SECTION 07 5423

ADHERED TPO MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

B. Section Includes:

1. Adhered TPO membrane roofing system on the following types of roof decks:
   a. Concrete roof decks.
   b. Steel roof decks.

2. Substrate board
3. Roof insulation with cover board facer.
4. Vapor retarder.
5. Roof pavers.
6. Roof walkway pads.

C. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.

1.2 DEFINITIONS

A. TPO: Thermoplastic polyolefin.

B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

C. Manufacturer Field Advisor: An employee of the Manufacturer, which lists and markets the primary components of the system under its name, and who is certified in writing by the Manufacturer to be technically qualified in design, installation, and servicing of the required products or an employee of an organization certified by the foregoing Manufacturer to be technically qualified in design, installation, and servicing of the required products.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.
   1. Corner Uplift Pressure: As shown on Structural Drawings.
   2. Perimeter Uplift Pressure: As shown on Structural Drawings.
   3. Field-of-Roof Uplift Pressure: As shown on Structural Drawings

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals’ “RoofNav” for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hail Resistance: SH.

E. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

1.4 SUBMITTALS

A. LEED Documentation Submittals:
   1. MR Credit 4: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      a. Include statement indicating costs for each product having recycled content.
   2. MR Credit 5: Product Data indicating location of manufacturer for regionally manufactured, extracted, harvested, or recovered materials or products.
      a. Installed Product: Roof membrane, insulation, and auxiliary materials; include statement indicating cost of roof membrane, insulation, and auxiliary materials and distance from manufacturer to Project site.
      b. Raw Materials Used in Manufacture of Roof Membrane, Insulation, and Auxiliary Materials: Include statement indicating cost and distance from point of extraction or recovery to Project site for each raw material used in the manufacture of roof membrane, insulation, and auxiliary materials.
   3. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
   4. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation fastening patterns.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:

1. Sheet roofing, 12 inches square, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Vapor retarder.
5. Termination bars.
6. Roof pavers.
7. Roof walkway pads.

E. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

F. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of meeting performance requirements.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system. Include test results indicating compliance with uplift pressures calculated according to ASCE 7.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

J. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.5 QUALITY ASSURANCE

A. Installer’s Qualification Data: A firm with not less than 10 years experience in installing sheet membrane roof systems. Provide the following:

1. Letter from roof membrane manufacturer certifying that Installer is licensed or approved to install the roof system.
2. Names, addresses, and telephone numbers of 5 buildings where Installer has installed TPO sheet membrane roof systems similar in material, design, and extent to that indicated for this Project, have a record of successful in-service performance and are covered by roof manufacturer’s warranty. Include roof membrane manufacturer’s name and warranty number.
3. Letter certifying that job foreman or crew chief and at least two other members of the roofing crew have installed at least 10 TPO adhered sheet membrane roof systems and are thoroughly familiar with all aspects of its installation.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project.
C. Source Limitations: Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

D. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

E. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner, Design/Builder, Owner’s insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, vapor retarder, walkway products, and other components of membrane roofing system.
2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:

1. Manufacturers:
   a. Carlisle SynTec Incorporated.
   b. Firestone Building Products Company.
   c. Johns Manville, Inc.

   Design team recognizes that Firestone's standard "tan" TPO products are listed no higher than SRI 77. Anything below SRI 78 will be rejected.
   SRI 101 typical white from Johns Manville; tan is special order and may have a lower SRI value. Team will only consider products with SRI value over 78.

2. Thickness: 80 mils, nominal.
3. Exposed Face Color: Beige.
4. Physical Properties:
   b. Elongation at Break: 15 percent; ASTM D 751.
   c. Tearing Strength: 55 lbf minimum; ASTM D 751, Procedure B.
   d. Brittleness Point: Minus 22 deg F.
   e. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F and an ozone level of 100 ppm; ASTM D 1149.
f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F; ASTM D 573.
g. Water Absorption: Less than 4 percent mass change after 166 hours’ immersion at 158 deg F; ASTM D 471.
h. Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   a. Plastic Foam Adhesives: 50 g/L.
   b. Gypsum Board and Panel Adhesives: 50 g/L.
   c. Multipurpose Construction Adhesives: 70 g/L.
   d. Fiberglass Adhesives: 80 g/L.
   e. Contact Adhesive: 80 g/L.
   f. Other Adhesives: 250 g/L.
   g. Single-Ply Roof Membrane Sealants: 450 g/L.
   h. Nonmembrane Roof Sealants: 300 g/L.
   i. Sealant Primers for Nonporous Substrates: 250 g/L.
   j. Sealant Primers for Porous Substrates: 775 g/L.

B. Sheet Flashing: Manufacturer’s standard unreinforced thermoplastic polyolefin sheet flashing, 60 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard water-based bonding adhesive for membrane and base flashings.

D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.4 SUBSTRATE BOARDS (AT STEEL ROOF DECKS)

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

1. Products: Subject to compliance with requirements, provide the following:
a. Georgia-Pacific Corporation; Dens Deck.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.5 VAPOR RETARDER


1. Products:
   a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A."
   c. Henry Company; Perma-Seal PE.
   e. Owens Corning; WeatherLock M.
   f. Protecto Wrap Company; Rainproof TM.

B. Primer: Manufacturer’s standard primer suitable for substrate to which vapor retarder is applied

2.6 TYPE 1: ROOF INSULATION WITH COVER BOARD FACER

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer’s standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

1. Insulation Board Size: Not to exceed 4 ft. by 4 ft.
2. Thickness: Maximum 2 inches.

B. Base Layer: Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Tapered/ Top Layer: Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.

1. Type VII, glass mat faced gypsum board facer, 1/2 inch thick. Provide the following:
   a. Product: ACFoam Composite; Atlas Roofing Corp.

D. Drain Sump: Polyisocyanurate board insulation, hinged 4 ft. by 8 ft. panel expands to 8 ft. by 8 ft.; tapered from perimeter of board to drain sump in middle of board. Install at roof drains.

E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
2.7 **TYPE 2: ROOF INSULATION AND COVER BOARD**

A. **Board Insulation:** Extruded-polystyrene board insulation complying with ASTM C 578, square edged.
   
   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      
      a. DiversiFoam Products.
      b. Dow Chemical Company (The).
      c. Owens Corning.
      d. Pactiv Corporation.
      e. T. Clear Corporation.

   2. **Type V, 100-psi minimum compressive strength.**

B. **Cover Board:** ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

   1. **Products:** Subject to compliance with requirements, provide the following:
      
      a. Georgia-Pacific Corporation; Dens Deck.

2.8 **INSULATION ACCESSORIES**

A. **General:** Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.9 **ROOF PAVERS**

A. **Application:** For roof top maintenance; locations shown on Drawings.

B. **Heavyweight Roof Pavers:** Heavyweight, hydraulically pressed, concrete units, with top edges beveled 3/16 inch, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:

   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      
      b. Roofblok Limited.
      c. Sunny Brook Pressed Concrete.
      d. Wausau Tile, Inc.; Terra-Paving Division.
      e. Westile Roofing Products.

   2. **Size:** 24 by 24 inches. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, width, and thickness.
3. Weight: 18 lb/sq. ft.
4. Compressive Strength: 6500 psi, minimum.
5. Colors and Textures: As selected by Architect from manufacturer's full range.
6. Accessories: Manufacturer’s adjustable height pedestals and shims.

C. SRI Index: Provide roof pavers with initial Solar Reflectance Index of not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

2.10 LIMESTONE PAVERS

A. Application: Dean’s Terrace.

B. Limestone Roof Pavers: Indiana Oolitic Limestone; grade and color as follows:
   2. Size: 12 by 30 by 2 inches. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, width, and thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

B. Steel Roof Decks: Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section “Steel Deck”.

C. Concrete Roof Decks:
   1. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed
   2. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer’s written instructions. Remove sharp projections.
B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD (STEEL ROOF DECKS)

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Steel Roof Decks: Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

3.4 VAPOR-RETARDER INSTALLATION

A. Install self-adhering sheet vapor retarder, wrinkle free, in a single layer over substrate board. Apply primer if required by manufacturer. Comply with temperature restrictions of vapor retarder manufacturer for installation. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover vapor retarder within 7 days.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.5 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Size of Insulation Board: Not to exceed 4 ft. by 4 ft. by 2 inches thick.

E. Roof Drains: Install drain sump insulation board, 8 ft. by 8 ft., at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Install subsequent layers of insulation in a cold fluid-applied adhesive.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply cut-edge sealant to seal cut edges of sheet membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply water-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.
D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings.

3.8 ROOF WALKWAYS

A. Roof Pavers: Install roof pavers according to manufacturer's written instructions in locations indicated.

1. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
2. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
3. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.
4. Maintain tolerances of paving installation within 1/4 inch in 10 feet of surface plane in any direction.

3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's Field Advisor to inspect roofing installation on completion. Provide not less than 48 hours’ notice to Owner and Architect.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. In the presence of the Architect, closely examine and probe all seams in the membrane and flashing.

1. Probe edges of all welded seams with blunt tipped cotter pin removal tool. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths. Repair defective areas.
2. Cut cross-section seam samples every day that seams are welded. Cut a minimum of two, 2-inch wide x 8-inch long seam samples through completed seams. Cut samples in presence of and where directed by the Director's Representative. Failure of samples to maintain the standard of Quality Standard Samples will be cause for rejection of the Work.
3. Repair all areas of welded seams where samples have been taken.

3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
SUBMITTAL COVER SHEET

Project: IU Jacobs School of Music
205 South Jordan Avenue
Bloomington, IN 47906
IU #: 20084991

Architect: BDMD Architects
626 North Illinois Street
Indianapolis, IN 46204

Attn: Nick Worden

NOTE: 30 YEAR WARRANTY REQUIRED PER 07 5423 1.8

Submit vapor retarder per Spec. Sect. 07 5423 2.5
Submit sample of "tan" TPO membrane

NOTE: Hunter panel "Nailbase" insul. (Spec. Sect. 07 2100 2.3) is to be typ. installed on vert. parapet walls, and on gwb-sheathed CFMF walls behind the interlocking metal panel system.

5/8" OSB is specified. There is no attachment of this mat'ld. to metal deck or wood substrates.

Submittal number: 13-075423-02.03
Status: Date Submitted
Nov 28, 2011
Copies

Description: Adhered TPO Membrane Roofing (13-07542)

Item: Product Data
Shop Drawing

Remarks:

Contractor's Stamp

Reviewed and found to be in general conformance with the contract documents except where noted.

THE HAGERMAN, INC.

By: [Signature]

FFC: 11-0140 "Submittal 075423"
IU Projectdoi #20084991

NOTE: ½" DENS DECK IS OK FOR THE "SUBSTRATE BOARD" ON THE METAL DECK.

¾" DENS DECK IS ACCEPTABLE FOR THE INSULATION "COVER BOARD FACER" IN PLACE OF 07 5423 2.6 l. a.
Steve's Roofing & Sheet Metal
5108 S. Commercial St.
Bloomington, IN 47403
(812) 824-3006 phone  (812) 824-3009 fax

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SUBMITTAL TRANSMISSION

TO:   Hagerman Inc.
      10315 Allisonville Rd
      Fishers, IN 46038

DATE: November 11, 2011
PROJECT NAME: IU Jacobs School of Music
PROJECT #: 20084991

Enclosed you will find the following submittal items:

- 07 4263 Interlocking Metal Wall Panels
- 07 4253 Adhered TPO Membrane
- 07 6119 Flat Seam Sheet Metal Roofing
- 07 6200 Sheet Metal Flashing
- 07 7100 Roof Specialties
- 07 7233 Roof Hatches

Thank you,

Becky Miller
Project Coordinator
ROOFING CONTRACTOR WORKMANSHIP WARRANTY

1) Contractor: Steve's Roofing & Sheet Metal

4) Roofing Materials Manufacturer: [Name and Address]

2) Roof Owner:

5) Warranty begins: [Date] and expires: [Date]

3) Type and Name of Building: [Building Name]

Building location: [Location]

Area of Roof: [Area]

6) Warranty: Contractor warrants to Owner that it applied the roofing materials to the above-described roof in accordance with (a) the written specifications of Roofing Materials Manufacturer and (b) good roofing industry practices, in effect on [Date], the date application commenced. Subject to the following terms, conditions and limitations, Contractor will, during the term of this Warranty, at its expense, repair or cause to be repaired leaks in said roof which are the result of defects in Contractor's workmanship. Upon expiration of the term of this Warranty, without notice from Owner of some defect, Contractor shall have no further obligation to make repairs at Contractor's expense under any provision of this Warranty and Owner shall not make any further demand or claim against Contractor concerning Contractor's workmanship, or the roofing materials installed, provided that Contractor promptly commences and diligently proceeds with the correction and repair of all such defects covered by this Warranty which are called to Contractor's attention during the term of this Warranty by Owner.

7) Terms, Conditions and Limitations. This warranty does not cover any leaks in the roof caused by: the acts or omissions of other trades or contractors; lightning, winds of peak gust speeds of 55 m.p.h. or higher measured at 10 meters above ground, hail storm, flood, earthquake or other unusual phenomenon of the elements; structural settlement, failure, movement, cracking or excess deflection of the roof deck; defects or failure of materials used as a roof substrate over which the roof system is applied; faulty condition of parapet walls, copings, chimneys, skylights, vents, supports or other parts of the building; vapor condensation beneath the roof; penetrations for pitch boxes; erosion, cracking and porosity of mortar and brick; dry rot; stoppage of roof drains and gutters; penetration of the roof from beneath by rising fasteners of any type; inadequate drainage, slope or other conditions beyond the control of Contractor which cause ponding or standing of water; termite or other insects; rodents or other animals; fire; or harmful chemicals, oils, acids and the like that come in contact with the roofing system and cause a leak or otherwise damage the roof system. If the roof fails to maintain a watertight condition because of damage by reason of any of the foregoing, this warranty shall immediately become null and void for the balance of its term unless such damage is repaired by Contractor at the expense of Owner.

8) Notification by Owner. During the term of this warranty, if the roof leaks, Owner must immediately notify Contractor by telephone of such leaks, and promptly confirm such telephone notice by written notice to Contractor.

9) Events Which May Void Warranty. This warranty shall become null and void:
(a) Unless Contractor receives notice from Owner in accordance with paragraph 8 above of any leaks and is provided an opportunity to inspect, and if required by the terms of this warranty to repair the roof;
(b) If work is done on such roof, including, but without limitation, work in connection with flues, vents, drains, sign braces, mailings, platforms or other equipment fastened to or set on the roof or if repairs or alterations are made to said roof, without first notifying Contractor in writing prior to work commencement.
(c) If any area of the roof is used as a promenade, walkway or work area, or is sprayed or flooded, unless such use was originally specified with a defined area and the specification is noted in paragraph 14 below.

10) Transferrability. This warranty shall accrue only to the benefit of the original owner named above. It is not transferable to any other person, except with the prior written consent of contractor.

11) No Other Warranties. No other express warranty is given by Contractor to Owner. The repair of the subject roof is the exclusive remedy. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. ALL IMPLIED WARRANTIES, AND SPECIFICALLY THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED AND DISCLAIMED.

This warranty is separate and apart from any warranty that may be issued to Owner by the Roofing Materials Manufacturer. CONTRACTOR EXPRESSLY EXCLUDES AND DISCLAIMS ANY RESPONSIBILITY TO OWNER IN CONNECTION WITH OR ATTRIBUTABLE TO THE ROOFING MATERIALS AND ANY SUCH ROOFING MATERIALS MANUFACTURER'S WARRANTY.

12) Incidental or Consequential Damages. UNDER NO CIRCUMSTANCES SHALL CONTRACTOR BE LIABLE TO OWNER OR ANY OTHER PERSON FOR ANY INCIDENTAL, SPECIAL, CONSEQUENTIAL OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR DAMAGE TO THE BUILDING OR ITS CONTENTS, WHETHER ARISING OUT OF BREACH OF WARRANTY, BREACH OF CONTRACT OR UNDER ANY OTHER THEORY OF LAW.

13) Payment to Contractor. This warranty shall not be or become effective unless and until Contractor has been paid in full for said roof in accordance with the agreement pursuant to which said roof was applied.

14) Additional conditions or exclusions

This warranty has been duly executed this [Date] day of [Month], 20[Year]

________________________________________________________

By: Steve's Roofing & Sheet Metal

Contractor

By: [Signature]

Owner

© 2002B Roofing Contractor Workmanship Warranty • Midwest Roofing Contractors Association • 800/497-6722 • www.merca.org ©
Project Name:  School of Music

Project Address:

JM Approved Roofing Contractor: Steve's Roofing & Sheet Metal
8/18/2010

Stevens Roofing & Sheet Metal
5108 S. Commercial St
Bloomington, IN 47403

Phone: 812-824-3006
FAX: 812-824-3009

RE: IU

To Whom It May Concern:

Please be advised that a Johns Manville Certified Roofing Contractor Agreement (the “Agreement”) presently exists between Johns Manville Roofing Systems Group and the above named contractor located at the above address. The Agreement stipulates that Johns Manville will issue Peak Advantage Guarantees for Johns Manville systems listed below.

APP/SBS Torch and Cold Applied
BUR/SBS Asphalt Applied
PVC
EPDM Single Ply
TPO
Cleanbond

All Terms
All Terms
All Terms
All Terms
All Terms

These guarantees will be issued to the above-named contractor in accordance with all procedures and requirements of the Johns Manville Peak Advantage Guarantee Program. This Agreement is subject to cancellation by either Johns Manville Roofing Systems Group or the above named contractor upon thirty (30) days written notice to the other party of the Agreement.

Please call 800-922-5922 if you need further information.

[Signature]

Johns Manville is a manufacturer of commercial roofing products and offers this general conceptual information to you as a courtesy. This complimentary assistance is not to be used or relied upon by anyone as a substitute for professional engineering design and documentation required by building code, contract or applicable law. By accepting these comments you agree they do not constitute any representations, endorsements of, or an assumption by Johns Manville of any liability for either the adequacy of the design of this building or any other material not supplied by Johns Manville.
Johns Manville

Peak Advantage Guarantee

Note: For the most current information on JM Peak Advantage Guarantees, please refer to the JM Roofing Web site.
Maintenance Program

In order to continue the coverage of this Guarantee, the following Maintenance Program must be implemented and followed:

1. Building Owner must notify JM Guarantee Services Unit immediately upon discovery of the leak and in no event later than ten (10) days after initial discovery of the leak, time being of the essence. Failure of the Building Owner to provide timely notice to JM Guarantee Services of any leak is a material ground for termination of the Guarantee.

2. In response to timely notice, JM will arrange to inspect the Roofing System and:
   (i) If, in JM's sole and absolute opinion, the leak(s) is not the responsibility of JM under the Guarantee (see Limitations and Exclusions), then JM will take prompt appropriate action to repair the damage to the Roofing System, at JM's expense.
   (ii) If, in JM's sole and absolute opinion, the leak(s) is the responsibility of JM under the Guarantee, then JM will advise the Building Owner within a reasonable time of the minimum repair costs, if any, and the Building Owner is required to return the Roofing System to a watershirt condition. If the Building Owner does not repair promptly and timely makes such repairs to the Roofing System, time being of the essence, this portion of the Guarantee will remain in effect for the unexpired portion of the Term. Failure to make such repairs in a timely and reasonable fashion will void any further obligation of JM under this Guarantee as to the damaged portion of the Roofing System as well as any other portion of the Roofing System impacted by such failure.

3. In the event an emergency condition exists which requires immediate repair to avoid damage to the building, its contents or occupants, then Building Owner may make reasonable temporary repairs to a Building Owner for these reasonable repair expenses. No such temporary repair expenses will be the responsibility of JM under the Guarantee.

There are a number of items not covered by this Guarantee that are solely the responsibility of the Building Owner. In order to ensure that your roof will continue to perform as expected and to continue JM's obligations under the Guarantee, you must examine and maintain these areas on a regular basis:

- Maintain a file for your records on the Roofing System mentioning to that limited to, the Guarantee, invoices, and subsequent logs of all inspections performed and repairs made to the Roofing System.
- Repair any Roofing System at your expense. This is not time-saving during the inspection of repairs. It is also a good idea to examine the Roofing System for damage to any portion of the system, such as hailstones, heavy rains, high winds, etc.
- Since these types of Roofing Systems typically reach low underlines, they are easily examined. However, care must be taken to prevent falling and other accidents. You may disclose and assume no liability for any inspections performed on this Roofing System.

When checking the Roofing System:

- Remove any objects such as leaves, dirt, branches, etc. that have accumulated.
- Clean gutters, downspouts, chimneys, and any surrounding areas. Make certain they allow water to exit the Roofing System. Use a vacuum cleaner and make certain they are not damaged by wind or traffic on the Roofing System, and make certain they are not damaged by any wall with the associated area. Do not clean up.
- Remove any debris on the Roofing System. Damaged materials, poorly fitted counter flashing, loose or missing nails, damaged nails, or loose nails can appear to be a removable leak. Have these items repaired by a qualified Roofing System contractor if found to be effective.
- Jot down the areas of concern, such as hainstones, evaporation, recurrence, etc. Make certain they do not move or become caught. Damage to the roof system by leaking materials onto the Roofing System.
- Check the building system and any problems in any turn may cause damage to your Roofing System.
- Take photographic evidence of any cracks, missing, or damaged areas must be recorded.

Maintaining your Investment:

- Avoid items such as climbing, accidentally damaging the memblance. Log all such trips to the Roofing System.
- Do not allow supersedes personal make penetrations into the Roofing System; these are to be made only by a JM Approved Roofing Contractor.
- All terms and conditions of this Guarantee shall be construed under the internal laws of the state of Colorado without regard to conflicts of law principles. The validity or enforceability of any other provision, which shall remain in full force and effect to the extent the remainder is inconsistent with the main text is preserved.

This Guarantee is valid only in the United States of America.

Guarantee Services Unit
Johns Manville, Guarantee Services Unit, 19400 West 18th Ave, Littleton, CO 80127 (shipping address)
Johns Manville, Guarantee Services Unit, P.O. Box 625001, Littleton, CO 80162-6001 (mailing address)

Guarantee Services Number
(303) 522-5800
E-mail: gsu@jm.com
www.jmcoo.com
JM TPO Roofing Membrane – 80 mil

Description
JM TPO thermoplastic polyolefin (TPO) membranes are reinforced with a polyester fabric and designed for use in mechanically fastened and adhered roofing applications.

Use
Install JM TPO Membranes in new, re-roof (tear-off) and re-cover roof constructions. In re-cover constructions, if the existing roof is sound, the single ply membrane can eliminate the cost of disposing the original roof.

Colors
White, Grey and Tan
Custom colors are available upon request and may be subject to minimum requirements and lead times.

Standard Sizes
<table>
<thead>
<tr>
<th>Color</th>
<th>Size (Length x Width)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>5' x 75' (1.52 m x 22.86 m)</td>
</tr>
<tr>
<td></td>
<td>8' x 75' (2.44 m x 22.86 m)</td>
</tr>
<tr>
<td></td>
<td>10' x 75' (3.05 m x 22.86 m)</td>
</tr>
<tr>
<td>Grey and Tan</td>
<td>5' x 75' (1.52 m x 22.86 m)</td>
</tr>
<tr>
<td></td>
<td>8' x 75' (2.44 m x 22.86 m)</td>
</tr>
<tr>
<td></td>
<td>10' x 75' (3.05 m x 22.86 m)</td>
</tr>
</tbody>
</table>

* Grey and Tan lead times are subject to availability and may require an upcharge for smaller projects.

JM Peak Advantage Guarantees
Enhanced guarantees are now available on certain systems for wind, hail and puncture. Consult your local sales representative for more information about the new Single Ply Guarantee Charges Requirements Guide for specific guarantee terms and costs.

<table>
<thead>
<tr>
<th>Product</th>
<th>Mechanically Fastened or Fully Adhered</th>
</tr>
</thead>
<tbody>
<tr>
<td>JM TPO 80</td>
<td>5, 10, 15 or 20 year</td>
</tr>
</tbody>
</table>

JM TPO Membranes meet or exceed all of the requirements of ASTM D 6878.

Tested Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Method</th>
<th>ASTM Requirements</th>
<th>80 Mil</th>
<th>XMD**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Sheet Thickness</td>
<td>D 751</td>
<td>&gt;0.039 in. (1.0 mm)</td>
<td>0.81 in. (2.06 mm)</td>
<td>0.035 in. (0.89 mm)</td>
</tr>
<tr>
<td>Thickness of Coating Over Fabric Weather Side</td>
<td>D 6878</td>
<td>&gt;0.012 in. (0.305 mm)</td>
<td>0.035 in. (0.89 mm)</td>
<td></td>
</tr>
<tr>
<td>Breaking Strength</td>
<td>D 751</td>
<td>&gt;220 lbf (978 N)</td>
<td>372.11 lbf (1,655.23 N)</td>
<td>374.63 lbf (1,666.44 N)</td>
</tr>
<tr>
<td>Elongation at Reinforcement Break</td>
<td>D 751</td>
<td>&gt;15%</td>
<td>36.53%</td>
<td>35.75%</td>
</tr>
<tr>
<td>Tearing Strength</td>
<td>D 751</td>
<td>&gt;55 lbf (245 N)</td>
<td>81.9 lbf (364.36 N)</td>
<td>214 lbf (951.92 N)</td>
</tr>
<tr>
<td>Brittleness Point</td>
<td>D 2137</td>
<td>-40°F (-40°C)</td>
<td>Pass @ -40°F (-40°C)</td>
<td></td>
</tr>
<tr>
<td>Ozone Resistance</td>
<td>D 1149</td>
<td>No Dracks</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td>Heat Aging (Pass/Fail)</td>
<td>D 573</td>
<td>Pass</td>
<td>Pass</td>
<td></td>
</tr>
</tbody>
</table>

** MD: Machine Direction  MD**: Cross Machine Direction  **Physical testing performed on a typical 10' (3.05 m) wide membrane**

Installation
Since JM TPO Membranes are thermoplastic, they can be rolled out onto the roof substrate and easily welded into one homogeneous sheet using hot-air welding procedures.

JM TPO Membranes can be mechanically fastened or adhered to the structural roof deck. Application must be in accordance with FM Global® requirements, building codes, and published standard fastening patterns or adhesives recommendations. Install JM TPO products in accordance with current JM TPO Applicator Guides or Detail Drawings.

Approvals
JM mechanically fastened and adhered TPO roof systems are classified by UL® (Underwriters Laboratories Inc.) and FM Global (Factory Mutual). When searching in RoofNav for a specific approval, be sure to indicate the mil thickness desired, i.e., JM TPO 80.

Energy and the Environment

<table>
<thead>
<tr>
<th>CRRC®</th>
<th>Initial Reflectivity: 0.77</th>
<th>Emissivity: 0.87</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Title 24</td>
<td>Pass</td>
<td>Reflectivity: 0.77</td>
</tr>
<tr>
<td>ENERGY STAR®</td>
<td>Initial</td>
<td>Reflectivity: 0.78</td>
</tr>
<tr>
<td>3 Yr. Aged</td>
<td>Cleaned 3 Yr.</td>
<td>Reflectivity: 0.68</td>
</tr>
<tr>
<td>LEED®</td>
<td>SRI of 101 as tested by ASTM E 1980.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recycled Content:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Postconsumer: 0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Postindustrial: 11%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Producing Locations: Scottsboro, AL</td>
<td></td>
</tr>
</tbody>
</table>

Results shown are for the initial reflectivity and emissivity for white membranes unless otherwise indicated; emissivity values for California Title 24 are tested per ASTM D 1371; LEED emissivity values are tested per ASTM E 408.

RS-864web 7-10 (Replaces 6-10)
JM TPO Roofing Membrane – 80 mil

JM TPO Membranes meet or exceed all of the requirements of ASTM D 6878.

**Tested Physical Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Method</th>
<th>ASTM Requirements</th>
<th>80 Mil MD**</th>
<th>XMD** **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Heat Aged Breaking Strength</td>
<td>D 751</td>
<td>&gt;80% retained values</td>
<td>381.31 lbf (1,697.19 N)</td>
<td>378.02 lbf (1,681.52 N)</td>
</tr>
<tr>
<td>Post Heat Aged Elongation at Reinforcement Break</td>
<td>D 751</td>
<td>&gt;80% retained values</td>
<td>36.67%</td>
<td>34.29%</td>
</tr>
<tr>
<td>Post Heat Aged Tearing Strength</td>
<td>D 751</td>
<td>&gt;60% retained values</td>
<td>80.4 lbf (357.64 N)</td>
<td>192.6 lbf (866.73 N)</td>
</tr>
<tr>
<td>Post Heat Aged Weight Change</td>
<td>D 1204</td>
<td>±1% max.</td>
<td>&lt;1%</td>
<td></td>
</tr>
<tr>
<td>Post Heat Aged Linear Dimension Change</td>
<td>D 6878</td>
<td>±1% max.</td>
<td>&lt;0%</td>
<td></td>
</tr>
<tr>
<td>Water Absorption</td>
<td>D 471</td>
<td>±3.0% max.</td>
<td>&lt;1.4%</td>
<td></td>
</tr>
<tr>
<td>Factory Seam Strength</td>
<td>D 751</td>
<td>&gt;66 (294)</td>
<td>96.33 lbf (428.5 N)</td>
<td></td>
</tr>
<tr>
<td>Post Xanon Visual Inspection</td>
<td>D 6878</td>
<td>Pass</td>
<td>Pass</td>
<td></td>
</tr>
</tbody>
</table>

**Supplemental Testing**

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Method</th>
<th>ASTM Requirements</th>
<th>80 Mil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Puncture</td>
<td>D 5635</td>
<td>N/A</td>
<td>35 Joules</td>
</tr>
<tr>
<td>Static Puncture</td>
<td>D 5602</td>
<td>N/A</td>
<td>Pass @ 44 lb (20 kg)</td>
</tr>
<tr>
<td>Reflectance</td>
<td>C 1549</td>
<td>N/A</td>
<td>81.52%</td>
</tr>
<tr>
<td>Emittance</td>
<td>C 1371</td>
<td>N/A</td>
<td>0.86</td>
</tr>
<tr>
<td>Resistance of Synthetic Polymer Material to Fungi</td>
<td>G 21</td>
<td>N/A</td>
<td>0 rating</td>
</tr>
<tr>
<td>Puncture Resistance (FTMS 101C, Method 2031)</td>
<td>N/A</td>
<td>N/A</td>
<td>526 lb (239 kg)</td>
</tr>
<tr>
<td>Moisture Vapor Transmission</td>
<td>E 96</td>
<td>N/A</td>
<td>0 g/m² per 24 hours</td>
</tr>
<tr>
<td>Hydrostatic Resistance, Mullen</td>
<td>D 751</td>
<td>N/A</td>
<td>802 PSI (4150 kPa)</td>
</tr>
</tbody>
</table>

**MD**: Machine Direction  
**XMD**: Cross Machine Direction  

* Physical testing performed on a typical 10' (3.05 m) wide membrane

Refer to the Material Safety Data Sheet prior to using JM TPO. Material Safety Data Sheet is available by calling (800) 922-5922 or on the Web at www.jm.com/roofing.
### Tapered Systems Group Quotation

<table>
<thead>
<tr>
<th>Master Project</th>
<th>Indiana University, Jacobs School of Music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quote Name</td>
<td>A2 IU Jacobs School of Music East Studio - Revised</td>
</tr>
<tr>
<td>Project Name</td>
<td>East Studio Building</td>
</tr>
<tr>
<td>Property Billing Address</td>
<td>BLOOMINGTON, IN</td>
</tr>
<tr>
<td>Master Project Reference Number</td>
<td>IN-2011-00016279</td>
</tr>
<tr>
<td>Total Quote SQ's</td>
<td>157.08</td>
</tr>
</tbody>
</table>

**Description:** 1/4" TAPERED ISO W/ 1/2" CRICKETS & 2" BASE LAYER AND 1/2" TAPERED ISO AT SUMP AREAS.

#### Product and Design Information:

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapered Slope</td>
<td>1/4&quot; TAPERED ISO (Polyiso)</td>
</tr>
<tr>
<td>Cricket Slope</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Tapered Min Thickness (IN)</td>
<td>0.500</td>
</tr>
<tr>
<td>Cricket Min Thickness (IN)</td>
<td>0.500</td>
</tr>
<tr>
<td>Tapered Max Thickness (IN)</td>
<td>9.75</td>
</tr>
<tr>
<td>Cricket Max Thickness (IN)</td>
<td>1.80</td>
</tr>
<tr>
<td>Average R-Value</td>
<td>25.91</td>
</tr>
<tr>
<td>Compressive Strength (PSI)</td>
<td>20 psi</td>
</tr>
<tr>
<td>Min R-Value</td>
<td>3.00</td>
</tr>
<tr>
<td>Base Layer ISO Thickness (IN)</td>
<td>2.00</td>
</tr>
<tr>
<td>Fill</td>
<td>ISO</td>
</tr>
</tbody>
</table>

#### Analysis and Pricing:

<table>
<thead>
<tr>
<th>Approximate Squares of Application</th>
<th>Pricing Based On</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cricket SQ's</td>
<td>3.84</td>
</tr>
<tr>
<td>Project Subtotal</td>
<td></td>
</tr>
<tr>
<td>Total Cricket Fill SQ's</td>
<td>0.00</td>
</tr>
<tr>
<td>Pre-Cut Charge</td>
<td></td>
</tr>
<tr>
<td>Total Tapered SQ's</td>
<td>221.76</td>
</tr>
<tr>
<td>Additional Freight</td>
<td></td>
</tr>
<tr>
<td>Total Tapered Fill SQ's</td>
<td>93.12</td>
</tr>
<tr>
<td>Total Price</td>
<td></td>
</tr>
<tr>
<td>Total Base SQ's</td>
<td>137.60</td>
</tr>
<tr>
<td>Total Flat SQ's</td>
<td>0.00</td>
</tr>
<tr>
<td>Shipping Info</td>
<td></td>
</tr>
<tr>
<td>FOB</td>
<td>Jobsite</td>
</tr>
<tr>
<td>Pallets</td>
<td>102.00</td>
</tr>
<tr>
<td>Truckloads (48ft)</td>
<td>2.13</td>
</tr>
</tbody>
</table>

Customer is responsible to fill truck or prorated freight charge will be invoiced at time of delivery. THIS IS AN ESTIMATE ONLY AND IS SUBJECT TO CHANGE WITHOUT NOTICE. THIS IS NOT AN OFFER. ATTENTION: FUEL SURCHARGE IS NOT INCLUDED IN THIS QUOTE.

For questions regarding this quote, please contact: taperdesign@jnm.com | PHONE: 800-341-8032 | FAX: 800-835-2341

JM Tapered Systems Group | 10100 West Ute Avenue | Mailstop R18 | Littleton, CO 80127
JM TPO – 80 mil
Thermoplastic Polyolefin Membrane

Meets or exceeds the requirements of ASTM D 6878

Features

**Thickness Over Scrim**: Optimized and tested on a continual basis with a state-of-the-art thickness gauge to verify that the thickness valued by our customers is incorporated into the sheet.

**One of the Widest Melt Windows**: Promotes better welds over a wider variety of speeds and temperatures, and leads to a softer, more flexible and workable sheet.

**Reinforced fabric scrim layer and top-ply thickness**: Lends to durable physical properties including:
- Long-term weathering, UV resistance and heat-aging properties
- High breaking and tearing strength

**Optimized TPO formulation**: delivers high-performance ozone resistance, cool roof reflectivity and overall weather resistance.

System Compatibility

<table>
<thead>
<tr>
<th>Multi-Ply</th>
<th>BUR HA</th>
<th>APP HA</th>
<th>SBS HW</th>
<th>BUR CA</th>
<th>APP CA</th>
<th>SBS HW</th>
<th>SBS CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPO MF</td>
<td>MF FA</td>
<td>PVC FA</td>
<td>EPDM MF</td>
<td>FA FA</td>
<td>MF FA</td>
<td>FA FA</td>
<td>BA BA</td>
</tr>
</tbody>
</table>

**Key**: HA = Hot Applied  CA = Cold Applied  HW = Heat Weldable  SA = Self Adhered  MF = Mechanically Fastened  FA = Fully Adhered  BA = Ballasted

Energy and the Environment

| CRRC® | Initial | Reflectivity: 0.77 | Emissivity: 0.87 |
| CA Title 24 | Pass | Reflectivity: 0.77 | Emissivity: 0.87 |
| ENERGY STAR® | Initial | Reflectivity: 0.78 |
| 3 Yr. Aged | Reflectivity: 0.68 |
| Cleaned 3 Yr. | No |
| LEED® | SRI of 101 as tested by ASTM E 1980. |
| Recycled Content | Post-consumer: 0%  Post-industrial: 5% |

Results shown are for the initial reflectivity and emittance for white membranes unless otherwise indicated; emissivity values for California Title 24 are tested per ASTM C 1371; LEED emissivity values are tested per ASTM E 408.

Peak Advantage® Guarantee Information

<table>
<thead>
<tr>
<th>Product</th>
<th>Guarantee Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>JM TPO 80</td>
<td>5, 10, 15, 20, 25, or 30 yrs</td>
</tr>
</tbody>
</table>

Installation/Application

Refer to the specific JM Specification sheets for details.

Packaging and Dimensions

<table>
<thead>
<tr>
<th>Roll Widths</th>
<th>5’ (1.52 m)</th>
<th>8’ (2.44 m)</th>
<th>10’ (3.05 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll Lengths</td>
<td>75’ (22.86 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll Coverage</td>
<td>375 ft² (34.84 m²)</td>
<td>600 ft² (55.74 m²)</td>
<td>750 ft² (69.68 m²)</td>
</tr>
<tr>
<td>Rolls per Pallet</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pallet Weight</td>
<td>1384 lb (627.8 kg)</td>
<td>1880 lb (852.8 kg)</td>
<td>2760 lb (1251.9 kg)</td>
</tr>
<tr>
<td>Pallets per Truck*</td>
<td>36</td>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>

**Colors**: White, Grey* and Tan*

*Grey and Tan lead times are subject to availability and may require an upcharge for smaller projects.

Codes and Approvals

Refer to the Material Safety Data Sheet and product label prior to using this product. The Material Safety Data Sheet is available by calling (800) 922-5922 or on the Web at www.jm.com/roofing.
JM TPO – 80 mil
Thermoplastic Polyolefin Membrane

Meets or exceeds the requirements of ASTM D 6878

Tested Physical Properties

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Tearing Strength</td>
<td>D 751</td>
<td>&gt;55 lbf (245 N)</td>
<td>179 lbf (796 N)</td>
</tr>
<tr>
<td>Breaking Strength</td>
<td>D 751</td>
<td>&gt;220 lbf (978 N)</td>
<td>439 lbf (1,953 N)</td>
</tr>
<tr>
<td>Overall Sheet Thickness</td>
<td>D 6878</td>
<td>+15%, -10%</td>
<td>0.079 in. (2.01 mm)</td>
</tr>
<tr>
<td>Thickness of Coating Over Fabric Weather Side</td>
<td>D 6878</td>
<td>&gt;0.015 in. (.381 mm)</td>
<td>0.035 in. (0.889 mm)</td>
</tr>
<tr>
<td>Elongation at Reinforcement Break</td>
<td>D 751</td>
<td>&gt;15%</td>
<td>29%</td>
</tr>
<tr>
<td>Ozone Resistance</td>
<td>D 1149</td>
<td>No Cracks</td>
<td>Pass</td>
</tr>
<tr>
<td>Heat Aging (Pass/Fail)</td>
<td>D 573</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>D 471</td>
<td>±3.0% max.</td>
<td>2.20%</td>
</tr>
<tr>
<td>Post Xenon Visual Inspection</td>
<td>D 6878</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>Post Heat Aged Breaking Strength</td>
<td>D 751</td>
<td>&gt;90% retained values</td>
<td>Pass, 473 lbf (2,104 N)</td>
</tr>
<tr>
<td>Post Heat Aged Elongation at Reinforcement Break</td>
<td>D 751</td>
<td>&gt;90% retained values</td>
<td>Pass, 31%</td>
</tr>
<tr>
<td>Post Heat Aged Tearing Strength</td>
<td>D 751</td>
<td>&gt;60% retained values</td>
<td>Pass, 160 lbf (715 N)</td>
</tr>
<tr>
<td>Post Heat Aged Weight Change</td>
<td>D 1204</td>
<td>±1% max.</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Post Heat Aged Linear Dimension Change</td>
<td>D 6878</td>
<td>±1% max.</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Brittleness Point</td>
<td>D 2137</td>
<td>-40°C (-40°F)</td>
<td>Pass @ -40°C (-40°F)</td>
</tr>
<tr>
<td>Factory Seam Strength</td>
<td>D 751</td>
<td>&gt;66 (294)</td>
<td>137 lbf (609 N)</td>
</tr>
<tr>
<td>Weight</td>
<td>NA</td>
<td>NA</td>
<td>0.40 lb/ft² (0.017 kg/m²)</td>
</tr>
</tbody>
</table>

*MD = Machine Direction  
**XMD = Cross-Machine Direction  
Note: All data represents tested values.

Supplemental Testing

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Puncture</td>
<td>D 5635</td>
<td>N/A</td>
<td>35 Joules</td>
</tr>
<tr>
<td>Static Puncture</td>
<td>D 5602</td>
<td>N/A</td>
<td>Pass @ 44 lb (20 kg)</td>
</tr>
<tr>
<td>Reflectance</td>
<td>C 1549</td>
<td>N/A</td>
<td>78%</td>
</tr>
<tr>
<td>Emittance</td>
<td>C 1371</td>
<td>N/A</td>
<td>0.87</td>
</tr>
<tr>
<td>Resistance of Synthetic Polymer Material to Fungi</td>
<td>G 21</td>
<td>N/A</td>
<td>0 rating</td>
</tr>
<tr>
<td>Puncture Resistance (FTM 101C, Method 2031)</td>
<td>N/A</td>
<td>N/A</td>
<td>526 lb (239 kg)</td>
</tr>
<tr>
<td>Moisture Vapor Transmission</td>
<td>E 96</td>
<td>N/A</td>
<td>0 g/m² per 24 hours</td>
</tr>
<tr>
<td>Hydrostatic Resistance, Mullen</td>
<td>D 751</td>
<td>N/A</td>
<td>602 PSI (4,150 kPa)</td>
</tr>
</tbody>
</table>

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