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| DIVISION 07 - THERMAL AND MOISTURE PROTECTION |
|  | 075600.11 Fluid-Applied Membrane Roofing, Concrete Deck, Vulkem® X4  |

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SECTION 075600.11 - FLUID-APPLIED MEMBRANE ROOFING, CONCRETE DECK

Fluid-Applied Roofing on Existing and New Concrete Decks: This custom section specifies Tremco AlphaGuard high-performance polyurethane coating applied as a high-reflectance roof coating onto new or refurbished concrete decks, including preparation of concrete deck and base flashing substrate. This Section includes options for use of AlphaGuard MT/MTS, AlphaGuard Bio, non-reinforced AlphaGuard Bio NR coatings, and AlphaGuard PUMA.

If tear-off of existing roofing is required as part of overall roofing project, use Section 070150.19 PREPARATION FOR REROOFING along with this section.

Roofing Installer's Warranty Form is now Section 070101.01 MEMBRANE ROOFING INSTALLER'S WARRANTY. Be sure to include this document in your project when required.

1. GENERAL
	* + 1. SUMMARY
				1. This Section includes the following:

Roof coating preparation including preparation of concrete deck and substrate to receive fluid-applied flashing.

Application of [fabric-reinforced] fluid-applied roof membrane and flashings to [prepared existing] [new]concrete deck.

Edit "Related Information" Paragraph below as required to coordinate work specified in several sections. Only list sections that are actually included in the Project Manual and available to the Contractor.

* + - * 1. Related Information:

Division 00 Document "Existing Condition Information" for related Project information not part of the Contract Documents.

Division 03 Section "Maintenance of Cast-in-Place Concrete: for removal of deteriorated concrete and subsequent replacement and patching

Division 06 Section "Miscellaneous Rough Carpentry" for [replacement parapet sheathing], [blocking] [and] [nailers].

Reference, include and edit this section only when the Contractor is responsible for: Thermographic survey and analysis; Core sampling and analysis; and/or Asbestos Testing. Fastener testing and Field inspection may also be included.

Division 07 Section "Preconstruction Testing for Re-Roofing" for Contractor's responsibilities for performance of preconstruction testing of existing roof.

Division 07 Section "Preparation for Re-Roofing" for existing roofing tearoff and substrate preparation for installation of new roofing membrane.

Division 07 Section "Sheet Metal Flashing and Trim" for manufactured reglets, formed metal roof flashings, expansion joints, copings, roof edge metal.

Division 07 Section "Roof Specialties" for manufactured copings and roof edge metal.

Division 07 Section "Manufactured Roof Expansion Joints."

NOTE: “Roof Drains” is a custom TremSpec section. Architects typically use "Storm Drainage Piping Specialties."

Division 22 Section ["Roof Drains"] ["Storm Drainage Piping Specialties"] for new or replacements roof drains.

HVAC and Electrical Sections should be provided by Design Professional. They are not available in SpecWriter and should not be referenced except when provided by Design Professional.

Division 23 Sections for HVAC equipment removal and reinstallation.

Division 26 Sections for electrical equipment disconnection and reconnection.

Allowances, Unit Prices and/or Alternates may be required in Bid Documents. Examples of allowances and unit prices might include extent of patching of existing roofing or deteriorated parapet sheathing that may be discovered following preparation of design documents. Revise paragraphs below if further description is required. Retain "Allowances," "Unit Prices," and "Alternates" Paragraphs below if work of this Section is affected by one or more of these bidding cost control measures. Coordinate with related Division 01 Sections and Bid Form Supplements. List only those sections that will actually be included in the Project Manual, specifically for this Project. Do not list sections that will not be included in the Project Manual. Coordinate with Architect/Owner's Consultant for any sections to be prepared and included by the Architect/Owner's Consultant.

* + - * 1. Allowances: Refer to Division 01 Section "Allowances" for description of Work in this Section affected by allowances.
				2. Unit Prices: Refer to Division 01 Section "Unit Prices" for description of Work in this Section affected by unit prices.
				3. Alternates: Refer to Division 01 Section "Alternates" for description of Work in this Section affected by alternates.
			1. ROOFING CONFERENCES
				1. Roofing Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system.

Delete subparagraphs below if not required. If retaining, revise to include Project-specific requirements. Insert additional requirements to suit Project.

Meet with Owner, [Architect,] [Owner's Consultant,] roofing materials manufacturer's representative, roofing Installer including project manager and foreman, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

Review drawings and specifications.

Review methods and procedures related to roofing preparation, including membrane roofing system manufacturer's written instructions.

Review roof drainage during each stage of roofing and review roof drain plugging and plug removal procedures.

Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect roofing.

Review HVAC shutdown and sealing of air intakes.

Review shutdown of fire-suppression, -protection, and -alarm and -detection systems.

Review governing regulations and requirements for insurance and certificates if applicable.

Review existing conditions that may require notification of Owner before proceeding.

* + - 1. DEFINITIONS

Retain definitions and terms that remain after this Section has been edited.

* + - * 1. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.
				2. Roofing Preparation: Existing roofing that is to remain and be prepared to accept restorative fluid-applied membrane application.
				3. Patching: Removal of a portion of existing membrane roofing system from deck or removal of selected components and accessories from existing membrane roofing system and replacement with similar materials.
			1. ACTION SUBMITTALS
				1. Product Data: For each type of product specified.
				2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

Base flashings and terminations.

Retain the following for IRMA/PRMA systems only.

Tapered insulation, including slopes.

Verify compliance with sustainable design requirements for solar reflectance and emissivity requirements.

* + - * 1. Sustainable Design Submittals:

Product Test Reports for Solar Reflectance: For roof coating, indicating that coated roof will comply with solar reflectance index requirement.

Retain subparagraph below if utilizing AlphaGuard Bio to meet Federal or Project requirements for bio-based material.

Indicate Food, Conservation, and Energy Act of 2008 Bio-based material requirement compliance.

Indicate type of bio-based material in product.

Indicate the percentage of bio-based content per unit of product.

Indicate relative dollar value of bio-based content product to total dollar value of product included in project.

* + - 1. INFORMATIONAL SUBMITTALS
				1. Contractor's Product Certificate: Submit notarized certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.
				2. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.

Letter written for this Project indicating manufacturer approval of Installer to apply specified products and provide specified warranty.

Certificate indicating Installer is qualified in Project jurisdiction to perform asbestos abatement.

* + - * 1. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
				2. Warranties: Unexecuted sample copies of special warranties.
				3. Inspection Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions required and carried out.

Submit reports within 48 hours after inspection.

* + - 1. CLOSEOUT SUBMITTALS
				1. Maintenance Data: To include in maintenance manuals.
				2. Warranties: Executed copies of approved warranty forms.
			2. QUALITY ASSURANCE
				1. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of three years' experience installing products comparable to those specified, able to communicate verbally with Contractor, [Architect] [Owner's Consultant], and employees, and the following:

Qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.

* + - * 1. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years' experience in manufacture of specified products in successful use in similar applications.

Retain paragraph below if Owner allows substitutions but requires strict control over qualifying of substituted manufacturers.

Approval of Other Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

Product data, including certified independent test data indicating compliance with requirements.

Samples of each component.

Sample submittal from similar project.

Project references: Minimum of five installations of specified products not less than five years old, with Owner [and Architect] [and Owner's Consultant] contact information.

Sample warranty.

* + - * 1. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

An authorized full-time technical employee of the manufacturer.

An independent party certified as a Registered Roof Observer by the IIBEC, retained by the Contractor or the Manufacturer and approved by the Manufacturer.

* + - * 1. Mockups: Provide roof coating mockup application within mockups required in other sections, or if not specified, in an area of not less than 150 sq. ft. (14 sq. m) of surface where directed by [Architect] [Owner] for each type of substrate condition. Include examples of surface preparation, crack and joint treatment, roof coating application, slip-resistant aggregate application, and flashing, transition, and termination conditions, to set quality standards for execution.

Include transitions and intersections of the roof membrane with adjacent parapets and wall systems.

If applicable, include no less than 13ft (3.96m) including one splice joint of Willseal® Expansion Joint System.

* + - * 1. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products.
			1. DELIVERY, STORAGE, AND HANDLING
				1. 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, approval or listing agency markings, and directions for storing and mixing with other components.
				2. Handle and store roofing materials, and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
				3. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting.
				4. Construction Waste: Store and dispose of packaging materials and construction waste in accordance with requirements of Division 01 Section [“Construction Waste Management”] [“Temporary Facilities and Controls.”]
			2. PROJECT / FIELD CONDITIONS

Retain, revise, or delete paragraphs and subparagraphs in this Article to suit Project.

* + - * 1. Protect building, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from roofing operations.
				2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
				3. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

Store all materials prior to application at temperatures between 60 and 90 deg. F (16 and 32 deg C).

Apply coatings within range of ambient and substrate temperatures recommended by manufacturer. Do not apply materials when air temperature is below 50 or above 110 deg. F (10 or above 43 deg C).

Do not apply roofing in snow, rain, fog, or mist.

* + - * 1. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
				2. Owner will occupy portions of building immediately below roofing area. Conduct roofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
			1. SCHEDULING
				1. Coordinate installation of roof membrane with completion of other work requiring interface with roof membrane.
				2. Schedule work so roofing system (including expansion joints if applicable) applications may be inspected prior to concealment.
			2. WARRANTY
				1. Special Manufacturer's Warranty: Manufacturer's standard form in which roofing membrane manufacturer agrees to furnish roofing membrane material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.

Access for Repair: Owner shall provide unimpeded access to the Project and the roofing system for purposes of testing, leak investigation, and repair, and shall reinstall removed cladding and overburden materials upon completion of repair.

Cost Limitation: Manufacturer's obligation for repair or replacement shall be limited to the original installed cost of the work.

Warranty Period: [] years date of Substantial Completion.

* + - * 1. Special warranties specified in this article exclude deterioration or failure of roofing membrane materials from the following:

Movement of the structure caused by structural settlement or stresses on the roofing membrane exceeding manufacturer's written specifications for elongation.

Mechanical damage caused by outside agents.

1. PRODUCTS
	* + 1. MANUFACTURERS
				1. Basis of Design: The roof system specified in this Section is based upon products of Tremco CPG Inc, Beachwood, OH, (866) 321-6357; email: techresources@tremcoinc.com; [www.tremcosealants.com](http://www.tremcosealants.com), [or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements].

<Insert manufacturer name>.

<Insert manufacturer name>.

<\*Specifier: You may include the following in addition to or in lieu of listing other approved manufacturers or as a stand-alone "approved equal" provision>.

Manufacturers of comparable products: Approved by [Owner] [Architect] [Owner's Consultant] prior to bid.

Retain "Source Limitations" Paragraph below if required to comply with FM Global, UL, applicable building code, or to comply with provisions of manufacturer's warranty.

* + - * 1. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.
			1. PERFORMANCE REQUIREMENTS
				1. General: Provide roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

* + - * 1. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

Retain first paragraph below if roofing system is to be designed to withstand uplift pressure established by IBC 1504.3 that is applied in most US jurisdictions. Coordinate this information with Design Professional Refer to, rather than duplicate, wind uplift requirements indicated elsewhere in the contract documents.

* + - * 1. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency in accordance with ANSI/FM 4474, UL 580, or UL 1897, and to resist uplift pressures.

DEFER: Delete subparagraphs 1, 2, 3 & 4 to defer requirements to Contractor or Design Professional as part of Submittals process. DRAWINGS: If referencing pressures on Drawings, select subparagraph 1 and delete subparagraphs 2, 3 & 4; obtain a copy of the drawings showing the pressures for checking against tested assemblies. SPECIFICATION: If stating pressures in specification, delete subparagraph 1 and edit subparagraphs 2, 3 & 4.

All Zones (Corner, Perimeter, and Field-of-Roof) Uplift Pressures: As indicated on Drawings.

If including pressures in the specification, it is recommended that you insert pressures calculated per code and then apply a 2X safety factor, as follows: Applicable version of ASCE 7 Strength Design Method x 0.6 = Allowable Stress Design x Safety Factor of 2 = Minimum Recommended Pressure for each Zone. Insert the Minimum Recommended Pressure value into the spec for each zone (values may be rounded up). Where Zone 1 and Zone 1' (prime) are indicated, list the higher pressure or manually insert another subparagraph.

Insert pressure value and then select either IP or SI unit of measure. If both IP and SI are required, use in-line editing to revise.

Zone 1 (Field-of-Roof) Uplift Pressure: <Insert pressure> [psf] [kPa].

Zone 2 (Perimeter) Uplift Pressure: <Insert pressure> [psf] [kPa], located within <Insert dimension> [ft.] [m.] of roof perimeter.

Zone 3 (Corner) Uplift Pressure: <Insert pressure> [psf] [kPa], located within <Insert dimension> [ft.] [m.] of outside corners.

Retain "FM Global Compliance" Paragraph below if Project is FM Global insured or if Client requests an FM RoofNav-listed system and proposed system complies. Coordinate requirements in FM classification with other requirements in this Section, including Part 1 Submittal Requirements Article and insulation and adhesive requirements in Part 2.

* + - * 1. FM Global Compliance: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4470 as part of a roofing system and shall be listed in FM Global's "RoofNav" or shall receive written FM Global project approval for Class 1 or non-combustible construction, as applicable. Identify applicable materials with FM Global markings.

Fire/Windstorm Classification:

Internal Fire: Class [1] [NC (Non-combustible)].

External Fire: Class [A] [B] [C].

Wind Uplift Rating:

Prescriptive enhancements for Zones 2 and 3 are permitted when Zone 1 pressure is 90 psf (4.31 kPa) or less. If utilizing prescriptive enhancements, select option and delete subparagraphs 2 and 3. If Zone 1 pressure is greater than 90 psf (4.31 kPa) , delete prescriptive enhancement option, retain subparagraphs 2 and 3, and insert pressures. One or more RoofNav assemblies may be required to meet the requirements for each roof zone. Where Zone 1 and Zone 1' (prime) are indicated, list the higher pressure or manually insert another subparagraph.

Insert pressure value and then select either IP or SI unit of measure. If both IP and SI are required, use in-line editing to revise.

Zone 1 (Field-of-Roof): <Insert pressure> [psf] [kPa][; with prescriptive enhancements for Zone 2 and Zone 3, in accordance with FM 1-29.]

Zone 2 (Perimeter): <Insert pressure> [psf] [kPa].

Zone 3 (Corner): <Insert pressure> [psf] [kPa].

Verify Hail Resistance Rating for applicable FM RoofNav Assembly. VSH (Very Severe Hail is a newer classification and most systems have not been tested by FM to this rating. Refer to FM 1-34 Hail Damage Map for additional information.

Hail Resistance Rating: [MH] [SH] [VSH].

The ANSI/SPRI ES-1 standard provides basic requirements for wind-load resistance design and testing for roof edge systems and nailers. It also provides minimum edge system material thicknesses that lead to satisfactory flatness, and designs to minimize corrosion.

If installing or rehabilitating copings or roof-edge flashings, retain "SPRI Wind Design Standard" paragraph and subparagraph below and edit to suit Project.

DEFER: Delete subparagraphs 1 & 2 to defer requirements to Contractor and/or Design Professional as part of Submittals process. DRAWINGS: If referencing pressures on Drawings, select subparagraph 1 and delete subparagraph 2; obtain a copy of the drawings showing the pressures for checking against tested assemblies. SPECIFICATION: If stating pressures in specification, delete subparagraph 1 and edit subparagraph 2; Pressure should not be less than indicated for roof corner zone 3. Use Section 077100 "Roof Specialties" to specify Tremco manufactured fascia and/or copings.

* + - * 1. SPRI Wind Design Standard: Manufacture and install copings and roof edge metal tested according to ANSI/SPRI ES-1.

Delete subparagraphs 1 and 2 to defer requirements to Contractor and/or Design Professional as part of Submittals process. Select either 1 or 2 below. Obtain pressures from Design Professional when possible. If pressures are indicated on Drawings, obtain a copy of the drawings showing the pressures for checking against tested assemblies; delete subsequent pressure paragraphs. If listing pressure in this Specification, delete reference to Drawings.

Design Pressure: As indicated on Drawings.

Design Pressure: <Insert pressure> [psf] [kPa].

* + - * 1. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:

Roof system manufacturer's construction details and recommendations.

NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.

SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.

Retain one of three options in first paragraph below based on fire classification of existing roof covering and proposed recoating application. Delete paragraph if including exterior fire-test exposure in FM Approvals class designation in "Performance Requirements" Article. Class A rating meets (IBC) building code requirements for all construction types; Refer to applicable code for acceptability of Class B or C ratings based upon construction type. Specify a Class A tested assembly whenever possible.

* + - * 1. Exterior Fire-Test Exposure: ASTM E108, [Class A] [Class B] [Class C]; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

The following should be identified and determined by Architect/Owner’s Consultant. Retain "Fire-Resistance Ratings" Paragraph below only if products specified are part of a fire-resistance-rated assembly. Indicate rating, testing agency, and testing agency's design designation on Drawings.

* + - * 1. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.

Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

Identify products with appropriate markings of applicable testing agency.

Retain one of the following three paragraphs, when required for sustainable design.

Retain first paragraph below if required for LEED-NC, LEED-CS, or LEED for Schools Credit SS 7.2. Requirement is minimum for roofs with slopes of 2:12 or less; revise for roofs with slopes steeper than 2:12.

* + - * 1. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

Retain first paragraph below if required for LEED-EB Credit SS 6.2.

* + - * 1. Solar Reflectance Index: Solar reflectance index not less than 90 for not less than 75 percent of the roof surface, when calculated according to ASTM E408 based on testing identical products by a qualified testing agency.
				2. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

Retain "Bio-Based Content" Paragraph below if utilizing AlphaGuard Bio to meet Federal or Project requirements for bio-based material.

* + - * 1. Bio-Based Content: Provide roofing rehabilitation coating materials meeting requirements of USDA Bio-based Affirmative Procurement Program, with not less than 20 percent bio-based content.
			1. MATERIALS
				1. General: Roofing materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system.

Retain "FM Global Standards" Paragraph below if FM material standards apply but proposed system is not an FM RoofNav-listed system. All products used in the assembly must be listed in FM RoofNav as approved for the purpose for which they are specified. (Fire, Windstorm and Hail ratings will not apply without a complete RoofNav assembly.)

* + - * 1. FM Global Standards: Roofing, base flashings, and component materials shall be identical to materials that comply with requirements in FM Global 4470 as part of a roofing system listed or approved by FM Global for Class 1 or non-combustible construction, as applicable. Identify applicable materials with FM Global markings.
				2. Temporary Roofing Materials: Selection of materials and design of temporary roofing is responsibility of Contractor.
				3. General: Provide adhesive and sealant materials recommended by roofing manufacturer for intended use and compatible with roofing materials.

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

Retain subparagraph below if low-emitting materials are required for sustainable design requirements of Project.

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):

Plastic Foam Adhesives: 50 g/L.

Gypsum Board and Panel Adhesives: 50 g/L.

Multipurpose Construction Adhesives: 70 g/L.

Other Adhesives: 250 g/L.

Sealant Primers for Porous Substrates: 775 g/L.

Delete Subparagraph below applies for unless required for sustainable design compliance. This requirement applies to all products inside the weather barrier which is the fluid-applied membrane. Verify that selected products comply with requirements.

Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

* + - 1. FLUID-APPLIED ROOFING MEMBRANE
				1. Polyurethane Elastomeric Fluid-Applied System: Two-coat fluid-applied roofing membrane formulated for application over prepared roof substrate.

Vulkem® X4: High performance, two-component, low odor, modified polyurethane, fully-reinforced fluid-applied roofing system for new construction roofing and restoration or repair of approved roofing substrates.

Basis of design product: Tremco, Vulkem X4.

Color: White.

Thickness over Smooth BUR/MB, Single-Ply, Structural Concrete Substrates: Base Layer: 3 gals/100 sq. ft. (48 wet mils) (1.2 L/m2); [Top Layer: 3 gals/100 sq. ft. (48 wet mils) (1.2 L/m2)] [Top Layer: 3.5 gals/100 sq. ft. (56 wet mils) (1.4 L/m2)].

Thickness over Granule MB Substrates: Base Layer: 3.5 gals/100 sq. ft. (56 wet mils) (1.4 L/m2); [Top Layer: 3 gals/100 sq. ft. (48 wet mils) (1.2 L/m2)] [Top Layer: 3.5 gals/100 sq. ft. (56 wet mils) (1.4 L/m2)].

Accelerated Weathering - 5,000 hrs, ASTM D4798: Pass.

Elongation (Non-Reinforced), ASTM D5147: 130 percent.

Indentation Hardness, ASTM D2240: 83 Shore A.

Water Absorption, ASTM D570: 2% @ 2 HRS, 73° F | 4% @ 24 hrs, 73° F

Tear Resistance, ASTM D624: 150 pli.

Tensile Strength (Non-Reinforced), ASTM D412: 720 psi.

Volume Solids: 100 percent.

Weight Solids: 100percent.

VOC: Less than 50 g/L.

Vulkem® X4: High performance, two-component, low odor, modified polyurethane, fully-reinforced fluid-applied roofing system for new construction roofing and restoration or repair of approved roofing substrates.

Basis of design product: Tremco, Vulkem X4.

Color: White.

Thickness over Smooth BUR/MB, Single-Ply, Structural Concrete Substrates: Base Layer: 3 gals/100 sq. ft. (48 wet mils) (1.2 L/m2); [Top Layer: 3 gals/100 sq. ft. (48 wet mils) (1.2 L/m2)] [Top Layer: 3.5 gals/100 sq. ft. (56 wet mils) (1.4 L/m2)].

Thickness over Granule MB Substrates: Base Layer: 3.5 gals/100 sq. ft. (56 wet mils) (1.4 L/m2); [Top Layer: 3 gals/100 sq. ft. (48 wet mils) (1.2 L/m2)] [Top Layer: 3.5 gals/100 sq. ft. (56 wet mils) (1.4 L/m2)].

Accelerated Weathering - 5,000 hrs, ASTM D4798: Pass.

Elongation (Non-Reinforced), ASTM D5147: 130 percent.

Indentation Hardness, ASTM D2240: 83 Shore A.

Water Absorption, ASTM D570: 2% @ 2 HRS, 73° F | 4% @ 24 hrs, 73° F

Tear Resistance, ASTM D624: 150 pli.

Tensile Strength (Non-Reinforced), ASTM D412: 720 psi.

Volume Solids: 100 percent.

Weight Solids: 100percent.

VOC: Less than 50 g/L.

* + - * 1. Reinforcing Fabric:

Polyester Reinforcing Fabric: 100 percent stitch-bonded mildew-resistant polyester fabric intended for reinforcement of compatible fluid-applied membranes and flashings [and as a protection layer under pavers or stone aggregates].

Basis of design product: Tremco, Permafab.

Tensile Strength, Minimum, ASTM D5034 (2-inch): MD - 110 lbs (49.8 kg); XMD - 60 lbs (27.2 kg) avg.

Elongation, Minimum, ASTM D5034 (1-inch): MD - 25 percent; XMD - 100 percent.

Tear Strength, Minimum, ASTM D5587: MD - 20 lbs (9.0 kg) avg; XMD - 20 lbs (9.0 kg) avg.

Weight: 3 oz./sq. yd (102 g/sq. m).

* + - 1. AUXILIARY ROOFING MATERIALS
				1. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with existing roofing system and fluid-applied roofing system.
				2. Roof Paver Ballast: Refer to Divsion 07 Section "Roof Pavers."

Retain "Ballast Retaining Bar" Paragraph and subparagraph below for ballasted systems.

* + - * 1. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.

Fasteners: 1-1/2-inch (38-mm) stainless steel fasteners with neoprene washers.

* + - 1. EXISTING CONCRETE REPAIR
				1. Concrete Repair: For removal of deteriorated concrete and subsequent replacement and patching, refer to [Division 03 Section "Maintenance of Cast-in-Place Concrete."] [Division 07 Section "Preparation for Re-Roofing."]

Only AlphaGuard Slip-Resistant Walkway Top Coat or Fibergrate FRP Molded Roof Walkways are permitted over AlphaGuard systems. Roof Pavers may be used in IRMA/PRMA configurations.

1. EXECUTION

Specifier: Part 3 Articles are structured to allow use of this Section for both re-roofing applications and to new construction. Edit below to correspond to Project.

If application is being made onto an existing concrete deck, also edit Section 07 01 50 "Preparation for Re-Roofing" to describe requirements for removal and preparation of existing roofing, and coordinate with work of this Section.

* + - 1. REMOVAL OF EXISTING ROOFING
				1. Refer to requirements of Division 07 Section "Preparation for Re-Roofing" for removal of existing roofing and requirements for temporary roofing coordinated with work of this Section.
			2. EXAMINATION
				1. Examine roofing substrates, with Installer present, for compliance with requirements and for other conditions affecting application and performance of fluid-applied roofing.

For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.

Verify that substrates are sound, visibly dry and free of moisture.

Verify that substrates have adequately cured to enable proper bond with base coat.

Application of fluid-applied roofing indicates acceptance of surfaces and conditions.

* + - 1. PREPARATION, GENERAL

Retain and edit paragraphs and subparagraphs below that correspond to project conditions.

* + - * 1. Protect existing roofing system that is indicated not to receive fluid-applied roofing, and adjacent portions of building and building equipment.
				2. Shut down air intake equipment in the vicinity of the Work in coordination with the Owner. Cover air intake louvers before proceeding with coating work that could affect indoor air quality or activate smoke detectors in ductwork.

Verify that rooftop utilities and service piping affected by the Work have been shut off before commencing Work.

Prevent dust, vapors, gases, and odors from entering occupied building during roof installation. When shutting down or blocking air intakes, provide makeup air or additional intake air from sources away from the work area.

* + - * 1. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

Do not permit water to enter into or under existing membrane roofing system components that are to remain.

* + - 1. CONCRETE DECK PREPARATION
				1. Concrete Deck Preparation, General: Repair, clean, and prepare concrete to sound condition free of grease, oils, coatings, dust, curing compounds and other contaminants.

Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

Choose one of the following two repair paragraphs. Select the first for light repair using patching resin; choose the second for large or deep repairs requiring patching mortar.

* + - * 1. Concrete Repair: Patch concrete surface with concrete repair resin products compatible with fluid-applied membrane roofing system.
				2. Concrete Repair: Remove defective concrete and repair honeycombs, cavities, joint cracks, voids and other defects by routing to sound material and patching. Patch all unsound or defective concrete with repair mortar recommended for application [and approved by Architect] [and approved by Owner's Consultant].
				3. Detergent Cleaning: Remove oil, grease smear and asphalt residue with trisodium phosphate. For oil contaminated surfaces, use steam cleaning in conjunction with a strong emulsifying detergent. Rinse thoroughly with potable water.

Mechanical Abrasion is required for direct-to-concrete AlphaGuard applications; it may be deleted when system includes an approved base sheet over the deck.

* + - * 1. Mechanical Abrasion: Smooth precast and formed concrete surfaces must be cleaned, roughened and made absorptive by mechanical abrasion. Remove surface laitance and abrade surface to CSP 3-6 in accordance with ICRI Guideline 310.

Acid Etching is optional. All other preparation paragraphs are required for direct-to-concrete application.

* + - * 1. Acid Etching: Where mechanical abrasion cannot be utilized, acid etch concrete deck with 15 percent hydrochloric acid solution. Following etching, flush surface with water to neutralize the surface; remove salts and residue from the reaction.
				2. Testing: Following surface preparation, perform testing to verify concrete substrate is adequate prepared to receive fluid-applied roofing in accordance with manufacturer's written instructions.

PH Test: Verify pH level is within range acceptable to roofing manufacturer when tested per ASTM D4262.

Pull Test: Verify that the cleaned surface pulls concrete when tested per ASTM D4541.

Select one of the following two Moisture Test methods. The second method is recommended, especially for new concrete decks.

Moisture Test: Verify that concrete substrate is visibly dry and free of moisture when tested by plastic sheet method per ASTM D4263.

Moisture Test: Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.

Test Frequency: One test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.

Submit test reports within 24 hours of performing tests.

* + - 1. PREPARATION OF EXISTING FLASHINGS

Retain and edit paragraphs and subparagraphs below that correspond to project conditions for re-roofing.

* + - * 1. Existing Flashing and Detail Preparation: Repair flashings, gravel stops, copings, and other roof-related sheet metal and trim elements. Reseal joints, replace loose or missing fasteners, and replace components that cannot be repaired to weathertight and like-new condition.

Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris, and prepare for application of re-coating system.

Do not damage metal counterflashings that are to remain. Replace damaged metal counterflashings with counterflashings [of same metal, weight or thickness, and finish.] [specified in Division 07 Section "Sheet Metal Flashing and Trim."] [specified in Division 07 Section "Roof Specialties."]

Roof Drains: Remove drain strainer and clamping ring. Grind metal surfaces down to clean, bare, metal. Prime metal surfaces with manufacturer's recommended primer.

Retain and edit this Article if base sheet is required. Select application method.

* + - 1. FLUID-APPLIED FLASHING APPLICATION
				1. Surface Priming: Prime flashing substrate with specified primer at rate indicated in Part 2 product listing, and allow primer to dry.
				2. Fluid-Applied Flashing and Detail Base Coat Application: Complete base coat and fabric reinforcement at parapets, curbs, penetrations, and drains prior to application of field of fluid-applied membrane. Apply flashing base coat in accordance with manufacturer's written instructions.

Apply base coat on prepared and primed surfaces and spread coating evenly. Extend coating minimum of 8 inches (200 mm) up vertical surfaces and 4 inches (100 mm) onto horizontal surfaces.

Back roll to achieve not less than minimum coating thickness indicated in Part 2 product listing, , unless greater thickness is recommended by manufacturer. Verify application thickness as work progresses.

For AG BIO and AG MT, retain first "Fabric Reinforcement" Paragraph and subparagraph below.

Embed fabric reinforcement into wet base coat. Lap adjacent flashing pieces of fabric minimum 3 inches (75 mm) along edges and 6 inches (150 mm) at end laps.

Roll surface of fabric reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

For AG PUMA, retain first "Fabric Reinforcement" paragraph and subparagraph below.

Fabric Reinforcement: Place fabric reinforcement onto wet base coat. Lap adjacent flashing pieces of fabric minimum 3 inches (75 mm) along edges and 6 inches (150 mm) at end laps.

Apply second base coat over installed fabric reinforcement and back roll to achieve not less than minimum coating thickness indicated in Part 2 product listing, unless greater thickness is recommended by manufacturer. Verify application thickness as work progresses.

Roof Drains: Install base coat onto surrounding membrane surface and metal drain bowl flange. Install target piece of fabric reinforcement immediately into wet base coat and roll to fully embed and saturate fabric. Reinstall clamping ring and strainer following application of top coat. Replace broken drain ring clamping bolts.

Allow base coat to cure prior to application of top coat.

Following curing of base coat and prior to application of top coat, sand raised or exposed edges of fabric reinforcement.

* + - 1. FLUID-APPLIED MEMBRANE APPLICATION
				1. Concrete Repair: Patch concrete surface with concrete repair resin products compatible with fluid-applied membrane roofing system.
				2. Surface Priming: Prime flashing substrate with specified primer at rate indicated in Part 2 product listing, and allow primer to dry.
				3. Base Coat: Apply base coat to field of membrane in accordance with manufacturer's written instructions. Apply base coat on prepared and primed surfaces and spread coating evenly.

Apply base coat on prepared and primed surfaces and spread coating evenly. Extend coating minimum of 8 inches (200 mm) up vertical surfaces and 4 inches (100 mm) onto horizontal surfaces.

Back roll to achieve not less than minimum coating thickness indicated in Part 2 product listing, , unless greater thickness is recommended by manufacturer. Verify application thickness as work progresses.

For AG BIO and AG MT, retain first "Fabric Reinforcement" Paragraph and subparagraph below.

Embed fabric reinforcing fabric into wet base coat. Lap adjacent flashing pieces of fabric minimum 3 inches (75 mm) along edges and 6 inches (150 mm) at end laps.

Roll surface of fabric reinforcing fabric to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

For AG PUMA, retain first "Fabric Reinforcement" paragraph and subparagraph below.

Fabric Reinforcement: Place fabric reinforcement onto wet base coat. Lap adjacent flashing pieces of fabric minimum 3 inches (75 mm) along edges and 6 inches (150 mm) at end laps.

Apply second base coat over installed fabric reinforcement and back roll to achieve not less than minimum coating thickness indicated in Part 2 product listing, unless greater thickness is recommended by manufacturer. Verify application thickness as work progresses.

Allow base coat to cure prior to application of top coat.

Following curing of base coat and prior to application of top coat, sand raised or exposed edges of fabric reinforcement.

* + - * 1. Top Coat: Apply top coat uniformly in a complete installation to field of roof and flashings.

Prime base coat prior to application of top coat if top coat is not applied within 72 hours of the base coat application, using manufacturer's recommended primer.

Apply top coat to flashings extending coating up vertical surfaces and out onto horizontal surfaces 4 inches (100 mm). Install top coat over field base coat and spread coating evenly.

Apply top coat and back roll to achieve not less than minimum coating thickness indicated in Part 2 product listing, unless greater thickness is recommended by manufacturer. Verify application thickness as work progresses.

Avoid foot traffic on new fluid-applied membrane for a minimum of 24 hours.

Retain "Protection Course" Paragraph below for IRMA/PRMA assembly. Protection course also prevents insulation from sticking to membrane.

* + - * 1. Protection Fabric: Cover membrane with protection fabric with overlapped joints before membrane is subject to construction traffic.
			1. INSTALLATION OF INSULATION
				1. Loosely lay board insulation units over roofing membrane, with long joints of insulation in continuous straight lines and with end joints staggered between rows. Abut edges and ends between units.
				2. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.

Retain subparagraph below if required, or revise to suit Project. Revise below if one or more insulation layers are topped with a final layer of mortar-faced board insulation.

Where overall insulation thickness is 2 inches (50 mm) or more, install required thickness in two or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of 6 inches (150 mm) in each direction.

* + - * 1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated

Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

Retain below if required for Project. Insulation drain sumps are allowed to taper down to a thickness of not less than 1 inch (25 mm) less than the thickness required to achieve the continuous insulation R-value (RSI) required by code. The size of the sump is further dictated by the slope. For example: A 1-inch (25 mm) deep sump at 1/4 per foot (1:48) slope would have a size of 4 by 4 feet (1200 by 1200 mm). To accommodate larger and/or deeper sumps, increase total insulation thickness as necessary.

* + - * 1. Insulation Drain Sumps: Tapered insulation sumps, not less than 2 by 2 ft. (600 by 600 mm), sloped to roof drain; sump to maximum depth of not more than 1 inch (25 mm) less than the Project-stipulated continuous insulation thickness based upon code requirements.
				2. Install filter fabric over insulation, overlapping edges and ends at least 12 inches (300 mm). Do not lap ends of fabric sheets within 72 inches (1800 mm) of roof perimeter. Extend fabric 2 to 3 inches (50 to 75 mm) above ballast at perimeter and penetrations. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation. Do not cover drains or restrict water flow to drains.
			1. INSTALLATION OF BALLAST

IMPORTANT NOTE: The use of aggregate on roofs as surfacing or ballast is restricted by code in most jurisdictions. Review applicable code to determine whether ballast/aggregate is permitted. For projects governed by IBC, refer to Chapter 15 (Section & Table 1504.8 in IBC-2015 and IBC 2018).

* + - * 1. Aggregate Ballast: Apply uniformly over roof membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to roofing system. Lay ballast as roof membrane is installed, leaving roofing ballasted at the end of the workday.

First three "Ballast Weight" subparagraphs below are based on ANSI/SPRI RP-4. Indicate dimensions of corners, perimeter, and field of roof on Drawings, based on FM Requirements.

Ballast Weight, ANSI/SPRI RP-4 System 1: Size 4 aggregate, 10 lb/sq. ft (50 kg/sq. m).

Ballast Weight, ANSI/SPRI RP-4 System 2: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m.), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m.), elsewhere.

Ballast Weight, ANSI/SPRI RP-4 System 2 High Wind: Size 2 aggregate, 13 lb/sq. ft (65 kg/sq. m).

Delete three "Ballast Weight" subparagraphs above and retain "Ballast Weight" Subparagraph below if FM Global recommendations apply. Insert weight of aggregate for each part of roof, based on recommendations in FM Global Property Loss Prevention Data Sheet 1-29. Indicate dimensions of corners, perimeter, and field of roof on Drawings, based on FM Global requirements.

Ballast Weight, FM-Compliant System: Size 3 aggregate, <Insert weight> [lb/sq. ft.] [kg/sq. m.] at corners, <Insert weight> [lb/sq. ft.] [kg/sq. m.] at perimeter, and <Insert weight> [lb/sq. ft.] [kg/sq. m.] elsewhere.

Retain "Roof-Paver Ballast" or "Roof-Paver and Aggregate Ballast" Paragraph below if roof pavers are required.

* + - * 1. Roof-Paver Ballast: Install [lightweight] [heavyweight] roof-paver ballast according to manufacturer's written instructions.
				2. Combination Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.

Ballast Weight, ANSI/SPRI RP-4 System 2: Install Size 4 aggregate ballast elsewhere on roof membrane at a minimum rate of 10 lb/sq. ft (50 kg/sq. m).

Ballast Weight, ANSI/SPRI RP-4 System 2 High Wind and System 3: Install Size 2 aggregate ballast elsewhere on roof membrane at a minimum rate of 13 lb/sq. ft (65 kg/sq. m).

For exposed membrane systems use AlphaGuard Slip-Resistant Walkways or Fibergrate FRP Molded Walkways. For IRMA/PRMA systems, roof pavers may be used. Delete this Article when using AlphaGuard Slip-Resistant Walkways

* + - 1. WALKWAY INSTALLATION
				1. Walkways, General: Install walkways according to roofing manufacturer's written instructions.

Where indicated on Drawings.

Delete above and retain one of more of following subparagraphs if walkways are not shown on Drawings. Revise to suit Project requirements.

Perimeter of each rooftop unit.

Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

Top and bottom of each roof access ladder.

Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.

* + - * 1. Slip-Resistant Walkway Topcoat: Apply walkway second topcoat following application and curing of top coat. Locate as indicated, or as directed by Owner.

Mask walkway location with tape.

Prime first top coat prior to application of walkway top coat if walkway top coat is not applied within 72 hours of the first top coat application, using manufacturer's recommended primer.

Apply walkway top coat and back roll to achieve not less than minimum coating thickness indicated in Part 2 product listing, unless greater thickness is recommended by manufacturer. Verify application thickness as work progresses.

Broadcast Slip-Resistant Top Coat Aggregate in wet top coat at rate indicated in Part 2 product listing or as otherwise recommended by coating manufacturer.

Back roll aggregate and top coat creating even dispersal of aggregate.

Remove masking immediately.

* + - * 1. Install FRP molded walkways according Division 07 Section "Roof Walkways."
				2. Roof-Paver Walkways: [Install] [Reinstall] walkway roof pavers over protection mat according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.
			1. FIELD QUALITY CONTROL

Choose one of the following two Roof Inspector paragraphs, as applicable. The first paragraph requires the Owner to provide and pay for the services of a Roof Inspector (Sometimes this is required by Owner's policy or by Local Ordinance/Authority.) The second paragraph requires the Contractor to provide and pay for the Roof Inspector. Roof Inspector is defined under Quality Assurance Article. The subsequent Roof Inspection paragraph requires the Contractor to engage the roof membrane manufacturer to inspect the application at key points.

* + - * 1. Roofing Inspector: Owner will engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.
				2. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of <Insert number of days> full-time days on site[, per 40-hour crew week,] to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with applicable criteria established in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roof Systems."
				3. Roof Inspection: Contractor shall engage roofing system manufacturer's technical personnel to inspect roofing installation, and submit report to the [Owner], [Architect] [and] [Owner's Consultant]. Notify [Architect], [Owner] [and] [Owner's Consultant] 48 hours in advance of dates and times of inspections. Inspect work as follows:

Upon completion of preparation of first component of work, prior to application of re-coating materials.

Following application of re-coating to flashings and application of base coat to field of roof.

Upon completion of re-coating but prior to re-installation of other roofing components.

* + - * 1. Repair fluid-applied membrane where test inspections indicate that they do not comply with specified requirements.
				2. Arrange for additional inspections, at Contractor's expense, to verify compliance of replaced or additional work with specified requirements.
			1. PROTECTING AND CLEANING
				1. Protect roofing from damage and wear during remainder of construction period.
				2. Correct deficiencies in or remove coatings that do not comply with requirements, repair substrates, and reapply coatings.
				3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075600.11