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USACE / NAVFAC / AFCEC **UFGS-07 18 16 (August 2025)**

Preparing Activity: NAVFAC **New**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2026
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COLD LIQUID-APPLIED REINFORCED POLYMETHYL METHACRYLATE ROOFING

08/25

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SECTION 07 18 16

COLD LIQUID-APPLIED REINFORCED POLYMETHYL METHACRYLATE ROOFING
08/25

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This guide specification covers the requirements for Polymethyl Methacrylate (PMMA) roofing applied over existing or new roofing systems in accordance with recommendations contained in UFC 3-110-03, Roofing.

This product can be used over existing roof systems as a means of extending their service life in lieu of removal and replacement. Use caution with this product over existing roofing system. Ensure existing roof system and substrate is structurally sound, properly attached, and dry in order to receive PMMA system. Acceptable existing roof system substrates include Built-Up, Metal, Single-Ply Membrane, and Modified Bitumen Roofing Systems.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	(2020) Specifications for Structural Concrete
ACI SPEC 308.1	>(2023) External Curing of Cast-in-Place Concrete - Specification

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-22	(2022; Supp 1 2023; Supp 2 2023; Supp 3 2025) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM C1325	(2025) Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
ASTM D41/D41M	(2011; R 2023) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D570	(2022) Standard Test Method for Water Absorption of Plastics
ASTM D1204	(2014; R 2020) Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
ASTM D2240	(2015; R 2021) Standard Test Method for Rubber Property - Durometer Hardness

ASTM D4541	(2022) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D5034	(2009; R 2017) Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM D5147/D5147M	(2018; R 2024) Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
ASTM D7264/D7264M	(2021) Standard Test Method for Flexural Properties of Polymer Matrix Composite Materials
ASTM E96/E96M	(2024a) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM F2170	(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
ASTM F2659	(2023) Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2015) Quality Management Systems-Requirements
ISO 14001	(2015) Environmental Management Systems — Requirements with Guidance for Use

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA C3701	(1997) Repair Manual for Low Slope Membrane Roof Systems
NRCA CONDET	(2025) Construction Details Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 15	(2012) Commercial Grade Power-Tool Cleaning

1.2 SEQUENCING

Coordinate the work with other trades to ensure that components which are secured to or stripped into the roofing system are available and that permanent flashing and counter flashing, in accordance with NRCA CONDET, and are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

PMMA Field Resin

Polymethyl Methacrylate Membrane (PMMA)

[Heat Island Reduction

] Construction Grade Caulk; G, [_____]

Polymethyl Methacrylate Flashing Membrane (PMMA); G, [_____]

Primers; G, [_____]

Reinforcing Medium; G, [_____]

Cant Strips; G, [_____]

Corrosion Resistant Primer; G, [_____]

[Surfacing and Finish Layer; G, [_____]

] Biodegradable Cleaner; G, [_____]

[SD-05 Design Data

Wind Uplift Calculations; G, [_____]

] SD-06 Test Reports

Field Inspection and Existing Conditions Report; G, [_____]

SD-07 Certificates

Manufacturer Qualifications; G, [_____]

Installer Qualifications; G, [_____]

Qualification of Inspector; G, [_____]

SD-08 Manufacturer's Instructions

Manufacturer's Written Instructions

SD-09 Manufacturer's Field Reports

Field Tests; G, [_____]

[Manufacturer's Inspection Report; G, [_____]

] SD-11 Closeout Submittals

Information Card

Warranty; G, [_____]

1.4 QUALITY CONTROL

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NOTE: All projects with more than 1400 square meters 15,000 square feet of roof area or that are defined as critical use or mission critical in the project DD Form 1391 must have a Registered Roof Consultant (RRC), a registered professional engineer (PE) or registered architect (RA or AIA) that specializes in roof system design and quality assurance services on the design team; this qualified professional must have documented training in the roof type being installed, in metal caps and flashing design, in wind uplift design using ASCE 7, in roof system thermal and moisture design, and in roof drainage design.

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1.4.1 Manufacturer Qualifications

Submit information documenting Manufacturer is ISO 9001 and ISO 14001 certified and Manufacturer of the PMMA system has proven 10-year track record of successful installations in the roofing industry.

Provide Manufacturer's written instructions for installation, including details.

1.4.2 Installer Qualifications

Submit information certifying the installer is approved by the coatings manufacturer and has a minimum of 5 years experience in the application of PMMA roof coatings and has applied five installations from the manufacturer being submitted of similar size, scope, and the same system as this project within the previous 3 years. Provide a list of five project references, including contact name and telephone numbers.

Provide proof of this qualification in written form from the manufacturer of the roofing system. A signed certificate from the Manufacturer stating that the Contractor is an approved installer of the Manufacturer's Complete Fluid Applied Roofing System and that each member of the installation crew has been trained in the system's proper installation and is certified by the Manufacturer's Technical Representative. Submit the names of the certified installers to Contracting Officer and only employees that are certified installers are allowed on the project.

1.4.3 Qualification of Inspector

An Approved Inspector (as designated by manufacturer) must be on site during all applications of any manufacturer's products. Submit Qualification of Inspector documenting approval by manufacturer an inspector for the installation of their system.

1.4.4 Product Standards

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NOTE: The following paragraph contains tailoring for ARMY and NAVY. Select the applicable tailoring option for the project.
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Ensure the coating system supplied is approved and listed by Factory Mutual as an acceptable Class I-4470 Roofing System Class I-4470 Roof Coating System over existing roof substrates.

Container labels are required to include this information or the container may be rejected by the Government representative at the jobsite. Manufacturer's name, product name, type, and class of material. Factory Mutual logo, batch or lot number, mixing and application instructions, and precautions.

1.4.5 Codes and Standards

The Contractor must be thoroughly familiar with all codes, regulations, and standards governing the specified work. Any contradiction between the manufacturer's requirements and these specifications must be brought to the attention of the Manufacturer and the Contracting Officer.

1.4.6 Deviations

Do not deviate from these specifications unless the deviation is submitted in writing in accordance with the General Conditions along with a letter from the roofing manufacturer technical department approving the details of the deviation.

[1.4.7 Wind Uplift Resistance

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NOTE: Include this section if PMMA system is being installed over a newly adhered coverboard. If the PMMA System is being installed over an unrated roof assembly, remove reference to FM test validation.

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NOTE: Determine the required wind uplift resistance based on ASCE 7 wind loading calculations or applicable building code requirements. The specified FM rating incorporates a safety factor of 2 over the maximum calculated uplift pressure. Therefore, a FM rating of 1-90 correlates to a maximum uplift calculation of 2.2 kPa 45 psf. When a rated system is specified, ensure the specified roof system is capable of meeting the wind uplift resistance specified. Where non-rated systems may be permissible, edit accordingly.

Delineate calculated values in the roof specification or drawings. Utilize independently tested and rated roof systems, such as Factory Mutual (FM), Underwriters Laboratory (UL), and Single Ply Roofing Industry (SPRI).

****

Ensure the complete roof system assembly is rated and installed to resist wind loads calculated in accordance with ASCE 7-22 and validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Submit licensed engineer's wind uplift calculations and substantiating data.

]1.4.8 Field Inspection and Existing Conditions Report

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NOTE: This represents a Contractor's Field Survey to confirm conditions shown in design documents.

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Field Survey report including moisture survey report and drawing illustrating any roof area containing entrapped moisture.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery of Materials

Deliver materials to the jobsite in manufacturer's original, sealed containers with labels legible and intact.

Deliver materials bearing the following information:

a. Name of manufacturer.

b. Name of contents and products code.

c. Net volume of contents.

d. Lot or batch number.

e. VOC content.

f. Storage temperature limits.

g. Shelf life expiration date.

h. Mixing instructions and proportions of contents.

i. Safety information and instructions.

1.5.2 Storage of Materials

Store materials in an area specifically designated for that purpose, in accordance with manufacturer's recommendations, where temperatures are not less than 10 degree C 50 degree F or higher than 37.8 degree C 100 degree F.

1.5.3 Material Handling

Handle, store, and install materials in accordance with manufacturer's instructions and all applicable safety regulatory requirements.

1.5.4 Damaged Materials

Reject contaminated, damaged, or unsealed materials, or materials not conforming to the specifications and immediately remove from the jobsite and replace at no additional cost to the Government.

Reject materials that have been installed and damaged prior to issuance of warranty and remove from the jobsite. This includes materials not protected from unprotected foot traffic, materials that were unprotected and used as a staging platform or storage area, materials that have been polluted with dirt, debris, metal shavings and other roofing materials, and or materials damaged by water intrusion.

1.6 ENVIRONMENTAL CONDITIONS

Install all materials in strict accordance with manufacturer's published safety requirements and weather precautions, and the following work restrictions:

a. Do not apply materials over dirt, oil, grease, or other pollutants (this includes foot traffic or markings caused hoses, electrical cords, flexible conduits on roof, or tires). Remove all dirt or markings prior to the installation of the various applications of coating used to produce the liquid applied roof system.

b. Do not apply PMMA system components when the Ambient temperature is below 4.4 degree C 40 degree F or above 35 degree C 95 Degree F, if any surface moisture is present, when the dew point is within minus 15

degree C 5 degree F of the surface temperature or when there is a possibility of temperatures falling below 0 degree C 32 degree F within a 24-hour period.

c. Do not apply PMMA system components if weather conditions do not permit complete cure before rain, dew, fog, or freezing temperatures occur. Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of waterproofing materials. Ensure all materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.

d. Monitor substrate and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Adjust materials and methods as necessary to accommodate varying project conditions. Do not install materials when conditions are unacceptable to achieve the specified results.

e. Do not apply if the wind velocity exceeds 10 mph without taking precautions.

f. Take all measures necessary to protect unrelated surfaces from coating overspray or spillage.

g. Contractor is responsible for any adverse conditions, which may result from applying coatings while the weather is rising during the morning hours, which might result in moisture being pulled upwards from the deck, which can result in vapor pockets forming.

h. Review project conditions and determine when and where conditions are appropriate to utilize the specified liquid applied, or semi-solid materials. When conditions are determined by the Contractor to be unsafe or undesirable to proceed, take measures to prevent or eliminate the unsafe or undesirable exposures and conditions, or utilize equivalent approved materials and methods to accommodate requirements and conditions.

i. Refer to product Safety Data Sheets (SDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

j. Implement odor control measures where required during the application of waterproofing materials and adjust methods as necessary to accommodate varying project conditions.

1.7 WARRANTY

Provide PMMA system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty to comply with the specified requirements. Minimum manufacturer warranty is required to have no dollar limit, cover full system water-tightness, and have a duration of 20 years.

1.7.1 Liquid-Applied Roof Membrane System Manufacturer's Warranty

Provide the roof membrane manufacturer's 20-year no dollar limit roof

system materials and installation workmanship warranty, including flashing, insulation[in compliance with ASTM D5034], and accessories necessary for a watertight roof system construction. Write warranty directly to the Government, commencing at time of Government's acceptance of the roof work. Upon completion of installation, and acceptance by the[Contracting Officer,][Architect,][Construction Manager] and Roofing System Engineer of Record, the manufacturer is required to supply the appropriate warranty to the Government. The warranty is required to state that:

a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the PMMA system manufacturer. All costs associated with the repair or replacement work are the responsibility of the PMMA system manufacturer.

b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.

c. Damage to the roofing system caused by design wind speeds determined by ASCE 7-22 or less is covered by the warranty.

1.7.2 Contractor's Warranty

The Contractor is required to warrant for a period of 2 years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The Contractor is responsible for correction of defective workmanship and replacement of damaged or affected materials. The Contractor is responsible for all costs associated with the repair or replacement work.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide Polymethyl Methacrylate (PMMA) roofing system complete as specified over[existing][new][Concrete, Built-Up, Metal, Single ply membrane, or Modified Bitumen Roofing Systems] [_____].[Apply PMMA only after patching and repairs of existing roof such as removing deteriorated and wet roof membrane and insulation has been accomplished and the roof has been accepted by the Government. Repairs of low-slope roofs are to comply with NRCA C3701.]

Coatings found to contain banned ingredients must be removed from the property or resurfaced with a complete roof system that meets the roofing specifications.

2.1.1 System Components

The system consists of a cold liquid applied reinforced waterproofing membrane, resin-mortar wearing layer, surfacing, and finish layers.

Work includes, but is not limited to, the following:

a. Preparation of existing[new] steel or concrete, and all flashing substrates.

b. Liquid applied reinforced flashings.

c. Liquid applied, self-leveling waterproof wearing layer.

d. Liquid applied, surfacing and finish.

e. All related materials and labor required to complete specified waterproofing necessary to receive specified manufacturer's warranty.

2.1.2 Elimination, Prevention of Fall Hazards

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NOTE: Incorporate in the design fall prevention methods or techniques to eliminate fall hazards from any part or component of the building, facility, structure, or equipment requiring future maintenance work, in accordance with ANSI/ASSE A1264.1. Fall prevention methods may include identifying, designing, and installing anchorages (hard points) for safe use of fall arrest equipment and systems. Select materials for metal compatibility in order to minimize corrosion, type 316 stainless steel is recommended. Based on the design, include specifics of the system(s) and material(s) in the following subsection.

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2.1.2.1 Fall Protection Systems

[_____]

2.1.3 Cool Roofs

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NOTE: Cool roof design must follow the requirements in UFC 3-110-03, and ASHRAE 90.1 Chapter 5, for the design of insulation and energy performance of the building. Cool roof design for insulation must meet at a minimum the ASHRAE 90.1 Chapter 5 zone requirements. Inadequate design of cool roofs in ASHRAE climate zones 4 and higher have resulted in unintended consequences of condensation below the membrane, overheating of masonry walls, interior spaces, roof top piping and mechanical equipment as a result of the reflected UV rays. If a cool roof is not selected in zones 1-3, meet one of the exception requirements listed in ASHRAE 90.1, Chapter 5 or provide thermal insulation above the deck with an R value of 33 or greater.

Retain the next to last bracketed note for projects with cool roof requirement. Retain the last bracketed sentence for project with sustainable third party certification credit requirement for reduced heat island effect.

****

Install a roof system that meets an overall performance as specified on the drawings or by insulation specified in other sections.[Provide a top surface finish that meets the criteria for Cool Roof Products.[Provide emittance and reflectance percentages, solar reflectance index values,[and]slopes [_____], to meet sustainable third party certification requirements for Heat Island Reduction.]]

2.1.4 Sustainability Requirements

Coordinate with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

2.2 MATERIALS

2.2.1 Polymethyl Methacrylate Membrane (PMMA)

Rapid curing, polymethyl methacrylate (PMMA) multi-component liquid resin with an embedded polyester or fleece reinforcement fabric used for monolithic waterproofing and flashing membranes.

a. VOC content: less than 30 g/L

b. ASTM D5147/D5147M Elongation at 23 degrees C 73.4 degrees F: 30 to 55 percent

c. ASTM D5147/D5147M Peak load at 73.4 degrees F lbf/in: 50 to 70

d. ASTM D5147/D5147M Tear resistance lbf: 60 to 110

e. ASTM D2240 Shore A hardness, durometer: 75 to 90

f. ASTM D570 Water absorption at 24 hours at 23 degrees C 73.4 degrees F: less than 1.0 percent

g. ASTM E96/E96M Water vapor permeance (perms): less than 1.0

h. ASTM D7264/D7264M Low temperature flexibility degrees C degrees F: minus 33 (minus 36.1) PASS

i. ASTM D5147/D5147M or ASTM D1204 Dimensional stability: less than 0.15 percent

Systems meeting UL Class and FM 4470 Approval. Products must bear seals of approval.

2.2.2 PMMA Detailer Resin

Micro-fiber enhanced, rapid curing, polymethyl methacrylate (PMMA) paste resin used for flashing difficult penetrations where a resin/fleece/resin application is not practical.

2.2.3 Liquid Roofing Membrane

Components of liquid applied roofing systems are listed below.

2.2.3.1 Primers

Apply appropriate primer on all substrates as required or recommended by the liquid roofing membrane manufacturer.

a. PMMA Metal Primer: polymethyl methacrylate (PMMA) metal primer promoting adhesion to various metal substrates. VOC content: less than 100 g/L.

b. PMMA All Purpose primer: All-purpose primer combined with a PMMA Catalyst promoting adhesion to cement board, concrete, masonry, wood. VOC content: less than 5 g/L

c. PMMA Primer and Sealer: polymethyl methacrylate (PMMA) for bituminous and asphaltic surfaces meeting ASTM D41/D41M criteria. VOC content: less than 25 g/L

d. PMMA Primer and Sealer: polymethyl methacrylate (PMMA)for horizontal concrete surfaces. VOC content: less than 25 g/L

e. PMMA RIGID PRIMER: Rapid curing, polymethyl methacrylate (PMMA) liquid resin used to promote adhesion of PMMA/PMA membranes over wood, concrete and other approved substrates. VOC content: less than 100 g/L

f. EPOXY PRIMER: two-part, high solids, penetrating, epoxy-based primer for concrete, metals, and other approved substrates. VOC content: less than 100 g/L

g. Low Odor Polyurethane Primer: Low odor, two-part polyurethane primer promoting adhesion to modified bitumen roofing, polyiso cover board, plywood, steel, galvanized steel, aluminum, copper, zinc and other substrates. VOC content: less than 5 g/L

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NOTE: Utilize a moisture mitigation primer if the moisture test results indicate moisture levels higher than what the manufacturer allows. If moisture levels are at or below the recommended values, the moisture mitigation primer can be deleted.

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h. Moisture Mitigation Primer: Low odor, two-part, moisture mitigation epoxy-based primer for concrete and other approved substrates. VOC content: less than 5 g/L

2.2.3.2 Reinforcing Medium

a. PMMA FLEECE: Woven or non-woven, polyester reinforcement used in PMMA/PMA liquid applied membrane and flashing applications.

(1) Thickness: 0.65-1.27 mm 25-50 mils

(2) Weights: 110-165 g/m2

(3) Width(s): 10 cm, 21 cm, 26 cm, 30.5 cm, 35 cm, 53 cm, 63.5 cm, 70 cm, 105 cm. 4.1 in, 8.3 in, 10.3 in, 12.0 in, 13.8 in, 20.7 in, 25 in, 27.6 in, 41.3 in. Size as required.

(4) Length: 50 m 164 ft

b. PMMA PRE-CUT FLEECE: Factory pre-cut woven or non-woven polyester reinforcement used for a variety of penetration flashings in PMMA/PMA liquid applied membrane and flashing applications.

(1) Thickness: 0.65-1.27 mm 25-50 mils

(2) Weights: 110-165 g/m2

(3) Component/Size(s): Small Pipe Flashing 13-76 mm 1/2-3 in, Large Pipe Flashing 102-203 mm 4-8 in, Universal Corner sizes as required.

2.2.3.3 PMMA Field Resin

Multi-component, fast curing, flexible PMMA based resin with catalyst for use in combination with fleece fabric to form a monolithic reinforced roofing membrane. Nominal Thickness must be a minimum 2.3 mm 90 mil PMMA roof membrane reinforced with the specified reinforcement.

2.2.3.4 Polymethyl Methacrylate Flashing Membrane (PMMA)

Rapid curing, polymethyl methacrylate (PMMA) multi-component liquid resin with an embedded polyester reinforcement fabric used for monolithic waterproofing flashing membranes. Nominal thickness must be 2.3 mm 90 mil.

a. VOC content: less than 25 g/L

b. Color: to meet cool roof requirements, or as determined by Contracting Officer.

c. ASTM D5147/D5147M Elongation at 23 degrees C 73.4 degrees F: 30 percent to 55 percent

d. ASTM D5147/D5147M Peak load at 23 degrees C 73.4 degrees F lbf/in: 50 to 70

e. ASTM D5147/D5147M Tear resistance lbf: 60 to 110

f. ASTM D2240 Shore A hardness, durometer: 75 to 90

g. ASTM D570 Water absorption at 24 hours at 23 degrees C 73.4 degrees F: less than 1.0 percent

h. ASTM E96/E96M Water vapor permeance (perms): less than 1.0

i. ASTM D7264/D7264M Low temperature flexibility degrees C degrees F: minus 33 (minus 36.1) PASS

j. ASTM D5147/D5147M or ASTM D1204 Dimensional stability: less than 0.15 percent

[2.2.3.5 Surfacing and Finish Layer (OPTIONAL)

For aesthetic treatments or slip resistant treatments on wearing surfaces of roof tops, concrete structures, or other exposed areas.

a. Vertical Surfaces:

PMMA Aesthetic Color Finish Base: Rapid curing, polymethyl methacrylate (PMMA) liquid pigmented resin or combined with PMMA COLOR PACK for custom color surfacing. VOC content: less than 25 g/L. Color to meet cool roof requirements, or as determined by Contracting Officer.

b. Deck Surfaces Traffic Surfacing - [Light][Heavy] Texture

PMMA Surfacing: Rapid curing, polymethyl methacrylate (PMMA) admixture consisting of resin premixed with aggregate or broadcast selected aggregate surface sand or quartz into finish. Combine with PMMA COLOR PACK for custom color traffic surfacing. VOC content: less than 12 g/L. Color to meet cool roof requirements, or as determined by Contracting Officer.

]2.2.3.6 PMMA Detailer Resin

Micro-fiber enhanced, rapid curing, polymethyl methacrylate (PMMA) paste resin used for flashing difficult penetrations where a resin/fleece/resin application is not practical. Do not install where differential movement is expected.

VOC content: less than 10 g/L

2.2.3.7 Wearing Layer

Polymethyl Methacrylate Self-Leveling Mortar (PMMA)

Rapid curing, polymethyl methacrylate (PMMA) liquid resin used as a heavy-duty wearing layer in pedestrian or vehicle traffic systems and for substrate repairs. Consists of Part B filler powder and Part A liquid resin.

VOC content: less than 5 g/L

2.3 ACCESSORIES

2.3.1 Construction Grade Caulk

Single package[polyurethane][or][silicone] sealant, as approved by roofing coating manufacturer for use in filling cracks, splits or voids, and for sealing reglet counter flashings.

2.3.2 Catalyst

PMMA Catalyst Powder: Reactive agent used to cure PMMA/PMA liquid resins.

2.3.3 Substrate Patching and Repair

2.3.3.1 Polymethyl Methacrylate (PMMA) Paste

Rapid curing, polymethyl methacrylate (PMMA) paste resin used to fill

small cracks, depressions and voids on non-traffic bearing substrates prior to the application of PMMA/PMA membranes.

VOC content: less than 10 g/L

2.3.3.2 Polymethyl Methacrylate (PMMA) Repair Mortar

Rapid curing, polymethyl methacrylate (PMMA) liquid resin used as a heavy-duty wearing layer in pedestrian or vehicle traffic systems and for substrate repairs. Consists of Part B filler powder or mortar aggregate and Part A liquid resin.

(1) PMMA Resin Part A: Rapid curing, polymethyl methacrylate (PMMA) liquid resin.

VOC content: less than 5 g/L

(2) Filler powder or aggregate Part B: Filler.

2.3.4 PMMA Cleaner

Clear, blended solvent used to clean and prepare plastic and metal surfaces, and to clean existing PMMA/PMA surfaces prior to the application of PMMA/PMA liquid applied membrane, flashings, and surfacing.

VOC content: less than 5 g/L

2.3.5 Roof Penetrations

Protective Cement Surface around Kitchen Vents and Grease Traps (where applicable): Provide Reinforced cement and polymer bonding agent slurry.

Slurry and polyester fabric are applied to the surface of the liquid applied roof system on all identified areas.

2.3.6 Cant Strips

Cant strips, where applicable, can be made from EPS, polyisocyanurate, or wood.

2.3.7 Corrosion Resistant Primer

Single component, premium quality exterior primer, as approved by the manufacturer. For corrosion protection, flash rust resistance and enhanced adhesion over all metal surfaces metal surfaces. Apply at a Minimum dry film thickness of 5.0 mils.

[2.3.8 Cover Board

****

NOTE: Some systems require removal of the existing single-ply membrane down to the substrate or cut the membrane into sections such as 10 ft by 10 ft panels or cut 6 inch circles down center of each sheet, every 5 to 8 ft and install a cover board or new insulation board over the cut single-ply prior to recovering with the PMMA system. If a cover board is not required, requirements for cover board and joint tape can be deleted.

****

Cement Roof Board: ASTM C1325, lightweight cementitious core with fiberglass mesh surfacing and reinforced edges.

][2.3.9 Joint Tape

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NOTE: If a cover board is not required, requirements for cover board and joint tape can be deleted.
****

A thermoplastic/rubber based sheet having a woven polyester backing used to treat joints between rigid insulation, flashing substrate panels and joints at cover plates used over sheet metal components. The tape must have a minimum width of 4 inches.

]2.3.10 Biodegradable Cleaner

Supply biodegradable cleaners mixed at rate of one part cleaner to nine parts water, unless otherwise directed by manufacturer.

Material Properties:

a. Biodegradable: Allows proper cleaning of substrates where washing with hazardous cleaning products would not be permitted prior to (re)coating.

b. Open Dry Time: Removes dirt, pollutants, and other contamination build-up even if the product dries prior to rinsing.

c. Environmentally Safe: Does not harm ground vegetation, water collection ponds, septic tanks, or treatment plants even in its concentrated form, nor cause adverse side effects when accidentally ingested by animal life.

d. Agency Approvals: Meets all the requirements of U.S.D.A. and FDA standards, and is OSHA compliant.

PART 3 EXECUTION

3.1 EXAMINATION

****
NOTE: The following contains tailoring for ARMY and NAVY. Select the applicable tailoring option for the project.
****

Do not begin installation until the following actions are completed:

a. Substrate Existing roof membrane has been properly prepared.

b. Examine all substrates where the specified roofing and flashing system will be applied and confirm their suitability to receive the specified roofing materials.

c. Verify substrate existing roof membrane surfaces are durable, free of

frozen matter, dampness, loose particles, cracks, pits, projections, or foreign matter detrimental to adhesion or application of waterproofing system.

d. Verify that substrate existing roof membrane surfaces are smooth and not detrimental to full contact bond of waterproofing materials.

e. Verify items that penetrate surfaces to receive waterproofing are securely installed.

f. Verify that substrate existing roof membrane areas are adequately supported and firmly fastened in place.

****
NOTE: Select paragraphs below if this work is included in Contractor's scope. Delete otherwise.
****

[g. Verify that roof deck has a minimum slope of 21 mm/m 0.25 inch/foot.

][h. Verify that roof does not have ponding water areas.

][i. Verify that all attached vertical walls are properly waterproofed.

]3.2 PREPARATION

****
NOTE: The following contains tailoring for ARMY and NAVY. Select the applicable tailoring option for the project.
****

Perform the following preparation activities:

a. Make all necessary repairs to substrate existing roof membrane. Contact manufacturer's technical representative for assistance.

b. Ensure all surfaces are clean and dry, and free of any dirt, dust, gravel, oil, surface chemicals or other contaminants that may interfere with optimum adhesion.

c. Wire brush any metal that has signs of rust and then coat with a rust primer (5.0 mils dry) prior to covering the insulation.

d. Coat metal with a rust primer (5.0 mils dry) prior to encapsulating with a liquid applied roof system.

e. Repair or replace any damaged or structurally unsound metal, lumber, or concrete.

f. Apply Surface Primer according to system manufacturer for all surfaces to receive PMMA Coating.

g. Remove all paint and loose material from the vertical wall surface to the minimum height shown on the drawings.

h. Protect adjacent surfaces not designated to receive waterproofing.

i. As a minimum, clean and prepare surfaces to receive waterproofing by

removing all loose and flaking particles, grease, and laitance with the use of a stiff bristle push broom and or washing. Take care not to inject water into the substrate existing roof membrane during washing. In some cases, additional drying time may be required after the cleaning process. Please consult the roofing manufacturer's technical representative for additional advice on cleaning various roofing substrates.

j. Do not apply waterproofing to surfaces unacceptable to manufacturer.

k. 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.

3.2.1 General

Ensure all substrates are clean, dry and 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 primer or resin materials to the substrate. Most surfaces will require mechanical abrasion in the form of scarifying, shot-blasting or grinding to achieve a suitable substrate.

Inspect all substrates, and correct defects before application of waterproofing materials. Fill all surface voids 1.5 mm 1/16 in or greater wide or deep with appropriate fill material.

3.2.2 Re-Roof Preparation

Remove roof surfaces and membranes not suitable for recover. Remove an area no larger than can be re-roofed in one day. Removal all base flashing, counterflashings, pitch pans, penetration flashings for application of new membrane. Examine clearances and modify curbs, sills and mechanical equipment to achieve minimum clearance. Curb heights must maintain a minimum 200 mm 8 inch clear curb height from the bottom of the metal flashing drip edge to the top of the roof membrane surface.

Protect all substrates, insulation, recovery board and coating from pollutants that may act as a bond-breaker between the various applications of coating. These pollutants include (but not limited to) foot traffic residue, metal shavings, tire tracks, markings caused by hoses and electrical cords, insulation adhesive, sealants, and cementitious materials. Remove all pollutants prior to the application of coatings.

[3.2.3 Cover Board Installation

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

b. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

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

d. 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.

e. 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.

f. Adhered Cover Board: Adhere cover board to substrate. 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.

][3.2.4 Concrete Substrates

a. Concrete must comply with requirements of ACI 301 and ACI SPEC 308.1.

b. Concrete compressive strength: 3,500 psi for all primers or 2,500 psi minimum when use of a moisture mitigation primer is required.

c. Relative humidity: Maximum 75 percent in accordance with ASTM F2170 unless otherwise approved.

d. Surface: Scarify, shot-blast or grind to ICRI Concrete Surface Profile CSP 3 to CSP 5; CSP 3 being the preferred profile. Provide a sound substrate free from laitance with an open concrete surface.

e. Adhesion: Adhesion of specified primer and liquid applied components must be minimum 220 psi for traffic bearing areas or 116 psi for non-traffic bearing areas in accordance with ASTM D4541.

f. Repair areas of spalls, voids, bug holes and other deterioration on vertical or horizontal surfaces as required or recommended by manufacturer.

][3.2.5 Masonry Substrates

a. Walls must be structurally sound built of hard kiln dried brick, reinforced concrete block, or waterproof concrete block construction. Liquid applied membrane must not be applied over soft or scaling brick or block, faulty mortar joints, or walls with broken, damaged or leaking coping. Repair areas of spalls, voids, bug holes and other deterioration on vertical surfaces as required or recommended.

b. Walls of ordinary hollow tile, or other materials which in themselves are not waterproofed, are not suitable to receive liquid applied membrane unless properly waterproofed to prevent moisture infiltration from above or behind the new liquid applied membrane.

c. Relative humidity: Maximum 75 percent in accordance with ASTM F2170 unless otherwise approved. Or when relative humidity testing is not possible, maximum of 4.5 percent using an electrical impedance moisture meter in accordance with ASTM F2659 unless otherwise approved.

d. Surface: Scarify, shot blast or grind to ICRI Concrete Surface Profile CSP 2 to CSP 4.

e. Adhesion: Adhesion of specified primer and liquid applied components must be minimum 220 psi for traffic bearing areas or 116 psi for non-traffic bearing areas in accordance with ASTM D4541.

][3.2.6 Metal Substrates

a. Clean and prepare metal to near-white metal in accordance with SSPC SP 15 (Commercial grade power tool cleaning) to a point maximum 3 mm 1/8 in beyond the termination of liquid applied membrane materials and wipe with solvent cleaner to remove oils, debris or contaminants.

b. Stainless Steel Series 300 and 400: Abrade to provide rough, open surface and wipe with solvent cleaner to remove oils, debris or contaminants.

c. Galvanized and Zinc-Rich Metals: Galvanized and zinc rich metals are coated with either a layer of oil to prevent white rust or is passivated which must be completely removed prior to applying primer or liquid applied waterproofing. This can be confirmed by applying a coat of copper sulfate solution to the prepared and cleaned galvanized/zinc metal. A properly prepared surface will turn black indicating the passivator has been removed. If the surface does not turn black, additional abrasive cleaning will be required. Apply a solution of phosphoric acid and detergents designed to remove grease and oil residue to provide a clean, lightly etched surface suitable for adhesion of subsequently applied coats in accordance with the manufacturer's instructions.

d. Adhesion: Examine metal substrates by conducting adhesion testing. Prime with specified metal primer where required to achieve adequate adhesion.

]3.2.7 Rigid Plastics (PVC and ABS)

Rigid plastics must be lightly abraded and wiped with solvent cleaner. Extend preparation maximum 3 mm 1/8 in beyond the specified termination of the liquid applied membrane flashing materials.

3.2.8 Insulation/Cover Board (Top Exposed Layer Only)

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

3.2.9 Other Flashing Surfaces

a. Remove all contaminants and prepare substrate as needed to receive liquid applied waterproofing.

b. Adhesion: Examine substrates by conducting adhesion testing. Prime with specified primer where required to achieve adequate adhesion.

c. Where conditions are found to be unsatisfactory, do not begin work until conditions are adjusted appropriately. Commencing of work indicates Contractor's acceptance of conditions.

3.3 PRIMER APPLICATION (GENERAL)

Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions. Utilize primer solution of a uniform color, with no light or dark streaks present. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.

Examine all substrates and conduct adhesion peel tests as necessary, to ensure satisfactory adhesion is achieved.

3.4 PMMA RIGID PRIMER APPLICATION

Mix primer resin and catalyst approximately 2 minutes using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified waterproofing materials. Apply primer using brush or roller at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.

Project conditions vary throughout the day. Monitor changing conditions and the curing time of primers. Allow primer to fully cure before membrane application.

[3.5 LOW ODOR EPOXY PRIMER APPLICATION (IF REQUIRED)

a. Mix A and B parts using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time.

b. Apply primer to compatible, clean and prepared substrate preferably with falling temperatures to reduce potential for pinholes from "off-gassing" and as required to enhance adhesion of new specified waterproofing materials.

c. Apply primer using notched squeegee and roller or brush at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.

d. When primer will be left exposed beyond recommended recoat times, broadcast 0.7-1.2mm #1 kiln-dried quartz into the final coat of epoxy primer while still wet at the rate of 1.5 kg/m2 30 lb/100 ft2 as a mechanical bonding layer. After cure, remove loose aggregate and keep dry until subsequent system components are applied.

e. Project conditions vary throughout the day. Monitor changing conditions and the curing time of primers.

f. Allow primer to fully cure before membrane application.

]3.6 MOISTURE MITIGATION EPOXY PRIMER APPLICATION

a. Mix A and B parts using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time.

b. Apply primer to compatible, clean and prepared substrate preferably with falling temperature to reduce potential for pinholes from "off-gassing" and as required to enhance adhesion of new specified waterproofing materials.

c. Apply primer using a notched squeegee and roller or brush at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.

d. Allow primer to fully cure and inspect for bubbles, blisters, voids or pinholes.

e. Repair bubbles, blisters, voids and pinholes as recommended by manufacturer.

f. For steep slope, vertical and flashing applications, minimum two coats of primer are required.

g. When primer will be left exposed beyond recommended recoat times, following any required primer repairs, apply a second coat of primer over the in-place primer and broadcast to excess with 0.7-1.2 mm #1 kiln-dried quartz into the final coat of epoxy primer while still wet at the rate of 1.5 kg/m2 30 lb/100 ft2 as a mechanical bonding layer. After cure, remove loose aggregate and keep dry until subsequent system components are applied.

h. Project conditions vary throughout the day. Monitor changing conditions and monitor the curing time of primers.

i. Allow primer to fully cure before membrane application.

3.7 SUBSTRATE PATCHING, LEVELING AND REPAIR

3.7.1 General

After priming and before commencing with application of liquid applied waterproofing, patch, level or repair all substrates as required to eliminate bug holes, voids, cavities, low spots, repair cracks or any other condition that may be detrimental to proper application of the liquid applied waterproofing.

3.7.2 Patching, Leveling and Repairs

a. Use manufacturer's approved paste or resin-mortar for all patching, leveling or repairs wherever possible. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions.

b. Traffic bearing substrates: Use only resin-mortar for all substrate leveling, patching and repairs.

c. Non-traffic bearing horizontal or vertical substrates: Use paste or resin-mortar for all substrate leveling, patching and repairs.

d. Application:

(1) Install paste or resin-mortar over a fully cured primer.

(2) Ensure the substrate is dry and free of any dust or loose

particles.

(3) Mix paste resin or resin-mortar using a slow speed agitator prior to pouring into a larger container.

(4) When required, combine the paste or resin-mortar with 0.7-1.2 mm #1 kiln-dried quartz aggregate as recommended for deep voids or large areas.

(5) Mix paste or resin-mortar and catalyst approximately 2 minutes using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of product that can be used within the application time.

(6) Apply the catalyzed paste or resin-mortar onto the substrate using a smoothing trowel, working the material into the surface for complete coverage and full adhesion.

(7) Paste or resin-mortar must be placed in lifts no greater than the maximum thicknesses recommended by the manufacturer.

(8) If additional lifts will be required, broadcast top surface of the placed paste or resin-mortar with clean dry 0.7-1.2 mm #1 kiln-dried quartz aggregate at approximately 25 percent coverage while the paste or resin-mortar is wet. Place next lift once the paste or resin-mortar has cured.

3.7.3 Non-Moving (Static) Cracks-1 mm or less

Determine that crack is non-moving. Remove any existing filler and clean out crack by brushing and oil-free compressed air. Fill crack with resin mortar or paste as required.

3.7.4 Moving (Dynamic) Cracks-1 mm or less

Determine that crack is moving. Remove any existing filler and clean out crack by brushing and oil-free compressed air. Fill crack with resin-mortar or paste as required. After the resin-mortar or paste has cured, apply minimum 100 mm 4 in wide joint tape and strip of reinforced cold liquid applied membrane centered over crack.

3.7.5 Moving (Dynamic) Cracks-3 mm or less

Determine that crack is moving. Remove any existing filler and clean out crack by brushing and oil-free compressed air. Fill crack with resin-mortar or paste as required. After the resin-mortar or paste has cured, apply bond breaker tape five times in width greater than the maximum anticipated expansion. Then cover with a strip of reinforced cold liquid applied membrane centered over crack sized to provided 50 mm 2 in minimum cover beyond all side of the bond breaker tape but no less than 150 mm 6 in minimum width.

3.7.6 Moving (Dynamic) Cracks - Greater than 3 mm

Moving cracks greater than 3 mm 1/8-inch must be routed out and filled with urethane sealant similar to an expansion joint. Moving joints or cracks larger than 6 mm 1/4-inch must be stripped in with a strip of membrane.

3.8 INSTALLATION AND STAGING

In a normal cold liquid applied membrane application the substrate is prepared and primed, flashings are installed followed by the application of the waterproofing membrane, mortar, surfacing and finish. When applying broadcast aggregate, the aggregate must not be left subject to the elements, and therefore must be top-coated with finish the same day of application whenever possible.

If work is interrupted for more than 12 hours, use manufacturer's approved cleaner to clean and reactivate applied primer, resin mortar, flashing or field membrane transition areas. Allow cleaner a minimum of 20 minutes evaporation time after application and cover within 60 minutes of application or as recommended by the manufacturer.

3.9 FLASHING MEMBRANE APPLICATION

3.9.1 General

a. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions. Install roofing membrane in strict accordance to roofing manufacturer's written instructions, starting at low point of roofing system. Do not apply to any substrate that contains coal-tar pitch, creosote or penta-based material that has been recently applied.

b. Provide a minimum vertical height of 200 mm 8 in for all flashing terminations wherever possible. Flashing height must be at least as high as the potential water level that could be reached as a result of a deluging rain or poor slope.

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

d. Terminate all flashing as required by the manufacturer. Cap flashings or counter flashings may be constructed of metal, stone, tile or other materials properly installed in accordance with industry-accepted practice.

e. Install all flashing membranes before installing field membranes.

f. Ensure the primed substrate is dry and free of any dust, loose particles or contaminants.

g. Precut reinforcing fleece to conform to terminations, transitions and penetrations being flashed. Ensure a minimum 100 mm 4 in overlap of fleece at side laps and extend flashing 100 mm 4 in minimum horizontally onto deck unless otherwise specified. Ensure the completed liquid applied flashing membrane is fully reinforced and ensure full saturation of fleece.

h. Wherever possible, use factory pre-cut fleece pipe penetration and universal corners.

i. Using the specified cleaner/solvent, wipe flashing membrane and primer surfaces to be covered with field membrane. Allow the surface to dry for a minimum 20 minutes before continuing work.

j. Mix waterproofing resin and catalyst approximately 2 to 5 minutes or time specified by the manufacturer using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of waterproofing resin that can be used within the application time.

k. Apply the base coat of catalyzed waterproofing resin onto the primed substrate using an approved brush or roller, or notched squeegee working the material into the surface for complete coverage, without voids and full adhesion.

l. Immediately apply the reinforcing fleece into the wet base coat of resin making sure the smooth side is up. Using a brush or roller, work the reinforcing fabric into the wet resin while applying the second coat of catalyzed waterproofing resin to completely encapsulate the fleece. Avoid any folds and wrinkles. Maintain 5 cm 2-inches minimum overlap at all side and butt laps of reinforcement and extend flashing a minimum of 100 mm 4 in horizontally onto deck. Apply supplemental resin on scrim as needed to ensure complete saturation. Fleece should darken, white spot indicates unsaturated fleece and must be corrected before resin cures.

m. 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 must extend 50 mm 2 in. past the reinforcement scrim in all directions.

n. Allow completed membrane to cure as recommended by the Membrane Manufacturer prior to continuing application or applying loads. Allow an additional 12 hours before foot traffic.

o. At membrane tie-ins, clean cured membrane with specified cleaner before application of adjacent membrane.

3.9.2 Penetrations and Flashings

a. Pipes, Conduits, Posts, Supports and Unusual Shaped Penetrations:

(1) Pipes, conduits and other items to be flashed must be separated with 13 mm 1/2 in minimum clearance or as recommended by manufacturer to adequately waterproof each individual penetration.

(2) All penetrations must be flashed individually. Two or more items ganged together in a flashing will NOT be permitted.

(3) Flash penetrations using cold liquid applied reinforced membrane or manufacturer's approved fibrated flashing resin. Apply flashing using factory pre-cut fleece wherever possible consisting of a reinforced deck skirt/target flashing applied over a reinforced vertical wrap finger flashing.

b. Drains:

(1) Follow manufacturer's specific drain flashing details for use on traffic bearing waterproofing systems.

(2) Flash drains using cold liquid applied membrane. Flashing must consist of a membrane target extending minimum 300 mm 12 in horizontally onto the substrate applied over a finger flashing

extended into the prepared drain bowl a minimum of 75 mm 3 in or terminated on exterior of trench drains where applicable.

(3) At no time should the cold liquid applied membrane be installed to restrict or reduce the drain inlet in size.

(4) For new drains, Contractor must include cost of all plumbing work, piping and connections to existing storm sewer system.

c. Hot Pipes:

(1) Protect cold liquid applied membrane components from direct contact with steam or heat sources when the in-service temperature exceeds 65.5 degrees C 150 degrees F. In all such cases flash to an intermediate "cool" sleeve.

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

(3) Flash sleeve using cold liquid applied reinforced membrane similar to a standard pipe flashing. Flashing must consist of a reinforced target applied over a reinforced vertical wrap finger flashing.

d. Flexible Penetrations:

(1) Provide a weather-tight gooseneck set in manufacturers resin paste and secured to the deck.

(2) Flash gooseneck penetrations using cold liquid applied reinforced membrane as recommended. Flashing must consist of a reinforced target and reinforced vertical wrap finger flashing.

e. Walls, Curbs and Bases:

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

f. Expansion Joints:

Flash all expansion joints with minimum two layers of manufacturers cold liquid applied reinforced membrane applied over an expansion joint compressible filler, expansion tube, backer rod and bond breaker tape as recommended by manufacturer.

g. Non-standard Flashing Details:

When required, consult manufacturer for recommendations on flashing non-standard conditions, penetrations or protrusions.

h. Traffic Curbs and Flashings Subject to Vehicle Impact:

Liquid applied flashings applied on curbs, walls and penetrations are subject to mechanical damage from vehicles. When required, especially at vehicular curbs, flashings should be protected using metal bollards, stand-offs, steel plate or other means as necessary.

i. Thru-Wall Flashing, Mud-set Masonry, and Poured-In-Place Concrete (Bonding/Protection Layer):

For all areas to receive new direct applied cement, concrete, or mortar setting bed, apply a supplementary wearing coat of the membrane manufacturer's cold liquid applied resin.

(1) Using a lambswool roller, apply an even layer of cold liquid applied resin at the minimum consumption of 1.5 kg/m2 30 lbs./100 ft2 or as recommended by the membrane manufacturer and broadcast 0.7-1.2mm #1 kiln-dried quartz aggregate into the wet resin to excess for full coverage.

(2) Allow resin bonding layer to cure as recommended by the membrane manufacturer prior to continuing application or applying loads. Remove excess un-adhered aggregate from surface by broom, vacuum or oil-free blower prior to apply overburden.

(3) When required, consult manufacturer for recommendations on flashing non-standard conditions, penetrations, or protrusions.

3.10 WATERPROOF PMMA MORTAR WEARING LAYER

a. Mix and apply resin-mortar layer in strict accordance with written instructions of manufacturer. Using a flat or V-notch trowel, apply an even layer of resin-mortar at minimum recommended consumption. Work wet resin with a pin rake or spiked roller, removing trapped air, and smoothing the resin-mortar layer.

b. After resin-mortar has cured, inspect surface and repair imperfections. Apply additional resin-mortar to cover voids or low spots and lightly grind sharps, protrusions and high-spots to develop a smooth finished surface.

c. Prior to applying surfacing layer or finish, remove excess residual dust, debris or contaminants from wearing layer surface by broom, vacuum or oil-free blower.

3.11 WATERPROOFING CONTINUITY TESTING AND QC EVALUATION

a. Prior to applying wearing layers, surfacing or finish, conduct a complete evaluation of the installed liquid applied waterproofing membrane and flashings to include both visual inspection as well as an acceptable method for (low voltage, high voltage or water-flood) continuity testing.

b. Immediately following evaluation and continuity testing, repair all deficiencies identified in liquid applied waterproofing membrane and flashings.

c. Upon satisfactory completion of all required repairs, proceed with application of wearing layer, surfacing and finish installation.

3.12 TRAFFIC SURFACING AND FINISH

3.12.1 General

a. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific

installation instructions.

b. Layout and install all surfacing and finish using manufacturer's recommended practice and procedure with appropriate color breaks reviewed and approved by the Government or Government's representative. Color breaks should help improve appearance, hide minor variations in color or texture and allow for localized repairs of the surfacing and finish if needed.

c c. Install wearing, surfacing and finish layers over fully cured primer, membrane or subsequent layers.

d. Ensure the substrate is dry and free of any dust, loose particles or contaminants.

e. Mix resins and resin-mortars using a slow speed agitator prior to pouring into a larger container.

f. For resin-mortars, combine the powdered filler with the resin and evenly mixed to create mortar.

g. Mix resin-mortar, surfacing or finish resins with catalyst approximately 2 to 5 minutes or time specified by the manufacturer using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of resin-mortar, surfacing or finish resin that can be used within the application time.

h. Apply the catalyzed resin-mortar, surfacing or finish resin onto the substrate as recommended, working the material into the surface for complete coverage and full adhesion.

i. At tie-ins and previously applied primer, membrane, resin-mortar, surfacing or finish layers, clean cured surface with specified cleaner before application of subsequent resin materials.

j. Traffic Surfacing and Finish are semi-rigid materials formulated for durability and performance. As semi-rigid components, when applied over softer or more flexible materials, cracks and micro fissures may occur in the surfacing and finish layer. Although this does not affect the system performance, it will impact the cosmetic appearance of the surfacing and finish. To help reduce or avoid potential cosmetic cracks or fissures, do not apply surfacing and finish over areas of potential movement including the following:

(1) Hold surfacing and finish back 13 mm 1/2 in from horizontal to vertical transitions at walls, penetrations and leading edge of any bond breaker.

(2) Do not apply surfacing and finish over any metal components where stripped in with membrane to allow for movement.

(3) Do not apply surfacing and finish over expansion joints or other joints where movement is possible.

3.12.2 Secondary Deck Areas - Standard Duty

Provide waterproofing manufacturer's standard-duty wearing coat using a combination of resin-mortar and textured surfacing resin with integrally mixed aggregate to create a highly slip-resistant wearing surface.

Light Texture Surfacing Layer:

a. Mix and apply an even topcoat of pigmented textured finish resin using a flat or V-notched trowel at minimum recommended consumption. Use an appropriate roller to remove excess resin or puddling. Roll textured finish resin in one direction, then roll in the cross direction to obtain a uniform finish.

b. For additional slip resistance, immediately after the final roller passes are completed, random broadcast 1.2 mm 0.047 in aluminum oxide to the desired degree onto the coating and lightly back roll one final time.

3.12.3 Main Deck Areas - Heavy Duty

Provide waterproofing manufacturer's heavy-duty wearing coat using a combination of resin-mortar and textured surfacing resin with integrally mixed aggregate to create a highly slip-resistant wearing surface.

Heavy Texture Surfacing Layer:

Mix and apply an even topcoat of manufacturer's pigmented textured coating resin with integrally mixed coarse aggregate to create a highly slip-resistant wearing surface at high traffic areas and turning radii using a flat trowel at minimum consumption recommended. When required, use an appropriate roller to remove excess resin, pudding, or even out to a uniform finish or add additional texture when required, using care not to overwork the surface.

3.12.4 Traffic Striping, Lines and Markings (Full Depth Color)

a. Provide waterproofing manufacturer's light or heavy textured finish resin surfacing with integrally mixed aggregate to create a highly slip-resistant full-depth color wearing surface for all traffic striping, lines and markings.

b. Create Striping, Line-Work and Marking (Negative Depression)

(1) Use stencils as required to mark and mask all striping, line-work and markings. Masking will be used to cover the entire area to subsequently be filled with full depth pigmented textured coating resin material.

(2) Apply surfacing layer and finish as previously indicated above. Remove all masking and stencils while surfacing layer and finish are still wet, using care to keep clean lines along edges of the in-place surfacing and finish material.

(3) After allowing surfacing and finish resin to cure, proceed with application of full depth pigmented striping, line-work and markings.

c. Apply Striping, Line-work and Markings:

(1) Mask around edges of depression in previously applied surfacing and finish created for all striping, line-work and markings. Use back end of dry, clean roller to embed masking into textured surface to help avoid bleed-out.

(2) Mix and apply cold liquid applied textured coating or textured finish traffic surfacing layer in strict accordance with written instructions of manufacturer using a flat trowel and completely filling depression created for striping, line-work and markings. When required, use an appropriate roller to remove excess resin, pudding, or even out to a uniform finish.

(3) Remove all masking while the surfacing layer and finish are still wet, using care to keep clean lines along edges of the in-place surfacing and finish material.

3.12.5 Traffic Striping, Lines and Markings (Surface Applied)

a. Provide waterproofing manufacturer's finish resin to create all traffic striping, lines and markings.

b. Mask perimeter edges of all striping, line-work and markings. Use back end of dry, clean roller to embed masking into textured surface to help avoid bleed-out.

c. Mix and apply cold liquid applied finish traffic in strict accordance with written instructions of manufacturer using a brush or roller.

d. Remove all masking while finish is wet, using care to keep clean lines along edges of the in-place surfacing and finish material.

3.13 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

3.14 CLEAN UP

Uncured resin is considered a hazardous material. Unused resin must be catalyzed and cured prior to disposal.

Clean up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

3.15 PROTECTION

Upon completion of new work (including all associated work), institute appropriate procedures for surveillance and protection of finished work during remainder of construction period. Protect all areas where waterproofing membrane, wearing layer, surfacing and finish have been installed.

3.16 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

3.16.1 Construction Monitoring

During progress of the roof work, Contractor is required to make visual

inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

a. Materials comply with the specified requirements.

b. Materials are not installed in adverse weather conditions.

c. All materials are properly stored, handled, and protected from moisture or other damages.

d. Equipment is in working order. Metering devices are accurate.

e. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

[3.16.2 Manufacturer's Inspection

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NOTE: Include this paragraph when the manufacturer's inspection of work is required. Use bracketed option in second paragraph to specify minimum number of required visits. The minimum and default is three visits during installation. To help determine if more than three visits should be specified, divide the total project roof area in squares by 100 and round to the nearest whole number. Coordinate this requirement with Section 01 45 00 QUALITY CONTROL paragraph QUALITY CONTROL (QC) SPECIALISTS - Experience Matrix.
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The roofing material manufacturer's technical representative must visit the work site to inspect ongoing work. Inspections are to include observing installation technique and verifying the quality of work-in-place for compliance with the manufacturer's instructions. Deficiencies identified by the manufacturer's technical representative must be corrected and re-inspected by the manufacturer's technical representative.

3.16.2.1 Frequency

The manufacturer's technical representative must visit the work site to inspect and document ongoing work a minimum of [three][_____] separate occasions during the course of the installation. One visit must occur during the first 20 squares of installation, one at substantial completion of the roof work, and all others during different periods of installation. Notify the Contracting Officer a minimum of 5 working days prior to each visit by the manufacturer's technical representative.

3.16.2.2 Field Inspection Report

Document inspection results in a report prepared and signed by the manufacturer's technical representative for each visit. Submit the report to the Contracting Officer with the contractor's daily Quality Control report. The manufacturer's field inspection report must include a description of ongoing work observed and whether the inspected work was satisfactory or unsatisfactory. The final report must include certification by the manufacturer's technical representative that the work was performed in accordance with the manufacturer's instructions and

contains no deficiencies. Submit the final manufacturer's field inspection report to the Contracting Officer within five working days of the final visit.

]3.17 PROTECTION

Protect installed products until completion of project. Touch-up, repair or replace damaged products before Substantial Completion.

3.17.1 Closeout Activities

3.17.1.1 Information Card

Provide a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm 0.039 inch thick aluminum card for exterior display. Provide a card measuring 215 mm by 275 mm 8 1/2 by 11 inch minimum. Information card is required to identify facility name and number; location; contract number; approximate roof area; detailed roof system description (as applicable), including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer. Provide an electronic copy of the Information Card to the Contracting Officer's Representative.

-- End of Section --