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Johns Manville is providing this specification to the user as a courtesy to utilize in their determination of the optimal system for their project’s specific needs. By utilizing the general information provided herein, the user agrees such information will not be relied upon as a substitute for professional engineering design and/or documentation required by building code, contract or applicable law. The information in this specification must be reviewed/approved by a project designer before use. The user of this information assumes sole responsibility for its use of this specification. Additional information, such as Data Sheets, SDS, Application Guides and other literature on the Johns Manville products used in this specification, can be found at https://www.jm.com/en/commercial-roofing/liquid-applied-roofing-systems/

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SECTION 075600

FLUID-APPLIED MEMBRANE ROOFING

1. GENERAL
	* + 1. SECTION INCLUDES
				1. PMMA membrane roofing system.
				2. Cover board.
				3. Roof insulation.
				4. Vapor retarder.
				5. Substrate board.
			2. Related Sections include the following:
				1. Division 03 Section “Lightweight Insulating Concrete” for lightweight insulating concrete.
				2. Division 05 Section "Steel Decking" for steel roof deck.
				3. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, cants, curbs, and blocking [**and for wood-based, structural-use roof deck panels**].
				4. Division 07 Section "Sheet Metal Flashing and Trim" for flashings and counter flashings.
				5. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.
			3. references
				1. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms used in this Section:

ASTM D 1079 “Standard Terminology Relating to Roofing and Waterproofing.”

Glossary of NRCA's "The NRCA Roofing Manual."

Roof Consultants Institute “Glossary of Roofing Terms.”

* + - * 1. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.
			1. DESIGN CRITERIA
				1. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
				2. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
				3. Installer shall comply with current code requirements based on authority having jurisdiction.
				4. Wind Uplift Performance: Roofing system shall meet the intent of systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.
				5. Fire-Test-Response Characteristics: Provide 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.

Exterior Fire-Test Exposure: Class **[A] [B] [C]**; UL 790, for application and roof slopes indicated.

* + - 1. SUBMITTALS
				1. Product Data: Manufacturer’s data sheets for each product to be provided.
				2. Detail Drawings: Provide roofing system details and details of attachment to other work, including:

Base flashings, cants, and membrane terminations.

Tapered insulation, including slopes.

Crickets, saddles, and tapered edge strips, including slopes.

Insulation fastening patterns.

* + - * 1. Verification Samples: Provide for each product specified.
				2. Installer Certificates: confirmation that installer is approved, authorized, or licensed by manufacture to install roofing system.
				3. Maintenance Data: Refer to Johns Manville’s latest published documents on www.JM.com.
				4. Guarantees: Provide manufacturer’s current guarantee specimen.
				5. Roofing sub-contractor shall provide a copy of the final System Assembly Letter issued by Johns Manville Roofing Systems indicating that the products and system to be installed shall be eligible to receive the specified manufacturer's guarantee when installed by a certified JM contractor in accordance with our application requirements, inspected and approved by a JM Technical Representative.
				6. Prior to roofing system installation, roofing sub-contractor shall provide a copy of the Guarantee Application Confirmation document issued by Johns Manville Roofing Systems indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.

1.6 QUALITY ASSURANCE

* + - * 1. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product who is eligible to receive the specified manufacturer's guarantee.
				2. Manufacturer Qualifications: Qualified domestic U.S. owned and based manufacturer that has **[**UL listing**]** or accredited testing agency listing for roofing system identical to that used for this Project.
				3. Testing Agency Qualifications: Independent testing agency with the experience and capability to conduct the testing indicated, as documented in accordance with ASTM E329.
				4. Test Reports:

Roof drain and leader test or submit plumber’s verification.

Core cut, if required.

Roof deck fastener pullout test, if required.

* + - * 1. Moisture Survey, if required:

Submit prior to installation, results of a non-destructive moisture test of roof system completed by approved third party. Utilize one of the approved methods:

Infrared Thermography

Nuclear Backscatter

* + - * 1. Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system shall be labeled by the single source roofing system manufacturer issuing the guarantee.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Use a breathable type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each workday. Do not remove any protective tarpaulins until immediately before the material is to be installed.
				2. 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 storage.
				3. 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.

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

* + - * 1. 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.
				2. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
			1. PROJECT CONDITIONS
				1. Do not apply waterproofing membrane or components during or with the threat of inclement weather. Application of cold fluid-applied reinforced membrane may proceed while air temperature is between temperature range specified in the most recent PMMA Application Guide for primers, mortars, and finish. The substrate shall be clean and dry and within the specified temperature range. The dew point temperature shall also be within the range specified.
				2. 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.
			2. guarantee
				1. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

Single-source special warranty includes base flashings, liquid applied flashing, roofing membrane accessories, **[roof insulation], [fasteners], [adhesives], [cover board], [substrate board], [manufacturer’s expansion joints], [manufacturer’s edge metal products]**, and other approved single-source components of roofing system marketed by the manufacturer.

Guarantee Period: **[10] [15] [20]** years from date of Substantial Completion.

Contractor is required to list “**INSERT FIRM NAME**” as the Specifier/Consultant of record in the appropriate fields (“Specifier Account”) when applying for the manufacturer’s warranty.

* + - * 1. Installer’s Guarantee: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

Warranty Period: **[Two] [Five]** years from date of Substantial Completion.

1. PRODUCTS
	* + 1. Liquid ROOFING MEMBRANE - PMMA
				1. Polymethyl-methacrylate (PMMA) Water Proofing Membrane: Two component resin with catalyst and reinforcement fabric. Cold fluid-applied membrane with fleece reinforcement installed to manufacture recommendations. Basis of design: JM PMMA Resin

80mil (nominal) dry film thickness to achieve waterproof membrane conforming to ASTM C836.

Components shall be mixed to manufacture requirements of a minimum of 2 minutes and to the ratios set by manufacturer.

* + - 1. FLASHING MATERIALS
				1. Polymethyl-methacrylate (PMMA) Water Proofing Membrane: Two component resin with catalyst and reinforcement fabric. Cold fluid-applied membrane with fleece reinforcement installed to manufacture recommendations. Basis of design: JM PMMA Flashing Resin

90 mil (nominal) dry film thickness to achieve waterproof membrane conforming to ASTM C836.

Components shall be mixed to manufacture requirements of a minimum of 2 minutes and to the ratios set by manufacturer.

* + - 1. AUXILIARY ROOFING MEMBRANE
				1. General: Auxiliary materials recommended by roofing system manufacturer for intended use.

Retain paragraph below if asphalt roofing cement is used to adhere flashings or integral metal sheet flashings.

* + - * 1. PMMA Primer: One of two-part, elastomeric, liquid-applied membrane. Promotes adhesion on concrete, masonry, wood and asphalt substrates. Basis of design: **[JM PMMA Primer All-Purpose] [JM PMMA Primer-Metal]**

Retain paragraph below if adhering base flashing or membrane in cold-applied adhesives.

* + - * 1. PMMA Resin, and Flashing Resin: One of two-part, elastomeric, liquid-applied membrane. Specially formulated resins for compatibility and use with flashing applications. Basis of design: JM PMMA Resin, JM PMMA Flashing Resin
				2. PMMA Reinforcement: Non-woven, chopped strand fabric reinforcement to improve tear strength, puncture resistance, and crack bridging capabilities. Basis of design: JM PMMA Scrim

Retain first paragraph below if sealant is needed for moving joints in sheet metal accessories or for certain locations where asphalt roofing cement may be inadequate or undesirable.

* + - * 1. PMMA Catalyst: One-part curing agent and catalyst. JM PMMA Catalyst
				2. PMMA Thickening Agent: One-part material for converting field grade resin to flashing grade (vertical applications). JM PMMA Thixo Liquid
				3. PMMA Surfacing and Color Finish: For use with PMMA membrane systems in combination with JM PMMA Catalyst to form a resilient finish top coat. Basis of design: **[JM PMMA Top Coat] [JM PMMA Textured Top Coat]**

Retain paragraph below if field-applied granules are required for incidental repairs or to coat “bleed-out” in cap sheet systems.

Retain paragraph below for aggregate surfacing. Select one of two options for type of aggregate.

* + - * 1. Miscellaneous Accessories: Provide all accessories to meet the roofing manufacturer’s guarantee requirements.
			1. Edge Metal Components
				1. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of design: **[Expand-O-Flash] [Expand-O-Gard]**
				2. Coping System: Manufacturer’s factory fabricated coping consisting of a base piece and a snap-on cap. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of design: **[Presto-Lock Coping] [Presto-Lock Gold Coping]**
				3. Fascia System: Manufacturer’s factory fabricated fascia consisting of a base piece and a snap-on cover. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of design: **[Presto Lock Fascia] [Presto-Tite Fascia]**
				4. Metal Edge System: Manufacturer’s factory fabricated metal edge system used to terminate the roof at the perimeter of the structure. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee.  Basis of design: Presto Stop Gravel Stop
				5. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."
			2. Cover board
				1. Cement Roof Board:  ASTM C 1325, lightweight cementitious core with fiberglass mesh surfacing and reinforced edges.  Basis of design: **[7/16 inch (11 mm) DEXcell Cement Roof Board] [½ inch (12.7 mm) Securock Cement Roof Board]**
			3. ROOF INSULATION
				1. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
				2. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class **[1] [2], Grade [2 (20 psi)] [3 (25 psi)]**, Basis of design: **[ENRGY 3] [ENRGY 3 25 PSI] [ENRGY 3 CGF] [ENRGY 3 25 PSI CGF]**

Provide insulation package with minimum R Value: **[insert R Value] [minimum required by applicable code]**.

Provide insulation package with minimum thickness **[insert thickness]**.

Provide insulation package in multiple layers.

Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch.

Determined in accordance with CAN/ULC S770 at 75ºF (24ºC)

* + - 1. Tapered insulation
				1. Tapered Insulation: ASTM C 1289, Type II, Class **[1] [2], Grade [2 (20 psi)] [3 (25 psi)]**, provide factory-tapered insulation boards fabricated to slope of **[1/4 inch per 12 inches (1:48)]** <Insert slope>, unless otherwise indicated. Basis of design: **[Tapered ENRGY 3] [Tapered ENRGY 3 25 PSI] [Tapered ENRGY 3 CGF] [Tapered ENRGY 3 25 PSI CGF]**
			2. INSULATION ACCESSORIES
				1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
				2. Provide saddles, crickets, tapered edge strips, and other insulations shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of design: Tapered ENRGY 3
				3. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of design: **[UltraFast Fasteners and UltraFast Plates], [All Purpose Fasteners and UltraFast Plates], [Lite-Deck Fasteners and Plates]**
				4. Urethane Adhesive: Manufacturer’s urethane adhesive formulated to adhere insulation to substrate. Basis of design: **[JM Two-Part Urethane Insulation Adhesive (UIA)] [JM One-Step Foamable Adhesive] [Roofing Systems Urethane Adhesive (RSUA)] [JM Two-Part Urethane Insulation Adhesive Canister]**
				5. Wood Nailer Strips: Comply with requirements in Division 06 Section **"**Miscellaneous Rough Carpentry**."**
			3. VAPOR RETARDER
				1. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt. Basis of design: GlasPly IV

Roofing Asphalt: ASTM D 312-15, Type IV.

* + - * 1. Torch Applied SBS Vapor Retarder: [ASTM D 6163, Grade S, Type I, glass-fiber-reinforced] [ASTM D 6164, Grade S, Type I, polyester-reinforced], SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified. Basis of design: **[DynaWeld Base] [DynaBase HW] [DynaWeld 180 S]**
				2. Self-Adhered SBS Vapor Retarder: [ASTM D 6163, Grade S, Type I, glass-fiber-reinforced], SBS-modified asphalt sheet; sand surfaced; suitable for application method specified. Basis of design: DynaGrip Base SD/SA
				3. Self-Adhered SBS Vapor Retarder: Tri-laminate woven polyethylene, nonslip UV protected top surface; suitable for application method specified. Basis of design: **[JM Vapor Barrier SAR].**
				4. Self-Adhered Primer: One-part penetrating primer solution to enhance the adhesion of self-adhering membranes. Basis of design: **[SA Primer] [SA Primer Low VOC] [JM All Season Sprayable Bonding Adhesive]**.
				5. Polyethylene Vapor Retarder: ASTM D 4397, [6 mils (0.15 mm)] [10 mils (0.25 mm)] thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
			1. SUBSTRATE BOARD
				1. Gypsum Board:  ASTM C 1177, coated glass-mat facer, water-resistant gypsum substrate for mechanically attached roof applications, [1/4 inch (6 mm)] [1/2 inch (13 mm)] [5/8 inch (16 mm)] thick. Basis of design: **[Securock Ultralight Glass-Mat Roof Board] [DEXcell Glass Mat Roof Board] [Dens Deck Roof Board]**
				2. Gypsum Board:  ASTM C 1177, Heavy duty coated glass-mat facer, water-resistant gypsum substrate for adhered roof applications, **[1/4 inch (6 mm)] [1/2 inch (13 mm)] [5/8 inch (16 mm)]** thick.  Basis of design: **[DEXcell FA Glass Mat Roof Board] [Dens Deck Prime Roof Board]**
				3. Gypsum Fiber Board: ASTM C 1278, non-faced, gypsum and cellulose fiber substrate, **[1/4 inch (6 mm)] [3/8 inch (9.5 mm)] [1/2 inch (13 mm)] [5/8 inch (16 mm)]** thick. Basis of design: Securock Gypsum-Fiber Roof Board
				4. Cement Roof Board:  ASTM C 1325, lightweight cementitious core with fiberglass mesh surfacing and reinforced edges, 7/16 inch (11 mm) thick.  Basis of design: **[DEXcell Cement Roof Board] [Securock Cement Roof Board]**
				5. High-Density Polyisocyanurate: ASTM C 1289, Type II, Class 4, Grade 1, High-density Polyisocyanurate technology bonded in-line to inorganic coated glass facers with greater than 80 lbs of compressive strength. Basis of design: ProtectoR HD

Thickness: 1/2 inch (13 mm)

R-value: 2.5

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates, areas, and conditions for compliance with the requirements affecting performance of roofing system.

General:

Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

Blocking, curbs, and nailers are required at edges of roof penetrations, area dividers, and terminations.

**Steel Decks:**

**Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."**

**Verify that decking is visibly dry and free of moisture.**

**Verify that the decking is smooth and free of large cracks, holes or sharp changes in elevation of the surface.**

**When applicable perform pull test with the specific fastener being used on the project to confirm the fastener resistance meets the requirements for that particular system.**

**Concrete Decks:**

**Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.**

**Verify that concrete substrate is visibly dry and free of moisture.**

Ensure general rigidity and proper slope for drainage.

Verify that deck is secured with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

* + - * 1. Unacceptable panels should be brought to the attention of the General Contractor and Project Owner’s Representative and shall be corrected prior to installation of roofing system.
			1. PREPARATION
				1. Clean and remover from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.
				2. 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.
				3. Proceed with each step of installation only after unsatisfactory conditions have been corrected.
			2. Re-roof Preparation
				1. Remove all roofing membrane, surfacing, coverboards, insulation, fasteners, asphalt, pitch, adhesives, etc.

Remove an area no larger than can be re-roofed in one day.

* + - * 1. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents, sumps and like components necessary for application of new membrane.
				2. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations.

Install decking to match existing as directed by Owner's Representative.

* + - * 1. Raise (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:

Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.

Secure top of flashing and install new metal counterflashing prior to re-installation of unit.

Perimeter nailers shall be elevated to match elevation of new roof insulation.

* + - * 1. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.
			1. Recover Preparation
				1. Prepare existing roof according to roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer, and requirements in this Section.
				2. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents, sumps and like components necessary for application of new membrane.
				3. Disable existing roof membrane per manufacturer’s instruction.
				4. Remove existing membrane per manufacturer’s written instructions.
				5. Remove and replace wet, deteriorated or damaged roof insulation and decking as identified in moisture survey.
				6. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations. Install decking to match existing as directed by Owner's Representative.
				7. Raise, (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:

Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.

Secure top of flashing and install new metal counterflashing prior to re-installation of unit.

Perimeter nailers shall be elevated to match elevation of new roof insulation.

* + - * 1. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.
			1. SUBSTRATE BOARD INSTALLATION
				1. 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.

Fasten or adhere substrate board to deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.

* + - 1. VAPOR-RETARDER INSTALLATION
				1. **Install polyethylene-sheet vapor retarder as a loosely laid single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.**

**Seal side and end laps with.**

* + - * 1. **Install 2 glass-fiber felt plies lapping each sheet 19 inches (483 mm) over preceding sheet.  Embed each sheet in a solid mopping of hot roofing asphalt per manufacturer’s written instructions.**
				2. **Install modified bituminous vapor retarder sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:**

**Unroll roofing membrane sheets and allow them to relax.**

**Torch-apply vapor retarder to substrate according to roofing system manufacturer’s instruction.**

**Adhere vapor retarder in a full mopping of hot asphalt to substrate according to roofing system manufacturer’s instruction.**

**Self-adhere vapor retarder to substrate according to roofing system manufacturer’s instruction.**

* + - * 1. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

Repair tears and voids in laps and lapped seams not completely sealed.

* + - * 1. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.
			1. INSULATION INSTALLATION
				1. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.
				2. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.
				3. Install tapered insulation under area of roofing to conform to slopes indicated.
				4. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.
				5. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
				6. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.
				7. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
				8. **Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.**

**Fasten top layer to resist uplift pressure at corners, perimeter, and field of roof.**

* + - * 1. **Adhered Insulation: Install each layer of insulation and cover board and adhere to substrate as follows:**

**Install each layer in a two-part urethane adhesive according to roofing system manufacturer’s instruction.**

**Install each layer to resist uplift pressure at corners, perimeter, and field of roof.**

* + - * 1. **Loose Laid Insulation with Top Insulation Layer Mechanically Fastened: Loose lay insulation with staggered joints and secure top layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to deck type.**

**Fasten top layer to resist uplift pressure at corners, perimeter, and field of roof.**

* + - * 1. **Mechanically Fastened with Subsequent Layers Adhered Insulation: Secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to deck type.**

**Fasten first layer to resist uplift pressure at corners, perimeter, and field of roof.**

**Install subsequent layers in a two-part urethane adhesive according to roofing system manufacturer’s instruction.**

**Install subsequent layer in a one-part urethane adhesive according to roofing system manufacturer’s instruction.**

**Install subsequent layer to resist uplift pressure at corners, perimeter, and field of roof.**

* + - 1. Cover board installation
				1. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.
				2. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.
				3. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

* + - * 1. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

* + - * 1. **Preliminarily Fastened Cover Board for Mechanically Fastened Systems: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.**
				2. **Adhered Cover Board (preferred): Adhere cover board to substrate as follows:**

**Install in a two-part urethane adhesive according to roofing system manufacturer’s instruction.**

**Install to resist uplift pressure at corners, perimeter, and field of roof.**

* + - * 1. **Mechanically Fastened Cover Board: Install cover board and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof cover board to deck type.**

**Fasten to resist uplift pressure at corners, perimeter, and field of roof.**

* + - 1. SUBSTRATE PREPARATION
				1. General:
				2. All substrates shall be free from gross irregularities, loose, unsound or foreign material such as dirt, ice, snow, water, grease, oil, release agents, lacquers, or any other condition that would be detrimental to adhesion of the primer and/or resin to the substrate. All surfaces will require scarifying, sandblasting or grinding to achieve a suitable substrate as acceptable to the Membrane Manufacturer.
				3. Inspect all substrates, and correct defects before application of new waterproofing. Fill all surface voids greater than 1/16 inch (1.5 mm) wide and/or deep with fill material acceptable to the Membrane Manufacturer.
				4. Substrate shall have a maximum moisture content of six (6) percent or 75% relative humidity and be prepared as required to provide adhesion of the membrane to substrate with a minimum bond strength of 116 psi (0.8 N/mm2) for roofing applications.
				5. Determinations of surface preparation indicated by bond strength and moisture content testing shall be periodically performed and recorded by the Contractor throughout the course of work. Test results shall be submitted in writing to the Owner or his designated Representative and Membrane Manufacturer for acceptance.
				6. The final substrate shall be clean, dry, and free of contaminants.
				7. Concrete:

New or existing concrete shall be free of sharps, projections, spalls, oil, grease, curing compounds, loose particles, moss, algae growth, latence, friable matter, dirt, and previous waterproofing materials.

All concrete and concrete repair materials shall be cured a minimum of 28 days in accordance with ACI-308, or as recommended by the concrete/mortar manufacturer, in order to achieve a minimum hardness of 3,500 psi (25 N/mm2) with a maximum moisture content of six (6) percent or 75% relative humidity.

Concrete shall be abrasively cleaned in accordance with ASTM D4259 to provide a sound substrate free from latence with an open abraded surface. When using mechanical methods to remove existing waterproofing products or surface deterioration, the surface profile is not to exceed 1/8-inch (3 mm) peak to valley.

Areas of spalls, voids, bug holes and other deterioration on vertical or horizontal surfaces shall be repaired in accordance with the requirements of the Membrane Manufacturer and the Owner or his designated Representative.

* + - * 1. Masonry Construction:

Walls shall be built with hard kiln dried brick, reinforced concrete block, or waterproof concrete block construction with a maximum moisture content of six (6) percent or 75% relative humidity.

Flashings shall not be applied over soft or scaling brick or block, faulty mortar joints, or walls with broken, damaged or leaking coping. Areas of spalls, voids, bug holes and other deterioration on vertical surfaces shall be repaired in accordance with the requirements of the Membrane Manufacturer and the Owner or his designated Representative.

Walls of ordinary hollow tile, or other materials which in themselves are not waterproofed, should not be accepted as suitable to receive flashings unless they are properly waterproofed, to prevent moisture infiltration from above or behind the new waterproofing membrane and flashings.

* + - * 1. Steel/Metal:

All metal surfaces shall be cleaned in accordance with SSPC - SP3, abraded, and wiped with solvent as required by Membrane Manufacturer. Extend preparation maximum 1/8 inch (3 mm) beyond the specified termination of the membrane flashing materials and notch to provide a rust-stop where required.

* + - * 1. Wood/Plywood:

New plywood shall be structural panels performance-rated pursuant to National Institute of Standards and Technology (NIST) voluntary product standard PS-1-95; identified with American Plywood Association (APA) grade trade marks C-D Exposure 1 rated sheathing or Sanded B-C Group 1 Exterior sheathing; ¾” minimum thickness tongue & groove single layer or 15/32” minimum thickness 2-layer staggered joint applications; using only screw type fasteners for attachment to structural members.

Hygroscopic building materials such as wood plank, timber or plywood will normally have higher moisture content (in the range of 8% to 12%) as they adsorb or de-sorb moisture to reach equilibrium moisture content with the surrounding air. Cold fluid-applied reinforced membrane should not be applied to damp or wet sheathing materials but may be applied to materials with higher moisture contents as indicated above, provided the exposed surface is clean and dry. Ultimately, determinations of moisture content and the resulting bond strength should be performed periodically to determine acceptability. If poor adhesion or blistering occurs, substrate will require additional drying time before proceeding.

After PMMA primer has been applied and allowed to cure, fill all open joints with PMMA paste then strip all plywood joints with minimum 1-1/2-inch (3.8 cm) wide bond breaker tape followed with minimum 6-inch (15-cm) wide strips of cold fluid-applied reinforced membrane flashing strip. Fill all knot holes and cracks with Membrane Manufacturers PMMA paste.

* + - * 1. Insulation/Cover Board (Top Exposed Layer Only):

After PMMA primer has been applied and allowed to cure, joints in top-layer (insulation or cover board) shall be covered with 4 inch (10 cm) wide strips of cold fluid-applied reinforced membrane or PMMA Paste as recommended or required by Membrane Manufacturer.

* + - * 1. Other Flashing Surfaces:

Remove all contaminants and prepare substrate as required by Membrane Manufacturer and the Owner or his designated Representative.

* + - 1. PRIMER APPLICATION
				1. Apply appropriate proprietary fast-curing primer on all substrates as required or recommended by the cold fluid-applied membrane manufacturer.
				2. For substrates requiring metal primer, apply single component fast-curing primer with a brush or lambswool roller at the minimum consumption as recommended by the Membrane Manufacturer and allow to cure as required depending upon temperature.
				3. For substrates requiring standard primer, apply two component fast-curing PMMA primer with a lambswool roller at the minimum consumption as recommended by the Membrane Manufacturer and allow to cure for 45 minutes minimum.
			2. MEMBRANE INSTALLATION & STAGING
				1. If work is interrupted for more than 12-hours, use Membrane Manufacturers cleaner/activator to clean and reactivate applied primer, resin or membrane transition areas. Activator should be allowed a minimum of 20-minutes evaporation time after application and covered within 60-minutes of application or as recommended by the Membrane Manufacturer.
				2. For all tie-in locations, provide a minimum overlap of 4 inches (10 cm), reinforcement and resin.
			3. ROOFING MEMBRANE INSTALLATION, GENERAL
				1. Install roofing system specification according to roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.
				2. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
				3. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.

Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

Remove and discard temporary seals before beginning work on adjoining roofing.

* + - * 1. Substrate-Joint Penetrations: Prevent PMMA roofing material from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
			1. Waterproofing MEMBRANE INSTALLATION - PMMA
				1. Install roofing membrane according to roofing manufacturer's written instructions, starting at low point of roofing system:

Mix and apply two-component primer in accordance with written instructions of membrane manufacture.

Do not apply to any substrate that contains coal-tar pitch, creosote or penta-based material that has been recently applied

* + - * 1. Mixing Instructions: The amount of JM PMMA Catalyst added to JM PMMA resins and primers varies based on resin type, resin quantity and temperature. Each resin has different densities so follow manufactures recommendation accordingly.

Thoroughly mix the entire container of resin for 2-3 minutes before each use, and prior to pouring off resin into a second container if batch mixing.

Catalyze only the amount of material that can be used within 10-15 minutes.

Add premeasured catalyst to the resin component, stir for 2 minutes using low speed mechanical agitator or stirring stick and apply to substrate.

Refer to individual product data sheets for appropriate percentage of JM PMMA catalyst and working temperature ranges.

* + - * 1. Evenly install PMMA membrane material using approved roller, brush or notched squeegee to obtain full coverage coating without voids.

Apply an even layer of cold fluid-applied resin at the minimum consumption recommended by the Membrane Manufacturer and allow to cure for 45 minutes minimum.

* + - * 1. Immediately roll the reinforcement scrim into the base layer while still wet. Use roller to work resin into fleece to fully saturate the scrim. Apply supplemental resin on scrim as needed to ensure complete saturation. Fleece should darken, white spot indicates unsaturated fleece and should be corrected before resin cures. Allow to cure until solid to the touch.

Work Membrane Manufacturers reinforcement into the wet resin, removing trapped air, using the lambswool roller. Maintain 2-inches (5 cm) minimum overlap at all side and butt laps of reinforcement and extend flashing a minimum of 4-inches (10 cm) horizontally onto deck.

* + - * 1. Apply an even coat of resin over the top of the in-place scrim at a rate recommended by the manufacture using the appropriate rollers. The liquid membrane should extend 2” past the reinforcement scrim in all directions.

Allow completed membrane to cure as recommended by the Membrane Manufacturer prior to continuing application or applying loads. Fluid-applied membrane shall be rainproof after approximately **[30] [45]-**minutes, and capable of carrying al load, i.e., be walked-on, in approximately **[1] [2]**-hours.

* + - * 1. Allow an additional 8-12 hours before foot traffic.
			1. FLASHING MEMBRANE APPLICATION
				1. General:

Install all flashings in accordance with details or as recommended by Membrane manufacturer.

Provide a minimum vertical height of 8 inches (20 cm) for all flashing terminations wherever possible. Flashing height shall be at least as high as the potential water level that could be reached as a result of a deluging rain and/or poor slope.

Do not flash over existing through-wall flashings, weep holes and overflow scuppers.

All flashing shall be terminated as required by the Membrane Manufacturer. Cap flashings or counter flashings may be constructed of metal, stone, tile or other materials properly installed in accordance with industry-accepted practice.

* + - * 1. Liquid Applied Flashing Membrane:

Mix and apply cold fluid-applied reinforced membrane flashing in strict accordance with written instructions of Membrane Manufacturer.

* + - * 1. Penetrations

Pipes, Conduits, and Unusual Shaped Penetrations:

Pipes conduits and other items to be flashed shall be separated with 1-inch (2.54 cm) minimum clearance or as recommended by Membrane Manufacturer to adequate waterproof each individual penetration.

All penetrations shall be flashed individually. Two or more items ganged together in a flashing will NOT be permitted.

Flash penetrations using cold fluid-applied reinforced membrane or Membrane Manufacturers proprietary flashing matrix as recommended. Flashing shall consist of a reinforced deck skirt/target flashing and reinforced vertical wrap.

Drains:

Flash drains using cold fluid-applied membrane. Flashing shall consist of target flashing extending minimum 12-inches (30 cm) horizontally onto the substrate and extend down into the prepared drain bowl a minimum of 3-inches (7.5 cm).

At no time should the cold fluid-applied membrane be installed to restrict or reduce the drain inlet in size.

For new drains, Contractor shall include cost of all plumbing work, piping and connection to existing storm sewer system.

Hot Pipes:

Protect cold fluid-applied membrane components from direct contact with steam or heat sources when the in-service temperature exceeds 150 degrees F. In all such cases flash to an intermediate "cool" sleeve.

Fabricate "cool" sleeve in the form of a metal cone using galvanized metal in accordance with membrane manufacturer details.

Flash sleeve using cold fluid-applied reinforced membrane or Membrane Manufacturers flashing matrix as recommended. Flashing shall consist of a reinforced deck skirt/target flashing and reinforced vertical wrap.

Flexible Penetrations

Provide a weather-tight gooseneck set in Membrane Manufacturers acrylic resin paste and secured to the deck.

Flash gooseneck penetrations using cold fluid-applied reinforced membrane or Membrane Manufacturers proprietary flashing matrix as recommended. Flashing shall consist of a reinforced deck skirt/target flashing and reinforced vertical wrap.

Walls, Curbs and Bases:

Flash all walls, curbs and base flashings using cold fluid-applied reinforced membrane. Wherever possible extend flashing up and over tops of walls, curbs and bases so the membrane terminates on the opposite vertical face of the building element.

Expansion Joints:

Flash all expansion joints with one or two layers of Membrane Manufacturers cold fluid-applied polyester fabric reinforced membrane applied over an expansion tube and/or bond breaker tape as recommended by Membrane Manufacturer.

* + - 1. Edge Metal INstallation
				1. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
				2. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements and SMACNA's "Architectural Sheet Metal Manual."
				3. Join individual sections in accordance with the membrane manufacturer's requirements and SMACNA's "Architectural Sheet Metal Manual."
			2. Roof Walkways, SURFACING & FINISHES (Optional)
				1. Where specified or required for walkways, anti-slip surfacing, and/or aesthetic treatment provide and install Membrane Manufacturers proprietary aesthetic topcoat finish, aesthetic topcoat finish mixed with integrally blended aggregate, or high traffic topcoat. A
				2. Mask perimeter edges of walkway or areas to receive surfacing or finish to provide clean lines and prevent over-painting of resins. Remove and re-apply masking before resin cures and as required between coats or sections.
				3. Aesthetic Slip Resistant Treatment

Where specified for aesthetic treatment provide and install Membrane Manufacturers proprietary aesthetic pigmented topcoat finish integrally mixed with aggregate using a lambswool roller.

Finish topcoat should be rainproof after approximately 30-minutes and can be walked-on in approximately 2-hours.

* + - * 1. Aesthetic Pigmented Topcoat

Where specified for aesthetic treatment provide and install Membrane Manufacturers proprietary aesthetic pigmented topcoat finish.

Finish:

Apply Membrane Manufacturers proprietary aesthetic cold fluid-applied pigmented resin topcoat finish using a hard rubber squeegee and a lambswool roller at the minimum consumption recommended by the Membrane Manufacturer.

Finish topcoat should be rainproof after approximately 30-minutes and can be walked-on in approximately 2-hours.

* + - * 1. Roof Walkways:

Where required or specified for areas requiring extra-duty walkways provide and install Membrane Manufacturers proprietary textured coating with integrally mixed with aggregate.

Mix and apply cold fluid-applied traffic surfacing layer in strict accordance with written instructions of Membrane Manufacturer.

JM PMMA Traffic Coating resin is rainproof after approximately 10-minutes and can be walked-on in approximately 1-hour.

* + - 1. paver WALKWAY INSTALLATION
				1. Roof-Paver Walkways: Install walkway roof pavers with applicable slip sheet according to manufacturer's written instructions in locations indicated, to form walkways.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. FIELD QUALITY CONTROL
				1. Owner or designated representative will provide on-site observation and inspection during installation.
				2. Owner will engage a qualified testing agency to perform tests and inspections.
				3. Final Roof Inspection: Arrange for roofing system manufacturer's technical representative to inspect roofing installation on completion and submit report to Architect.
				4. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
				5. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
			3. PROTECTING AND CLEANING
				1. Protect 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.
				2. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
				3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION