203	75 lb/in.
Water Absorption	ASTM C-272	0.1%
Water Vapor Permeance	ASTM E-96	0.3-.8 perm
Dimensional Stability	ASTM D-2126	2% max

If insulation is specified, Ram-Aeration 600 is included in the assembly. Ram-Aeration 600 is designed to be placed over the insulation to provide air flow and accelerate moisture evaporation from the insulation surface, reducing temporary thermal loss.

7. Aeration Mat: Ram-Aeration 600, geotextile sheeting and plastic gridwork.
8. Drainage and water retention Mat: Ram Roofscape 1241, composite polyethylene drainage medium consisting of a 3 dimensional water retaining core with polypropylene geotextile fabric bonded to both sides of the core. Ram-Drain-Roofscape 1241 shall comply with the following minimum specifications.

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Thickness	ASTM D-177	0.45 inches
Compressive Load Test Flow	ASTM D-1621 mod. ASTM D-4716	15,000 lbs. / sqft 12 gals./min/ft wide
Fabric Flow	ASTM D-4491	.70 gpm / sq ft
Grab Tensile	ASTM D-4632	130 lbs.
U.V. Resistance	ASTM D-4355	Stabilized passed.
Puncture Resistance	ASTM D-4833	35 lbs.

Water Retention

10 cu. in./sf

B Related Materials:

1. Primer: **ram Primer/Surface Conditioner** shall comply with ASTM D-41 requirements.
2. Nails and Mechanical Fasteners: As specified by the Manufacturer for specific applications and approved by the membrane Manufacturer.

Optional Related Materials

3. Geotextile Erosion Control Mat – open grid thermoplastic mat
4. Temporary Erosion Control Mesh – photo-degradable open weave mesh designed to hold seed and soil in place until vegetation is established. Typically lasts through one or two growing seasons under normal conditions.
5. Root Stabilization Mat – nylon matting promotes healthier turf with less maintenance. Buried and placed one inch below top of soil level, will permanently hold roots and soil in place.
6. Paver Units – Exposed aggregate precast concrete units, lightly sandblasted in production, in standard colors as selected by the Architect. Paver unit size shall be 2 inches thick, 24 inches x 24 inches square. Paver unit manufacturer shall be approved by the membrane manufacturer for total system warranty.

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Compressive Strength	ASTM C-140	8000 psi, min.
Water Absorption	ASTM C-140	5% max
Freeze/Thaw Resistance	ASTM C-67:8	1% loss, max
Flexural Strength	ASTM C-293	600 PSI

7. Paver Pedestal units and Leveling Plates: Barrett “Roofscape” Pedestal Units fabricated from high density polyethylene with integral 1/8 inch joint spacer ribs. Pedestal units shall have thorough drainage. Pedestal units shall meet the following values:

<u>TEST</u>	<u>METHOD</u>	<u>TYPICAL TEST RESULTS</u>
Low Temperature Brittleness	ASTM D-476	90°F
Shore Hardness	ASTM D-1706 D	65
Softening point	ASTM D-1525 2	64°F
Weatherability		Unaffected

8. Filter Fabric: nonwoven polypropylene RAM Filter Fabric P3P or Confil 0689H.

Additional Optional Items: Contact Barrett Tech Services for additional information.

- 9. Moisture Retention Mat
- 10. Pond Liners
- 11. Metal Curbing
- 12. Arbor Tie-Anchors
- 13. Drain Boxes
- 14. Vent Pipe Boxes
- 15. Boardwalk Panels
- 16. Concrete Curbs

PART 3 - EXECUTION

3.01 PREPARATION

- A. Remove trash, debris, grease, oil, water, moisture and other contaminants from the deck which may affect bond of bitumen to deck surface.

Optional:

Sand-blasting and/or shot-blasting procedures may be required on certain renovation work to provide the best possible surface. If required, provide unit price per square foot in bid documents.

- B. Condition of Surface: Any new concrete surfaces shall be wood float finish ACI301-11.7.3 or better. All concrete shall have cured for a minimum of 28 days or, alternatively, pass ASTM D-4263 Moisture Content Test and the NRCA deck dryness test. All surfaces shall be dry, clean, firm and free from laitance, frost, dust, dirt, oil, unapproved curing compounds or other foreign matter detrimental to performance of waterproofing membrane. The Contractor shall certify no wax base curing compounds have been used. Follow ASTM D-5295 Guide for preparation of concrete surfaces.

Before commencing work, examine all areas and report in writing to Architect any conditions that will adversely affect successful installation. Do not begin work until the conditions have been corrected. Voids, cracks, holes and other damaged surfaces shall be repaired with materials compatible with ram-**Tough** 250. On existing concrete decks, all old existing membrane and flashings shall be completely removed to bare concrete.

- C. Expansion Joints: Expansion joints shall be sharply formed and free of broken edges or loose aggregate and completely free of preformed joint fillers, sealants or back-up

materials to a depth that is at least twice the width of the joint. Curb expansion joints at each side of the joint, either by integrally forming with the slab or securely fastening sulfate treated wood strips to deck. Chamfered the edges of curbs that membrane is installed over.

- D. Verify concrete surfaces are properly cured, dry and reasonably smooth. Prepare other surfaces according to respective Manufacturer's published instructions. All metal work shall be free of process oils and rust, cleaned to a bright condition. Use cleaning materials and methods necessary to render an acceptable dust free surface, including oil free filtered compressed air or high speed power blowers. Protect adjacent areas from damage with tarpaulin or other durable materials.
- E. No protection from the weather is necessary for **ram-Tough** 250, but temporary protection for installed membrane is required to prevent damage by mechanical gouging, scraping, spilling of oil, solvents or exposure to excessive heat.
- F. Delivery and Storage: Deliver and store materials undamaged in original containers with Manufacturer's labels and seals intact.

3.02 INSTALLATION

- A. Surface Conditioner: Each day, prior to application of **ram-Tough** 250, apply surface conditioner, as a fine spray at a rate of approximately 1 gallon per 300-600 square feet. Allow to dry completely tack free. Do not allow primed surface to be contaminated with construction debris or dust barrier. Re-prime and allow to dry as may be required by job conditions.
- B. Application: Units of **ram-Tough** 250 shall be melted in an approved double-jacket air or oil bath melter under continuous agitation until the material can be drawn free-flowing and lump-free at a temperature of approx. 350°F - 400°F. The **ram-Tough** 250 shall be applied at a rate to provide a continuous coating not less than 125 mils thick. Carry slab applications up all vertical wall surfaces a minimum of 8 inches.
- C. Hot fluid applied **ram-Tough** 250 shall be applied in a width exceeding the reinforcement fabric roll width. While **ram-Tough** 250 is hot and tacky, install specified Poly-Felt 125 VP reinforcement, brooming in place from the side of the fabric. Side laps shall be a minimum of 2 inches with lap placement so that water flows over them and not against them. All laps shall be sealed with hot **ram-Tough** 250 under lap. In no place shall reinforcement touch reinforcement. End laps shall be 7 inches. Carry reinforcement up all vertical wall surfaces a minimum of 6 inches.
- D. After reinforcement fabric has been placed and broomed in, install second layer of **ram-Tough** 250, a minimum of 125 mils thick, at all points of the deck and walls. Carry slab applications up vertical wall surfaces a minimum of 8 inches. Do not

leave any reinforcement fabric uncoated at end of day's work or in inclement weather. Complete installation of all plies each day including cap sheet.

3.03 FLASHING

Carry hot applied roof **ram-Tough** 250 and reinforcement up all junctions of horizontal deck and vertical surfaces, all changes of plane and all cold joints and cracks as indicated on the drawings. At all parapets, walls, curbs, penetrations, drains, edges, changes of plane and stress conditions install **ram-Flash** 327 HDR 60 mil neoprene flashing with hot fluid **ram-Tough** 250 under the reinforcement sheet as shown on the drawings, extending to top of the flashing. Where applicable, mechanically fasten with 1/8 inch flat bar stock termination bar and fasteners approved for the substrate receiver. Overcoat the neoprene flashing with another 125 mil coat of the **ram-Tough** 250.

Application width of neoprene flashing sheet shall be a minimum 6 inches total, minimum 3 inches in any single direction, or under if required by field conditions.

3.04 CRACK TREATMENT

At all cracks and construction joints, apply **ram-Tough** 250, 125 mils thick, then center a 6 inch wide strip of **ram** Flash 327 HDR neoprene flashing over the joint or crack and embed into the warm **ram-Tough** 250. Avoid air pockets. Allow assembly to cool. Reinforcement and flashing should be installed before the continuous, unbroken thick film of bitumen or reinforcement felt is applied over the entire roof surface and flashing areas in accordance with specification in Section 3.02.

3.05 EXPANSION JOINTS

Over expansion joints, up to 3 inches in width with a designed total movement of 50% or less, **ram** Flash 327 HDR neoprene flashing shall be placed over the joint as shown on the drawings and embedded into a 125 mil thick coating of **ram-Tough** 250. The sheet shall be looped into the joint 1-1/2 times the joint width at maximum opening and extend 8 inches onto the deck on each side of the joint. The sheet shall be covered and the loop filled solid and flush with **ram-Tough** 250. Install 2 inch foam rod and second sheet of neoprene flashing looped over the foam rod. Extend sheet 12 inches onto the deck on each side of the joint. Overcoat flange on each side with Ram Tough 250.

3.06 PROTECTION COURSE

After water test is completed, using **ram-Tough** 250 as adhesive and starting at the low points, apply specified protection course lapping the side laps a minimum of 2 inches in direction of drainage gradient so water flows over and not against laps.

3.07 WATER TEST

Each contiguous flat deck area shall be water tested with 2 inches of standing water for a 24-hour period. Provisions for overflow in event of rain shall be provided. Any area not passing Water Test shall be repaired and retested until watertight. Water Test shall be witnessed and approved by Architect and Manufacturer providing the system warranty.

3.08 ROOT BARRIERS

Primary and secondary root barriers shall be installed in accordance with manufacturers recommendations. Generally the primary root barrier is installed under the insulation and the secondary root barrier is installed over the insulation and aeration 600.

3.09 INSULATION

After the membrane, flashing and other associated work is completed, water tested and approved by the manufacturer, proceed with the installation of the extruded polystyrene insulation. Place insulation panels directly on the protection course and root barrier with open channel sides down. Stagger end joints. Tightly abut all boards. The maximum acceptable opening between boards is $\frac{1}{8}$ inch. Provide temporary ballast as required to prevent wind damage.

3.10 RAM-AERATION 600

Shall be placed directly over insulation. Provide 3 inch sidelaps. Install secondary root barrier and seam all joints with tape and hot air gun.

3.11 WATER RETENTION AND DRAINAGE MAT

Starting at the low points, apply water retention drainage mat over secondary root barrier, with reservoir cups oriented to retain water. At the side laps glue or tape fabric overlap 2 feet on centers with $\frac{1}{2}$ inch overlap over the previously installed material. End laps are installed by pulling back the fabric 6 inches, nesting the next roll of material into the exposed 6 inch lap, replacing the 6 inch fabric flap, taping it in place and proceeding with installation. Temporary ballast may be used to keep drainage course in place until overburden is installed.

3.12 PAVERS AND PEDESTALS

Specified paver units shall be set on specified pedestals to line and grade as shown, with uniform joint width. Adjust pedestal elements so that precast paver has bearing on all four corners. Where cutting is required, it shall be done with a high speed masonry saw producing clean sharp edges. Precast paver units shall fit to within $\frac{1}{8}$ inch of all projections and walls or

as shown on drawings. Protect units in place from soiling or damage during the construction process. Replace any units damaged prior to completion. Provide shims as required to align paver surface with existing elements and other pavers.

- 3.13 GEOTEXTILE EROSION CONTROL MAT
- 3.14 TEMPORARY EROSION CONTROL MESH
- 3.15 ROOT STABILIZATION MAT
- 3.16 MOISTURE RETENTION MAT
- 3.17 POND LINERS
- 3.18 METAL CURBING
- 3.19 ARBOR TIE-ANCHORS
- 3.20 DRAIN BOXES
- 3.21 VENT PIPES BOXES
- 3.22 BOARDWALK PANELS
- 3.23 CONCRETE CURBS
- 3.24 FIELD QUALITY CONTROL

Contact Barrett Tech Service @ 800-647-0100
or Barrett033@aol.com
for optional specification assistance

- A. Adhesion Tests and Thickness Tests shall be monitored by Applicator every hour throughout the application process.
- B. Test Cuts of waterproofing or flashing membrane shall be made at locations of Architect's or Manufacturer's request:
 - 1. Remove one 2 inch x 6 inch unsurfaced cut per 100 squares of deck area.
 - 2. Follow field audit criteria outlined by ASTM Standards.
 - 3. Send roof cuts to: Structural Research Inc., Madison, Wisconsin, or Manufacturer approved accredited laboratory for laboratory examinations. Applicator shall allow \$500.00 for testing fees per 100 squares of roof area. Laboratory reports shall be submitted by the laboratory directly to the

Architect.

4. Repair sampled areas by filling in the cut-out area then use a "feathered in" patch consisting of Poly•Felt 125 VP, **ram-Tough** 250 following the Manufacturer's procedures.
- C. Correct any deficiencies in the deck membrane, if any, (determined by deck cut analysis) as prescribed by material Manufacturer and approved by the Architect.

3.26 CLEANING

- A. Remove equipment, trash, debris and any excess material from the jobsite.
- B. Repair damage and remove any stains caused by Work of this Section.

3.27 PROTECTION

General Contractor shall protect finished deck areas from damage during subsequent construction.

MAINTENANCE:

Semi-annual inspections and a systematic maintenance program are recommended to the Owner and Architect. Consult your Barrett Representative or Barrett Approved Applicator for further information.