SECTION 07 14 16.10

INSULATED COOL ROOF/WATERPROOFING (KEMPEROL REFLECT 2K FR)

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\*\* NOTE TO SPECIFIER \*\* Kemper System, Inc.; Waterproofing & Roofing Membrane products.  
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This section is based on the products of Kemper System, Inc., which is located at:  
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 [click Here] for additional information  
  
Kemper System is the worldwide leader, innovator and manufacturer of the highest quality, cold liquid-applied, fully reinforced waterproofing and roofing membranes in the industry. Architects, engineers, roofing consultants, quality contractors and building owners have come to trust Kemper System when only the best will do.  
  
For over 50 years, Kemper System waterproofing, roofing and surfacing products have been protecting some of the world's most important landmarks and valuable properties. With offices in 10 countries, Kemper System membranes protect over 2 billion square feet of surfaces under the most adverse conditions.  
  
From the top of the Empire State Building to Buckingham Palace to the Alaskan Pipeline, when there is a critical waterproofing, roofing and surfacing challenge, Kemper System delivers the solution.  
This Specification includes Kemperol Reflect 2K FR Cool Roof Waterproofing System. KEMPEROL®Reflect 2K FR is a two-component, polyurethane, liquid resin roofing and waterproofing membrane and flashing system, and all other ancillary waterproofing work including insulation, cover boards, sealants and metal work. KEMPEROL®Reflect 2K FR is a UV and color stable, odor and solvent free, Low VOC, cold liquid-applied, highly reflective and fire-rated roofing and waterproofing resin system.

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Cool Insulated Roof Waterproofing.
  1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 03 30 00 - Cast-in-Place Concrete [03 30 00] - Cast-In-Place Concrete
    2. Section 06 64 00 - Plastic Paneling [06 61 16] - Rough Carpentry: Wood Blocking and Nailers.
    3. Section 07 27 19 - Plastic Sheet Air Barriers [07 26 00] - Vapor Retarders.
    4. Section 07 61 00 - Sheet Metal Roofing [07 62 00] - Sheet Metal Flashing and Trim.
    5. Section 22 11 13 - Facility Water Distribution Piping [22 14 26] - Facility Storm Drains
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. ACI-308 - Recommended Practice for Curing Concrete
    2. ASTM C 96 - Test Method for Specific Gravity and Absorption of Fine Aggregate
    3. ASTM C 473 - Standard Test Methods for Physical Testing of Gypsum Panel Products
    4. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
    5. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
    6. ASTM C 947 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading)
    7. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
    8. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
    9. ASTM D 1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
    10. ASTM D 1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
    11. ASTM D 2240 - Standard Test Method for Rubber PropertyDurometer Hardness
    12. ASTM D 4259 - Standard Practice for Abrading Concrete
    13. ASTM D 5147 - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
    14. ASTM D 6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
    15. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
    16. ASTM D 6222 - Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements
    17. ASTM E 96 - Tests for Water Vapor Transmission of Materials in Sheet Form
    18. ASTM E 661 - Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads
    19. ASTM E 831 - Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
    20. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
    21. ASTM 2420 - Standard Test Method for Determining Relative Humidity on the Surface of Concrete Floors Slabs using Relative Humidity Probe Measurement and Insulated Hood
    22. SSPC - Steel Structures Painting Council painting standards.
    23. CRRC (Cool Roof Rating Council) - Standard 1
    24. FM - Approvals Guide
    25. FM Loss Prevention Bulletin 1-49
    26. SMACNA - Architectural Sheet Metal Manual
  1. PERFORMANCE
     1. System shall comply with FM / UL testing data showing that the system meets the local wind uplift requirements and provides a Class A fire-rated roof assembly.
     2. System shall be listed on the CRRC website coolroofs.org showing that the initial solar reflectance, thermal emittance, and SRI values comply with LEED requirements, local building code requirements, and any specific project requirements.
  2. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's data sheets on each product to be used, including:
        1. Product Literature.
        2. Preparation instructions and recommendations.
        3. Storage and handling requirements and recommendations.
        4. Installation methods.
        5. Safety Data Sheets (SDS) for all components.
     3. Shop Drawings: Show including plans and details of cool insulated roof waterproofing system including membrane, penetration flashings, base flashings, and expansion joints size, flashing details, and attachment.
     4. Verification Samples: For each product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, thickness, color, texture and surfacing.
     5. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
     6. Field Quality Control: Submit the following.
        1. Daily inspection and testing reports
        2. Substrate and Bond Testing Reports
        3. Completed Membrane Reports
     7. Closeout Submittals: Submit roofing/waterproofing manufacturer and applicator's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
  3. QUALITY ASSURANCE
     1. Manufacturer Qualifications: Company specializing in manufacturing cold fluid-applied reinforced polyurethane system with a minimum of 20 years of documented experience with applications in the United States.
     2. Installer Qualifications: Company specializing in performing the work of this section with a minimum of 3 years documented experience and approved by system manufacturer for warranted membrane installation.
     3. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress
     4. Manufacturer's Field Service: Membrane manufacturer shall provide the services of a competent field representative on-site to provide the following inspections:
        1. Job start inspection at the beginning of each phase of the project, to review special detailing conditions and substrate preparation.
        2. Periodic in-progress inspections throughout duration of the project to evaluate membrane and flashing application.
        3. Observe field quality control testing.
        4. Final punch-list inspection at the completion of each phase of the project prior to installation of any surfacing or overburden materials.
        5. Warranty inspection to confirm completion of all punch list items, and surfacing,
     5. Source Limitations: Obtain all principal components of roofing/waterproofing system from a single manufacturer. Secondary products that are required shall be as recommended and approved in writing by the roofing/waterproofing system manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the manufacturer.

\*\* NOTE TO SPECIFIER \*\* Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project.

* + 1. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
       1. Prepare and clean a 3 foot (0.9 m) by 3 foot (0.9 m) area of each substrate material type anticipated and located in areas designated by Architect.
       2. Test each area to verify that substrate preparation meets specified requirements. Tests shall include tensile bond strength and moisture content of substrate.
       3. Do not proceed with the work until test results and workmanship are approved by Architect.
       4. Rework mock-up area as required to produce acceptable work.
       5. Maintain mock-up for quality control during the progress of the remaining work.

\*\* NOTE TO SPECIFIER \*\* Select one of the following two Field Quality Control paragraphs if required and delete the one not required. Coordinate with FIELD QUALITY CONTROL paragraphs in Part 3 of this specification. Delete both paragraphs if not required. Vector Mapping is recommended if the project size and/or quality warrant taking such a precaution.

* + 1. Electronic Field Vector Mapping (EFVM) testing is required on the completed membrane prior to the installation of overburden as part of the final field quality control. EFVM testing shall be arranged through the membrane manufacturer and performed by International Leak Detection (ILD) or an approved testing company. Check project compatibility with the membrane manufacture and ensure that all necessary components for the EFVM testing are included in the design. Testing shall be observed by the manufacturer's field service representative.
    2. Field Quality Control Flood Test: Conduct a flood test of the completed membrane and flashing system prior to the installation of any overburden/surfacing. Test shall be of a 24 hour minimum duration, and shall apply a water head of 2 inches over the entire application area. Any incidents of water entry shall be evaluated and all necessary repairs conducted, followed by an additional flood test until all repairs are completed successfully.
  1. PRE-INSTALLATION CONFERENCE
     1. Convene a pre-roofing conference approximately two weeks before scheduled commencement of roofing/waterproofing system installation and associated work.
     2. Require attendance of installers of substrate construction to receive roofing/waterproofing, installers of work in and around roofing/waterproofing which must precede or follow roofing/waterproofing work including mechanical and electrical penetration, equipment openings, subsequent finish work, and the Architect, Owner, and roofing/waterproofing system manufacturer's representative.
     3. Objectives include:
        1. Review foreseeable methods and procedures related to roofing/waterproofing work, including set up and mobilization areas for stored material and work area.
        2. Tour representative areas of roofing/waterproofing substrates, inspect and discuss condition of substrate, penetrations and other preparatory work.
        3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
        4. Review roofing/waterproofing system requirements, Drawings, Specifications and other Contract Documents.
        5. Review and finalize schedule related to roofing/waterproofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
        6. Review required inspection, testing, certifying procedures.
        7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
        8. Record conference including decisions and agreements reached. Furnish a copy of records to each party attending.
  2. DELIVERY, STORAGE, AND HANDLING
     1. Store products in manufacturer's unopened packaging with labels intact until ready for installation.
     2. Store materials off the ground or on pallets, under cover and in a cool, dry location, out of direct sunlight, in accordance with manufacturers recommendations. Store roll goods horizontally on platforms sufficiently elevated to prevent contact with water and other contaminants. Do not use rolls that are wet, dirty or have damaged ends. Materials must be kept dry at all times. Plastic wrapping installed at the factory should not be used as outside storage covers.
     3. Do not store materials in quantities that exceed design loads, damage substrate materials, hinder installation or drainage.
     4. Follow manufacturer's directions for protection of materials prior to and during installation. Do not use materials that have been damaged to the point that they will not perform as specified. Fleece reinforcing materials must be clean, dry and free of all contaminants.
     5. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of the MSDS and local authorities having jurisdiction.
     6. Maintain copies of all current SDS for all components on site. Provide personnel with appropriate safety data information and training as it relates to the specific chemical compounds to be utilized.
  3. SEQUENCING
     1. Apply roofing/waterproofing in a timely manner in conjunction with work of other trades. Coordinate with other trades to avoid traffic over or against completed membrane surfaces.
     2. Coordinate with installation of drains as shown on Drawings, including flashing, and associated roofing/waterproofing work.
     3. Field Quality Control:
        1. On-Site Substrate Testing of substrates shall be successfully completed prior to installation of roofing/waterproofing membrane.
        2. Field Quality Control Tests of completed sections of waterproofing membrane shall be successfully completed before proceeding with protection layers and overburden. Schedule tests promptly to allow timely installation of protection layers.
  4. PROJECT CONDITIONS
     1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
     2. Do not apply roofing/waterproofing membrane during or with the threat of inclement weather.
     3. Application of roofing/waterproofing membrane may proceed while air temperature is between 40 degrees F (5 degrees C) and 90 degrees F (32 degrees C) providing the substrate is a minimum of 5 degrees F above the dew point.
     4. When ambient temperatures are at or expected to fall below 50 degrees F (10 degrees C), or reach 85 degrees F (30 degrees C) or higher, follow Membrane System Manufacturer's recommendations for weather related additives and application procedures.
     5. Ensure that substrate materials are dry and free of contaminants. Do not commence with the application unless substrate conditions are suitable. Contractor shall demonstrate that substrate conditions are suitable for the application of the materials.
     6. Where required by the Architect, implement odor control and elimination measures prior to and during the application of the roofing/waterproofing materials. Control/elimination measures shall be field tested at off-hours and typically consists of 1 or a multiple of the following measures
        1. Sealing of air intakes with activated carbon filters. Install filters in accordance with requirements and recommendations of the filter manufacturer. Seal filters at joints and against building exterior walls to prevent leakage of unfiltered air.
        2. Sealing of doorways, windows, and skylights with duct tape and polyethylene sheeting to prevent leakage of air into the building.
        3. Erection and use of moveable enclosure(s) sized to accommodate work area(s) and stationary enclosure for resin mixing station. Enclosure shall be field constructed or pre-manufactured of fire retardant materials in compliance with local requirements in accordance with requirements of the Owner or his designated Representative. Provide enclosure(s) with mechanical air intake/ exhaust openings and Odor Control Air Cleaners, as required to clean enclosed air volume and to prevent odor migration outside the enclosure. Exhaust opening shall be sealed with activated carbon filter
        4. Protection of Contractor personnel and occupants of the structure and surrounding buildings as necessary to comply with requirements of OSHA, NIOSH and/or governing local authority.

\*\* NOTE TO SPECIFIER \*\* Select the warranty required from the following paragraphs and delete those not required. Various Kemper warranties are available. Warranties range from limited materials warranties to limited materials and labor warranties with coverage for insulation, ballast, vegetated overburden and surfacing.

* 1. WARRANTY

\*\* NOTE TO SPECIFIER \*\* The following warranty is available for a period of 5 or 10 years. Insert the period required.

* + 1. Manufacturer's Material Warranty: Provide \_\_ year manufacturer's material only warranty for supply of membrane only, limited to amounts necessary to effect repairs necessitated solely by material defective in content and composition.

\*\* NOTE TO SPECIFIER \*\* The following warranty is available for a period of 10 or 20 years. Insert the period required.

* + 1. Manufacturer's Select Labor and Material Warranty: Provide \_\_ year manufacturer's select warranty that provides for cost of labor and materials required to address loss of watertightness, limited to amounts necessary to affect repairs necessitated by defective material, with total expenditure limited to the original cost of Kemperol materials.

\*\* NOTE TO SPECIFIER \*\* The following warranty is available for a period of 10, 15 or 20 years. Insert the period required.

* + 1. Manufacturer's Premier Warranty: Provide \_\_ year manufacturer's premier warranty that provides for cost of labor and materials for loss of watertightness, limited to amounts necessary to effect repairs necessitated by either defective material or defects in related installation workmanship, with no dollar limitation ("NDL").

\*\* NOTE TO SPECIFIER \*\* Installer warranties are recommended and are becoming more common. Such warranties generally ensure a more vested interest in the integrity of the installation. Insert 2 or 5 year installer warranty period as required.

* + 1. Roofing/waterproofing applicator's Warranty: Provide \_\_ year "Applicator Maintenance Warranty" covering workmanship for all work of this section including installation of membrane, flashings, metal work, and roofing/waterproofing accessories.

1. PRODUCTS
   1. MANUFACTURERS

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs as applicable.

* + 1. Acceptable Manufacturer: Kemper System America, Inc., which is located at: 1200 North America Drive; West Seneca, NY 14224; Toll Free Tel: 800-541-5455; Fax: 716-558-2978; Email: [request info (inquiry@kempersystem.com)](https://admin.arcat.com/users.pl?action=UserEmail&company=Kemper+System+America,+Inc.&coid=44753&rep=&fax=716-558-2978&message=RE:%20Spec%20Question%20(07146kem):%20%20&mf=); Web: <http://www.kemper-system.com/us/eng>
    2. Acceptable Manufacturer: Kemper System Canada, Inc., which is located at: 6345 Netherhart Road, Unit 4 Mississauga, Ontario L5T 1B8 Tel: 905-624-5463. Fax: 905-624-2840. Email: inquiry@kempersystem.com. Web: www.kemper-system.com/us/eng/.

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements [01 60 00].
  1. PRODUCTS
     1. General: Materials shall be products of a single manufacturer or items standard with manufacturer of membrane roofing/waterproofing system. Provide secondary materials that are produced or are specifically recommended by manufacturer of membrane roofing/waterproofing system to ensure compatibility.
     2. Monolithic Membrane: Kemper System America's monolithic membrane is created in the field by combining the KEMPEROL Reflect 2K FR two-part, cold fluid-applied reactive cure polyurethane resin with Kemperol polyester reinforcing fleece. Kemperol polyester reinforcing fleece is a 360 degree needle punched non-woven 165 g/m2 polyester reinforcing fleece, for a finished dry film membrane thickness of .080 inch nominal per ply. Membrane shall have the following properties:
        1. Physical Properties: All times are approximate and depend upon air flow, humidity and temperature.
           1. Color: Bright White
           2. Physical State: Cures to Solid
           3. Solar Reflectance (initial) CRRC Rated 0.87, ASTM C 1549
           4. Thermal Emittance (initial) CRRC Rated 0.90, ASTM C 1371
           5. SRI (initial) 110, ASTM E 1980
           6. Thickness (165 Fleece): 80 mils
           7. VOC Content: 2.0 g/l
           8. Peak load @ break 70 lbf CMD - 100 lbf MD, ASTM D 4073
           9. Elongation: Min 30 percent, ASTM D 5147
           10. Tearing Strength 60.0 lbs/in, ASTM D 4073
           11. Dimensional stability D 1204: 0.15 percent
           12. Puncture resistance FTMS 101-2031: 140 lbs.
           13. Water absorption D 570: Less than 3 percent
           14. Impact resistance D 2240: Shore A 75 plus or minus 15 percent
           15. Crack spanning: 0.08 inch (2 mm)
           16. Usage time: 30 minutes
           17. Rainproof after: 2 hours
           18. Solid to walk on after: 24 hours
           19. Completely hardened: 3 days
           20. Short-term temperature resistance: 482 degrees F (250 degrees C)
     3. Membrane Flashings: Composite of the same resin material as field membrane with 165 g/m2 fleece reinforcement.
     4. Substrate Primer and Resin Additives:

\*\* NOTE TO SPECIFIER \*\* Select the one of the following two paragraphs as applicable for the system specified.

* + - 1. Polyurethane Primer: Kempertec D/R primer ,two-component, solvent-free polyurethane resin for use in improving adhesion of membrane to wood, metal and bituminous substrate surfaces.
      2. Epoxy Primer: Kempertec EP/EP5 primer, two-component, solvent-free epoxy resin for use in improving adhesion of membrane to cementitious/masonry substrate surfaces.
      3. Cold Weather Additive: Kemperol A 2K-PUR Accelerator, additive specifically designed to accelerate the resin reaction time at ambient temperatures below 50 degrees F (10 degrees C). Accelerator to be used with resin Component A prior to mixing of multi-component resin.

\*\* NOTE TO SPECIFIER \*\* Select the following as applicable for the system specified.

* + 1. Cap Sheet:
       1. APP Cap Sheet: KEMPER APP CAP FR, Mineral-surfaced polyester-reinforced APP-modified bitumen cap sheet conforming to ASTM D 6222, suitable for torch application.
          1. Properties:

Granule colors: White, Black

Physical state: Granulated surface

Nominal thickness: 4.1 mm (160 mils)

Tensile strength (0 degrees F): 150 lbf CMD. 95 lbf MD, ASTM D 6222

Tensile strength (77 degrees F): 100 lbf CMD. 75 lbf MD, ASTM D 6222

Elongation (0 degrees F): 50 percent CMD. 40 percent MD, ASTM D 6222

Elongation (77 degrees F): 85 percent CMD. 60 percent MD, ASTM D 6222

Tear resistance (77 degrees F): 100 lbf CMD. 140 lbf MD, ASTM D 6222

Cold flexibility: minus 30 degrees C, ASTM D 6222

* + - 1. SBS Cap Sheet: Mineral-surfaced fiberglass or polyester-reinforced SBS-modified bitumen cap sheet conforming to ASTM D 6163 (fiberglass) or ASTM D 6164 (polyester), suitable for torch, hot asphalt, or self- adhered application.

\*\* NOTE TO SPECIFIER \*\* Select and edit the following insulation as applicable for the system specified. Note that all insulation requires cover board.

* + 1. Insulation:
       1. Flat Foam Insulation Polyisocyanurate Insulation with Non-asphaltic Fiber Reinforced Facers (Hunter Panel - H-Shield): Meeting or exceeding the requirements for ASTM C 1289, Type II with the following characteristics:
          1. ASTM C 1289, Type II, Class 2:

Grade 2 (20 psi)

Grade 3 (25 psi)

* + - * 1. Board Size:

48 by 48 inches

48 by 96 inches

* + - * 1. Minimum Board Thickness: 1.5 inches.
        2. R Value: Provide Insulation with LTTR (Long Term Thermal Resistance) in accordance with ASTM C 1289
        3. Board Edges: Square
      1. Flat Foam Polyisocyanurate Insulation with Coated Glass Fiber Facers: Hunter Panels -H-Shield CG, 1.0 inch minimum thickness, with the following characteristics:
         1. ASTM C 1289, Type II, Class 2:

Grade 2 (20 psi)

Grade 3 (25 psi)

* + - * 1. Board Size:

48 by 48 inches

48 by 96 inches

* + - * 1. Board Thickness: \_\_\_
        2. R Value: Provide Insulation with LTTR (Long Term Thermal Resistance) in accordance with ASTM C 1289.
        3. Board Edges: Square

\*\* NOTE TO SPECIFIER \*\* Select and edit the following as applicable for the system specified. Note that insulation without coated glass facers requires cover board.

* + - 1. Tapered Polyisocyanurate Insulation with Non-Asphaltic Fiber Reinforced Facers: Hunter Panel-H-Shield, 1.0 inch minimum thickness, with the following characteristics:
         1. ASTM C 1289, Type II, Class 1:

Grade 2 (20 psi)

Grade 3 (25 psi)

* + - * 1. Board Size:

48 by 48 inches

48 by 96 inches

* + - * 1. Total Thickness: As required to achieve an average R value of \_\_\_ for tapered insulation system.
        2. R Value: Provide Insulation with LTTR (Long Term Thermal Resistance) in accordance with ASTM C 1289
        3. Board Edges: Square
        4. Slope of tapered board shall be:

1/16 inch (2 mm) per foot.

1/8 inch (3 mm) per foot.

3/16 inch (5 mm) per foot.

1/4 inch (6 mm) per foot.

3/8 inch (10 mm) per foot.

1/2 inch (12.5 mm) per foot.

Slope as indicated on the Drawings

* + - 1. Tapered Polyisocyanurate Insulation with Coated Glass Fiber Facers: Hunter Panels-Tapered H-Shield, 1.0 inch minimum thickness, with the following characteristics:
         1. ASTM C 1289, Type II, Class 2:

Grade 2 (20 psi)

Grade 3 (25 psi)

* + - * 1. Board Density: 2.0 lb/cu ft
        2. Board Size: 48 by 48 inches
        3. Total Thickness: As required to achieve an average R value of \_\_\_ for tapered insulation system.
        4. R Value: Provide Insulation with LTTR (Long Term Thermal Resistance) in accordance with ASTM C 1289
        5. Board Edges: Square
        6. Slope of tapered board shall be:

1/16 inch (2 mm) per foot.

1/8 inch (3 mm) per foot.

3/16 inch (5 mm) per foot.

1/4 inch (6 mm) per foot.

3/8 inch (10 mm) per foot.

1/2 inch (12.5 mm) per foot.

Slope as indicated on the Drawings.

\*\* NOTE TO SPECIFIER \*\* Select the one of the following as applicable for the system specified. Note that tapered insulation requires cover board.

* + 1. Insulation Cover Board:
       1. Cement Roof Board: USG - SECUROCK Cement Board, high compressive strength, non-combustible, roof underlayment board consisting of aggregated Portland cement slurry with polymer-coated glass-fiber mesh, with the following characteristics:
          1. Board Weight: 2.4 lbs/sq.ft.
          2. Board Size: 48 by 48 inches and 48 by 96 inches
          3. Board Thickness: 1/2 inch
          4. Flexural Strength: > 750 psi, parallel, per ASTM C 947
          5. Compressive Strength: > 1000 psi nominal
          6. Flute Spannability: 12 inches, per ASTM E 661
          7. Permeance: 5.84 perms, per ASTM E 96
          8. Thermal Conductivity: R-value of 0.39 as determined by ASTM C 518
          9. Coefficient of thermal expansion: 4.5 by 106 per ASTM E 831
          10. Linear variation w change in moisture: < 0.07 percent maximum per ASTM D 1037
          11. Water absorption: < 15 percent maximum per ASTM C 473
          12. Mold resistance: 10 per ASTM D 3273
          13. Board Edges: Square
       2. Polyisocyanurate Insulation Cover Board Hunter Panels H-Shield HD: High compressive strength (100 psi) underlayment board with heavy-duty coated glass non-perforated facers with the following characteristics:
          1. Board Weight: 0.34 lb/sq. ft
          2. Board Size: 48 inches by 96 inches
          3. Board Thickness: 1/2 inch
          4. Thermal Conductivity: R-value of 2.5 as determined by ASTM C518
          5. Board Edges: Square
       3. Plywood Cover Board (APA-rated C-C Plugged): Exterior-grade plywood sheathing board, installed plugged side up, with the following characteristics:
          1. Board Weight: 2.1 lb/sq. ft
          2. Board Size: 48 by 96 inches
          3. Board Thickness: 3/4 inch
          4. Thermal Conductivity: R-value of 0.77 as determined by ASTM C 518
          5. Board Edges: Tongue and groove

\*\* NOTE TO SPECIFIER \*\* Select one or more attachment methods as applicable for the system specified. Note that hot asphalt attachment is not acceptable with cover board.

* + 1. Insulation and Cover Board Securement:
       1. Mechanical Fasteners: Trufast FM-approved corrosion resistant insulation fasteners of appropriate length with plates. Securement pattern shall be in accordance with specified wind uplift rating for system application. Roofing fasteners shall be a type approved by membrane and insulation manufacturer.
       2. Foamable Adhesive: Millennium One Step Foamable Adhesive is a highly elastomeric, one-step, all-purpose, foamable adhesive that contains no solvents. It is designed for use as an adhesive for bonding approved roof insulation and cover board to a building's structural roof deck, base sheets, and smooth or properly prepared graveled built-up roof surfaces. Roofing adhesive shall be a type approved by membrane and insulation manufacturer.

\*\* NOTE TO SPECIFIER \*\* Select the accessories required for the project and the system specified and delete those that are not applicable.

* 1. ACCESSORIES
     1. Solvent-Based Cleaner for Tools and Membrane Tie-Ins: Methyl Ethyl Ketone (MEK) or acetone.
     2. Citrus-Based Cleaner for Membrane: Kempertec Klean.
     3. Water-Based Cleaner for Membrane: Simple Green HD.
     4. Aggregate Specification and Size: All surfacing aggregates shall be washed, kiln-dried, dust-free, suitable for broadcast, round grain or angular, and sized as follows:
        1. Kemperol Mixing Sand (00) #35 (0.3 - 0.6 mm) for patching voids less than 1 inch.
        2. Kemperol Surfacing Sand (0) #18 (0.5 - 1.2 mm) for patching voids from 1 to 2 inches or surfacing.
        3. Kemperol Surfacing Sand (1) #14 (0.8 to 1.5 mm) for coarse surfacing.
        4. Kemperol Ceramaquartz (30 mesh) (S Grade blend) for aesthetic color quartz finished surfacing.
        5. Mixing Proportions shall be a ratio of resin to sand at 1:2 by volume for leveling, 1:4 by volume for patching, or as approved by membrane manufacturer.
     5. Backer Rod: Expanded, closed-cell polyethylene foam designed for use with cold-applied joint sealant.
     6. Joint Sealant:
        1. Cover Board/Insulation: Kempertec Joint Sealant, single component, non-sag elastomeric polyurethane sealant for use in sealing joints, cracks, gaps, and transitions in cover boards, insulation and plywood.
        2. Multipurpose Sealant: GreatSeal PE-150, a single component, polyether, multi-purpose sealant for use above the roofing/waterproofing membrane, doors and windows, masonry, siding, concrete, and more. Can be applied on a damp surface and in cold weather. Bonds aggressively to wood, Modified Bitumen, asphalt, EPDM, PVC and PIB, vinyl, fiberglass, glass, painted, galvanized and anodized metals and Kynar finish.
     7. Wood Nailers and Cant Strips: New wood nailers and cant strips shall be pressure treated for rot resistance using Wolmanized or Osmose K-33, #2 or better lumber. Asphaltic or creosote treated lumber is not acceptable.
     8. Expansion Joints in Excess of 2 Inches: Provide flat, vulcanized waterproofing joint integral with the waterproofing membrane to accommodate movements over 2 inches (50 mm) and capable of 500 percent elongation at minus 40 degrees F (minus 40 degrees C) across its length and at all vulcanized points.
        1. Product: Joint material SITURA INC. RedLINE.
        2. Connections: All connections factory fabricated by vulcanization.

1. EXECUTION
   1. EXAMINATION
      1. Do not begin installation until substrates have been properly prepared and conditions are suitable to proceed with the Work of this specification.
         1. Substrates shall be inspected and repaired as needed to provide a proper surface to receive roofing/waterproofing system.
         2. Verify substrate surface slopes to drain for horizontal roofing/waterproofing applications.
         3. Identify incompatible or unsatisfactory substrates, if any.
      2. Verify substrate openings, curbs, and protrusions through deck/substrate, wood cant strips and reglets are in place and solidly set.
      3. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
   2. PREPARATION
      1. General: Surfaces to be prepared as a substrate for the new roofing/waterproofing system as follows:
         1. Determine the condition of the existing structural deck/substrate. All defects in the deck or substrate shall be corrected before new roofing/waterproofing work commences. Areas of deteriorated deck/substrate, porous or other affected materials must be removed and replaced with new to match existing.
         2. Prepare flashing substrates as required for application of new roofing/waterproofing membrane flashings.
         3. Inspect substrates, and correct defects before application of new roofing/waterproofing. Fill all surface voids greater than 1/8 inch wide with an acceptable fill material.
         4. Remove all ponded water, snow, frost and/or ice from the work substrate prior to installing new roofing/waterproofing materials.
         5. Substrate for roofing/waterproofing shall be clean, dry, free of loose, spalled or weak material including coatings, mineral aggregate, and flood coat/gravel surfacing, oil, grease, contaminants, abrupt changes in level, roofing/waterproofing agents, curing compounds, and free of projections which could damage membrane materials.
      2. On-Site Substrate Testing: Perform tests at the beginning of the Work, and at intervals as required to assure specified substrate conditions with a minimum of 3 tests per 5000 SF area to be waterproofed. Smaller areas shall receive a minimum of 3 tests. Submit test results to the Architect promptly as they are completed. Notify the Architect immediately in the event the test results are below specified values. Do not begin application of waterproofing until acceptable conditions are achieved.
         1. Cementitious Substrates:
            1. Evaluate Surface moisture content by means of a Tramex Concrete Moisture Encounter Meter CME4 in accordance with ASTM F 2659. A surface moisture content of under 5 percent is required to allow for proper primer penetration into the substrate.
            2. Frothing, bubbling, or pinholes within the primer indicates excessive moisture content within the substrate, beneath the surface. Blistering of membrane may result from excessive substrate moisture. Primer application during late afternoon/early evening will reduce vapor pressure within the substrate and may alleviate these conditions.
            3. Continued frothing, bubbling, or pinholes indicates excessive moisture content that requires more substantial measures. Evaluate substrate moisture content by:

Relative Humidity (RH) test in accordance with ASTM F 2170: Relative moisture content of 75 percent or greater indicates the need for more extensive substrate priming and sealing.

Anhydrous Calcium Chloride Test in accordance with ASTM F 1869: Maximum result 3 lb / 1,000 ft2 of area per 24-hour period, greater values indicates the need for more extensive substrate priming and sealing

Where results exceed the maximum acceptable reading contact Membrane Manufacturer for recommendations.

* + - 1. Substrate Bond Strength:
         1. Evaluate bond strength by means of Elcometer Adhesion Tester Model 106 or similar device, or by the performance of a manual pull test.
         2. Tensile bond strength of membrane to substrate must be greater than or equal to 150 psi (1.0 N/mm2).
         3. Adequate surface preparation will be indicated by 135 degree peel bond strength of membrane to substrate such that cohesive failure of substrate or membrane occurs before adhesive failure of membrane/ substrate interface.
         4. In the event the bond strengths are less than the minimum specified, additional substrate preparation and testing is required. Repeat testing to verify suitability of substrate preparation.
         5. Where results exceed the maximum acceptable reading contact Membrane Manufacturer for recommendations.

\*\* NOTE TO SPECIFIER \*\* Select required substrate preparation method(s) from the following paragraphs and delete those that are not applicable.

* + 1. Existing Asphaltic Bituminous Roofing/waterproofing:
       1. Remove existing flashings down to the structural substrate/penetration at all flashing areas.
       2. Damaged/saturated areas of existing roofing membrane and underlying assembly shall be removed and replaced, or repaired in kind.
       3. Smooth-surfaced membrane with applied coating shall have all loose coating removed, and an adhesion test performed by Roofing/waterproofing Manufacturer's Technical representative to confirm acceptable adhesion.
       4. Granule-surfaced membrane shall have all loose granules removed from the surface by vacuuming and power brooming.
       5. Gravel-surfaced membrane shall have all loose gravel removed and the roof surface thoroughly cleaned with all ridges and high points removed. A layer of coated glass-faced polyisocyanurate foam insulation with cementitious cover board shall be adhered in foam roof adhesive over the roof surface, or mechanically attached through the existing roof assembly into the structural deck.
    2. Existing Coal Tar Pitch Bituminous Roofing/waterproofing:
       1. Remove existing flashings down to the structural substrate/penetration at all flashing areas.
       2. Damaged/saturated areas of existing roofing membrane and underlying assembly shall be removed and replaced, or repaired in kind.
       3. Gravel-surfaced membrane shall have all loose gravel removed and the roof surface thoroughly cleaned with all ridges and high points removed. A layer of coated glass-faced polyisocyanurate foam insulation (R=20 min. or greater as required to prevent the pitch from reaching 85 degrees F) with cementitious cover board shall be adhered in foam roof adhesive over the roof surface.
    3. Existing Polymeric Single Ply Roofing/waterproofing:
       1. Remove existing flashings down to the structural substrate/penetration at all flashing areas.
       2. Damaged/saturated areas of existing roofing membrane and underlying assembly shall be removed and replaced, or repaired in kind.
       3. A layer of coated glass-faced polyisocyanurate foam insulation with cementitious cover board shall be adhered in foam roof adhesive over the roof surface, or mechanically attached through the existing roof assembly into the structural deck.
    4. Structural Concrete:
       1. New concrete shall be cured a minimum of 28 days in accordance with ACI-308.
       2. Concrete shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, bituminous products and previous roofing/waterproofing materials.
       3. Concrete shall have a maximum surface moisture content of 5 percent determined by periodic surface moisture testing during the work.
       4. Concrete shall be abrasively cleaned in accordance with ASTM D 4259 to provide a sound substrate free from laitance. Achieve an open concrete surface in accordance with ICRI surface profiles CSP 3-5. When using mechanical methods to remove existing roofing/waterproofing products or surface deterioration, the surface profile is not to exceed 1/4 inch (peak to valley).
       5. Substrate shall be sound and all spalls, voids and blow holes on vertical or horizontal surfaces must be repaired prior to placement of the primer coat. Spalls and other deterioration shall be repaired in accordance with the requirements of the Architect and Membrane manufacturer.
       6. Areas of minor surface deterioration of 0.25 inch (6 mm) or greater in depth shall be repaired to prevent possible pooling of the liquid applied materials, leading to excessive usage of primer and resin.
       7. Hollow-core panels, T-panels, and Twin-T panels shall have grouted joints between panels and shall be provided with mechanical securement from panel to panel.
       8. For concrete materials with a compressive strength of less than 3,000 psi contact Roofing/waterproofing Manufacturer's Technical Department for substrate preparation requirements.
    5. Masonry:
       1. Masonry walls hard kiln dried brick or waterproof concrete block construction.
       2. Areas of soft or scaling brick or concrete, faulty mortar joints, or walls with broken, damaged or leaking coping shall be repaired in accordance with the requirements of the Architect and Roofing/waterproofing Manufacturer.
    6. Steel/Metal:
       1. Clean and prepare metal surfaces to near white metal in accordance with SSPC - SP3, Power Tool Cleaning, or as required by Roofing/waterproofing Manufacturer. Extend preparation a minimum of 1 inch beyond the termination of the membrane flashing materials.
       2. In addition to cleaning, all metal surfaces shall be abraded to provide a rough open surface. A wire brush finish is not acceptable.
    7. Wood/Plywood: Plywood shall be identified with American Plywood Association (APA) grade trademarks and meet the requirements of Product Standard PS1.
       1. Fit plywood to all penetrations, projections, and nailers. Plywood shall be secured, with joints not greater than 1/4 inch. Fill all joints and gaps up to 1/2 inch with polyurethane joint sealant
       2. Strip all plywood joints with fleece reinforcement imbedded into the wet primer or resin. Under no circumstances shall the membrane be left unsupported over a space greater than 1/4 inch.
    8. Other Flashing Surfaces:
       1. Remove all contaminants as required by membrane manufacturer. Surface preparation shall be performed by means approved by Architect and Roofing/waterproofing Manufacturer.
    9. Finish Leveling, Patching and Crack Preparation:
       1. General: Epoxy primer/sand mix is preferred for all concrete and masonry substrate finish leveling, crack and wall/deck preparation and patching. epoxy primer/sand patching mix provides a set time of approximately 12 hours and does not require surface grinding when the membrane is applied within the appropriate recoat time. Kemperol primer/sand mix can be applied in conjunction with general surface priming.
       2. Concrete and Masonry Substrate Leveling and Patching: Substrate conditions are to be evaluated by the installer, the Architect, and Membrane manufacturer. Perform leveling and patching operations as follows:
          1. Level uneven surfaces with a leveling mixture of primer and approved kiln-dried silica sand in a 1:2 primer to sand ratio by volume. Spread and plane this compound with a squeegee and trowel to achieve a flat surface.
          2. Fill cavities with a patching mixture of primer and approved kiln-dried sand in a 1:4 primer to sand ratio by volume.
          3. Silica sand must be kept absolutely dry during storage and handling.
          4. Any surface to be leveled or filled must first be primed with an acceptable primer.
       3. Joint and Crack Preparation: Joints, cracks and fractures in the structural deck/substrate shall be prepared prior to installation of the roofing/waterproofing membrane to prevent telegraphing through the roofing/waterproofing membrane.
          1. Non-Moving Cracks, Joints, and Voids: Clean out crack/ joint by brushing and oil-free compressed air. Fill crack/joint with polyurethane joint sealant. Voids require the installation of backer rod or other backing material prior to application of the polyurethane joint sealant. Allow to cure as required by joint sealant manufacturer.
          2. Moving Cracks: Clean out crack by brushing and oil-free compressed air. Fill crack with polyurethane joint sealant. Allow to cure as required by joint sealant manufacturer. Following full curing of primer, apply roofing/waterproofing resin and a 4 inch (10 cm) wide strip of membrane (resin and fleece) in strict accordance with Membrane manufacturer's written instructions.
  1. WOOD NAILER INSTALLATION
     1. Install pressure-treated wood nailers as indicated, and as required by the Membrane manufacturer. Wood nailers are required to match the thickness of insulation and cover board, and are to be secured directly to the structural deck. Wood nailers shall be installed at all roof edges and on either side of expansion joints, as well as beneath any equipment flanges.
     2. Wood nailers shall be firmly fastened to the deck. Mechanically fasten wood nailers as required to resist a force of 200 lbs per lineal foot, but with no less than 5 fasteners per 8 foot or 6 fasteners per 10 foot length of nailer. Refer to current FM Loss Prevention Bulletin 1-49 for additional attachment recommendations.

\*\* NOTE TO SPECIFIER \*\* Select the following paragraph if required for the system specified. Delete if not applicable.

* 1. CAP SHEET TEMPORARY ROOF/VAPOR RETARDER INSTALLATION
     1. Install mineral-surfaced cap sheet in accordance with cap sheet manufacturer's current published specifications and recommendations for use with adhered roofing/waterproofing.

\*\* NOTE TO SPECIFIER \*\* Select required material from the following paragraphs and delete those that are not applicable.

* + - 1. Mineral Surfaced Cap Sheet Torch-Applied Attachment: Follow cap sheet manufacturer's recommendations for the appropriate application procedure. Roll each cap sheet into molten bitumen. Limit bitumen bleed-out at laps to 1/4 inch or less.
      2. Mineral Surfaced Cap Sheet Solid-Adhered Attachment: Follow cap sheet manufacturer's recommendations for the appropriate asphalt application rate and application procedure. Roll each cap sheet into a full mopping of hot steep asphalt (Type III) at the recommended EVT range. Broom in the cap sheet to spread the roofing asphalt for maximum contact. Limit bitumen bleed-out at laps to 1/4 inch or less.
      3. Mineral Surfaced Cap Sheet Self-Adhered Attachment: Follow cap sheet manufacturer's recommendations for the appropriate application procedure.
    1. Neatly fit cap sheet to all penetrations, projections, curbs, and walls. Extend over all nailers. Cap sheet shall be overlapped a minimum of 3 inches for side laps and 6 inches for end laps. Seal at penetrations, projections, curbs and walls with polyurethane joint sealant. Do not use asphaltic flashing cement.

\*\* NOTE TO SPECIFIER \*\* Select the following paragraph if required for the system specified. Delete if not applicable.

* 1. INSULATION AND COVER BOARD INSTALLATION
     1. General: Install insulation and cover board accordance with the manufacturer's current published specifications and recommendations for use with adhered roofing.
        1. Install only as much insulation and cover board as can be primed, sealed, and protected before the end of the day's work or before the onset of inclement weather.
        2. Fit insulation and cover board at all penetrations, projections, and nailers. Insulation shall be loosely butted, with joints not greater than 1/4 inch. All joints greater than 1/2 inch shall be filled with acceptable insulation. Cover board shall be loosely butted, with joints not greater than 1/4 inch. All joints from up to 1/2 inch shall be filled with polyurethane joint sealant. Strip all insulation and cover board joints with polyester fleece reinforcement imbedded into the wet primer or resin. Under no circumstances shall the membrane be left unsupported over a space greater than 1/4 inch.
        3. Strip all insulation and cover board joints with 4 inch wide strip of flashing membrane. Under no circumstances shall the membrane be left unsupported over a space greater than 1/4 inch.
        4. Stagger multiple layers of insulation and cover board a minimum of 6 inches in each direction.
        5. Steel Deck Substrates: Place boards perpendicular to steel deck flutes with edges over flute surface for bearing support. Edges shall be checked so that no edges are left substantially unsupported along the flutes.
        6. Drain Sumps: Insulation shall be feathered or tapered to provide a sump area a minimum of 36 inches by 36 inches where possible at all drains. Taper insulation around roof drains so as to provide proper slope for drainage. In areas where feathered or tapered insulation leaves insulation core exposed, cover with an appropriate cover board or base sheet/cap sheet assembly to provide a sound and smooth substrate surface.
        7. Tapered Insulation: Place tapered thickness insulation to the required slope pattern in accordance with insulation manufacturer's instructions.
     2. Mechanical Attachment: Mechanically attach insulation and cover board using fastener manufacturers' recommendations for the appropriate fastener and plate type, size and length. Reference FM approvals for fastening patterns to satisfy FM wind uplift requirements. Additional fasteners are required in the corner and perimeter regions of the roof. Secure insulation/cover board in accordance with approval requirements.
     3. Foamable Adhesive Attachment: Follow insulation, cover board and adhesive manufacturers' recommendations for the appropriate adhesive application rate and application procedure. Place the boards onto the roofing adhesive beads. Walk on the boards to spread the roofing adhesive for maximum contact. Periodically walk on the boards until firmly attached. Reference FM approvals for adhesive application patterns that satisfy FM wind uplift requirements. Additional adhesive is required in the corner and perimeter regions of the roof. Secure insulation/cover board in accordance with approval requirements.
  2. PRIMER APPLICATION
     1. General:
        1. Mix and apply two-component primer in strict accordance with written instructions of Membrane Manufacturer.
        2. Substrate surface must be dry, with any remaining dust or loose particles removed using clean, dry, oil-free compressed air, industrial vacuum, cloth wipe or a combination of methods.
        3. Do not apply primer on any substrate containing asphalt, coal-tar pitch, creosote or penta-based materials unless approved in writing by Membrane Manufacturer. Some substrates may require additional preparation before applying primer.
     2. Mixing of Kempertec EP and Kempertec D Primers:
        1. Premix primer Component A thoroughly with a spiral agitator. Pour entire unit of primer Component B into entire unit of primer Component A and mix the components for approximately 2 minutes with a clean spiral agitator on slow speed without creating any bubbles or streaks. DO NOT AERATE. Primer solution should be a uniform color, with no light or dark streaks present.
        2. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.
     3. Mixing of Kempertec EP5 Primer: Also to be used when ambient temperature is 50 degrees F (10 degrees C) and below.
        1. Premix primer Component A thoroughly with a spiral agitator or stir stick. Pour entire unit of primer Component B into entire unit of primer Component A and mix the components for approximately 2 minutes with a clean spiral agitator on slow speed without creating any bubbles or streaks. DO NOT AERATE. Primer solution should be a uniform color, with no light or dark streaks present.
        2. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.
        3. Mix only full units of primer. Primer pot life is approximately 20 minutes.
     4. Mixing of Kempertec R Primer:
        1. Premix primer Component A within clear pouch to obtain consistent appearance. Remove separation cord. Knead primer Component B into Component A and mix the components for approximately 1 minute. The Primer solution should be a uniform color, with no light or dark streaks present.
        2. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.
        3. Mix only full units of primer. Primer pot life is approximately 5-10 minutes.
     5. Application:
        1. After mixing, apply the primer with a roller or brush evenly onto the surface in a cross directional method, or utilizing the pour and spread method to fully cover the substrate.
        2. Porous and higher moisture content concrete substrates may require an adjustment to the primer application rate or multiple coats to achieve proper pore saturation.
        3. For EP and EP5 Primer applications, broadcast Kemperol Surfacing sand (0, #18) at the rate of 50 lbs. / 100 ft2 into the wet primer to increase surface area and enhance adhesion. Remove excess sand after primer has fully cured prior to membrane application.
        4. Curing time is approximately 12-16 hours for D and EP primers and approximately 3-4 hours for R and EP5 primers. Kemperol membrane may be applied when the primer is completely dry and without tack. Do not apply Kemperol membrane to tacky or wet primer.
        5. Exposure of primer in excess of 8 days or premature exposure to moisture may require abrasion of contaminated surface and application of new primer coat.
  3. MEMBRANE APPLICATION
     1. General:
        1. Apply the roofing/waterproofing membrane immediately following full curing of the primer in order to obtain the best bond between primer and membrane.
        2. Mix and apply cold fluid-applied reinforced polyurethane roofing/waterproofing membrane in strict accordance with written instructions of Membrane Manufacturer.
        3. Primed substrate surface shall be dry, with any remaining dust or loose particles removed using clean, dry, oil-free compressed air, industrial vacuum, cloth-wipe or a combination.
        4. Protect all areas where membrane has been installed. Do not work off installed membrane during application of remaining work before 48 hours of curing. Movement of materials and equipment across installed membrane is not acceptable. If movement is necessary, provide complete protection of affected areas.
        5. Follow the Membrane Manufacturer's recommendation for hot and cold weather application. Monitor surface and ambient temperatures, including the effects of wind chill.
     2. Mixing of Kemperol REFLECT 2K FR Resin:
        1. Premix resin Component A with a spiral agitator until the liquid is a uniform color. If the ambient temperature is below 50 degrees F (10 degrees C), then a weather related additive should be combined and mixed into the Component A.
        2. Accelerator should be added to resin Component A when ambient temperature is 50 degrees F (10 degrees C) and below. Accelerator should be mixed with the spiral agitator for 2 minutes or until both liquids are thoroughly blended.
        3. Pour entire resin Component B into entire resin Component A and thoroughly mix the components with a clean spiral agitator. The Resin solution should be a uniform color, with no light or dark streaks present. Mix only full units, do not break down units.
        4. Resin pot life is approximately 30 minutes.
     3. Application of Resin/Fleece:
        1. After the Resin is mixed, using a Kemperol roller nap or brush, apply 2/3 of the resin liberally and evenly onto the surface. Covering one working area at a time, between 10 - 15 sq.ft.
        2. Roll the Kemperol Fleece directly into the resin, making sure the SMOOTH SIDE IS FACING UP (natural unrolling procedure), avoiding folds and wrinkles. The fleece will begin to rapidly saturate with the liquid resin mix. Use the roller or brush to work the resin into the fleece, saturating from the bottom up, and eliminating air bubbles, wrinkles, etc. It is important to correct these faults before the resin cures.
        3. Apply the remaining 1/3 of the resin to the top of fleece to complete the saturation. Rolling the final coat of resin onto the fleece should result in a glossy appearance. The fleece can only hold so much resin and all excess should be rolled forward to the unsaturated portion of the fleece. The correct amount of resin will completely saturate the fleece. Work wet membrane to avoid any blisters, openings, or lifting at corners, junctions, and transitions. Always assure full resin saturation of fleece.
        4. Prevent contact between mixed/unmixed resin and new/existing membrane. If any unmixed resin contacts membrane surface remove immediately and clean thoroughly with a cloth rag.
        5. At all fleece seams, allow a 2 inch (5 cm) overlap for all side joints and a 4 inch (10 cm) overlap for all end joints.
        6. At membrane tie-offs, clean in-place membrane with MEK when resin has cured. Allow solvents to fully evaporate before application of new resin. DO NOT APPLY PRIMER TO EXISTING KEMPEROL MEMBRANE.
  4. FLASHING APPLICATION
     1. General:
        1. Install flashing system in accordance with the requirements/recommendations of the Membrane manufacturer and as indicated on the manufacturer's standard drawings. Provide system with base flashing, edge flashing, penetration flashing, counter flashing, and all other flashings required for a complete watertight system.
        2. Wherever possible, install the flashings before installing the field membrane to minimize foot traffic over newly installed field membrane.
        3. All membrane flashings shall be installed concurrently with the roofing/waterproofing membrane as the job progresses. Temporary flashings are not allowed without prior written approval from the Membrane manufacturer. Should any water penetrate the new roofing/waterproofing membrane because of incomplete flashings, the affected area shall be removed and replaced at the Contractor's expense.
        4. Provide a minimum vertical height of 8 inches for all flashing terminations. Flashing height shall be at least as high as the potential water level that could be reached as a result of a deluging rain and/or poor slope. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.
        5. All flashings shall be terminated as required by the Membrane Manufacturer.
        6. Alkalinity surface protection consisting of one application of EP primer and one application of approved broadcast mineral aggregate surfacing shall be applied wherever stone, concrete, or masonry elements will be placed directly over the flashing.
     2. Metal Flashing - General:
        1. Metal flashings shall be fabricated in accordance with the current recommendations of SMACNA and in accordance with the Manufacturer's standard drawings.
        2. Metal flashing flanges to which membrane is to be bonded shall be a minimum of 4 inches in width, and secured to the substrate or wood nailers 6 inches on center staggered with fasteners appropriate to the substrate type. Flanges shall be provided with a roughened surface that has been cleaned of all oil and other residue.
        3. Metal edges that will be overlaid with membrane shall be provided with a 1/4 inch minimum hemmed edge.
        4. Apply primer, resin and fleece to metal flange, extending membrane to outside face of metal edging, and to vertical face of metal base/curb flashing.
     3. Membrane Flashing - General:
        1. Membrane flashings shall be fabricated with primer appropriate for the substrate surface, resin of the same base chemical type as the field membrane, and fleece of the same weight as the field membrane unless specified otherwise.
        2. Primer, resin, and fleece mixing and application methods as specified for field membranes are also suitable for membrane flashing.
        3. Fleece shall overlap 2 inches (5 cm) minimum for all joints. Fleece shall be cut neatly to fit all flashing conditions without a buildup of multiple fleece layers. Work wet membrane with a brush or roller to eliminate blisters, openings, or lifting at corners, junctions, and transitions.
     4. Pipes, Conduits, and Unusually Shaped Penetrations:
        1. Flashing is typically constructed as a two part assembly consisting of a vertical wrap and a horizontal target patch. Provide a minimum of a 2 inch (5 cm) overlap between vertical and horizontal flashing components.
     5. Drains and Scuppers:
        1. Acceptable drain and scupper materials are galvanized, galvalum, cast iron, cast aluminum, copper, hard PVC, and ABS.
        2. Flashing material shall extend 4 inches minimum onto drain or scupper flange and into drain/ scupper body.
        3. Install clamping ring if provided as part of the drain or scupper design. Install a strainer basket to prevent debris from clogging the drainage line.
     6. Hot Stacks:
        1. Protect the membrane components from direct contact with steam or heat sources when the in-service temperature exceeds 170 degrees F. In all such cases flash to an intermediate "cool" sleeve.
        2. Fabricate "cool" sleeve in the form of a flanged metal cone using galvanized metal, mechanically attached to the structure or wood nailers.
        3. Flashing is typically constructed as a two part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a 2 inch (5 cm) overlap between vertical and horizontal flashing components.
     7. Flexible Penetrations:
        1. Provide a weathertight gooseneck of round cross-section for each penetration or group of penetrations. Set in water cut-off mastic and secure to the structural substrate.
        2. Flashing is typically constructed as a two part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a 2 inch (5 cm) overlap between vertical and horizontal flashing components.
     8. Walls, Curbs and Base Flashings:
        1. Wall, curb and base flashings shall be installed to solid substrate surfaces only. Adhering to gypsum-based panels, cementitious stucco, synthetic stucco, wood or metal siding, and other similar materials is not acceptable.
        2. Reinforce all transition locations and other potential wear areas with a 4 inch wide membrane strip evenly positioned over the transition prior to installing the exposed flashing layer.
        3. Reinforce all inside and outside corners with a 4 inch diameter conical piece of membrane prior to installing the exposed flashing layer.
        4. All pins, dowels and other fixation elements shall be flashed separately with a vertical flashing component prior to installing the exposed flashing layer.
        5. Extend flashing a minimum of 4 inches onto the field substrate surface.
     9. Drip Edges and Gravel Stops:
        1. Metal drip edges and gravel stops shall be installed to solid substrate surfaces or wood nailers only. Securement to gypsum-based panels, cementitious stucco, synthetic stucco, wood or metal siding or coping, and other similar materials is not acceptable.
        2. Flash all drip edges and gravel stops by extending the field membrane all the way to the edge of the exposed face prior to installing the metal edging. Strip in the metal flange with a separate 8 inch wide strip of membrane adhered to both the securement flange and to the field membrane.
        3. For conditions where water infiltration behind the exposed drip edge or gravel stop face is possible, install a separate membrane layer positioned behind the face area and extending a minimum of 4 inches past the securement flange onto the field substrate prior to installing the drip edge or gravel stop.
     10. Field Fabricated Control or Expansion Joint Flashing:
         1. Control or expansion joints in excess of 2 inches in width and all expansion joints subject to vehicular traffic require the use of a separate engineered joint system.
         2. Grind or otherwise bevel the inside edges of the joint opening to provide a smooth transition edge for the fleece.
         3. Flashing typically consists of a fully saturated membrane bottom layer looped into the joint as a cradle, a compressible foam or rubber insert at 25 percent compression fitted into the joint, and a membrane top layer applied over the joint. Extend both fleece layers 4 inches minimum onto the field substrate on both sides of the joint.
         4. Apply the field membrane over the entire joint area.
     11. Electrical Conduit, Gas Lines and Lightning Protection
         1. Supports for electrical conduit and gas lines greater than 1 inch in diameter require the use of a separate engineered support system.
         2. Supports for electrical conduit and gas lines 1 inch or less in diameter, and bases for lightning protection rods and cable, can be adhered directly to the membrane surface with a single-component, polyurethane construction adhesive.
     12. Alkalinity Protection:
         1. Where placement of concrete, mortar or adhesive setting beds are required over sections of the waterproofing membrane or flashing, apply manufacturer's epoxy primer/coating at the manufacturer's recommended coverage rate, with broadcast to excess of kiln-dried silica sand into wet primer/coating.
         2. Protection shall extend a minimum of 1 foot (0.3m) past the concrete form on all sides.
         3. Provide continuous cleaning with water and brush to eliminate settlement of concrete residues on in-place waterproofing membrane adjacent to area of concrete placement.
  5. TEMPORARY CLOSURES AND WATERSTOPS
     1. Ensure that moisture does not damage any completed section of the new roofing/waterproofing system. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition. All temporary closures shall be made as recommended or required by the membrane manufacturer.

\*\* NOTE TO SPECIFIER \*\* Select the following two surfacing paragraphs to match the application required. Delete if not applicable.

* 1. MEMBRANE PREPARATION FOR SURFACINGS AND COATINGS
     1. Membrane must be clean and dry, and free of all contaminants that may interfere with the adhesion of the surfacing and coating to the membrane surface.
     2. Membrane exposed less than 48 hours prior to application of surfacing and coating materials does not require special surface preparation. It is highly recommended that all surfacing and coating materials be applied to the membrane surface within 48 hours.
     3. Membrane exposed longer than 48 hours will require sanding/scuffing of the surface to remove the hard gloss finish, followed by an MEK or acetone solvent wipe.
  2. SURFACING AND FINISHES

\*\* NOTE TO SPECIFIER \*\* Select one or both of the following surfacing paragraphs to match the application required. Delete if not applicable.

* + 1. Aggregate Finish Surfacing
       1. Where specified, provide and install approved kiln-dried silica sand, or other approved mineral surfacing to achieve an aesthetic and/or non-skid surface.
       2. Pre-mix single-component and two-component coatings prior to application to achieve an even consistency.
       3. Broadcast specified and approved sand or aggregate in excess into a bonding coat application of Membrane Manufacturer's approved aggregate coating system applied over clean, cured membrane at the manufacturer's recommended application rate. Aggregate shall be applied to excess to obtain uniform and full coverage.
       4. Following minimum 2 hour cure time remove loose/un-embedded mineral aggregate by blowing with oil-free compressed air or with a vacuum. Re-broadcast clean mineral aggregate as required to provide full embedment and coverage of membrane.
       5. Seal aggregate surface with a sealing coat application of Membrane Manufacturer's approved coating, applied at the manufacturer's recommended application rate. After completion of surfacing, avoid any traffic to allow for surfacing to cure.

\*\* NOTE TO SPECIFIER \*\* Select the following optional field testing paragraphs if required. Delete if not required.

* 1. FIELD QUALITY CONTROL

\*\* NOTE TO SPECIFIER \*\* Select the one of the following two field testing paragraphs as required. Delete the one not applicable. Flood Test can be used as an alternate to an EFVM test

* + 1. Electronic Field Vector Mapping (EFVM) test shall be completed prior to the installation of the overburden, but after the membrane receives a final inspection. Test shall be scheduled through the membrane manufacturer a minimum two weeks prior to the test and completed by an approved testing company. All located deficiencies shall be repaired and followed by a re-inspection by the membrane manufacturer.
    2. Flood Test of the completed membrane and flashing system shall be conducted prior to the installation of any overburden/surfacing. Flood test shall be of a 24 hour minimum duration, and shall apply a 2 inch water head of over the entire application area. Any incidents of water entry shall be evaluated and all necessary repairs conducted, followed by an additional flood test.
    3. Prepare a written report of results of successful and unsuccessful inspection testing and submit to Architect within 7 days following each test. Report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of roofing/waterproofing in event of an unsuccessful test.
    4. Complete all post installation procedures in accordance with the manufacturer's guidelines for warranty issuance of the specified warrantee.
    5. Notification of Completion: Notify the membrane manufacturer of job completion and schedule a final inspection date.
    6. Final Inspection: At the completion of the Work meet with the membrane manufacturer's technical field representative to evaluate the completed installation of the field and flashing membrane. Complete all previously noted punch list items prior to the scheduled meeting.
    7. Correction of Work: Work that does not conform to specified requirements including tolerances, slopes, and finishes shall be corrected and/or replaced. Any deficiencies of membrane application, termination and/or protection as noted during the Membrane Manufacturer's inspections shall be corrected and/or replaced.
  1. CLEANING
     1. Clean-Up: Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be restored to preconstruction condition.
     2. Roofing/waterproofing materials, components and accessories shall be removed from Site and taken to a legal dumping area authorized to receive such materials.
     3. Disposal of Primer and Resin: Cured resin may be disposed of in standard landfills. Uncured resin is considered a hazardous material and must be handled as such, in accordance with local, state and federal regulation
  2. PROTECTION
     1. Protect building components with tarps or other suitable materials, from soil, stains, or spills at all hoisting points and areas of application.
     2. Any such damage shall be repaired at Contractor's expense to Owner's satisfaction or be restored to original condition.
     3. Provide barricades, retaining ropes, safety elements and any appropriate signage required.
     4. Protect finished roofing/waterproofing membrane from damage by other trades by the use of a cushioning layer such as 1 inch thick expanded polystyrene insulation and an impact layer such as 1/2 inch thick exterior-grade plywood.
     5. Do not allow waste products containing petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil, animal fat, etc. or direct steam venting to come into direct contact with the membrane unless approved by manufacturer's chemical resistance chart.
     6. Eliminate construction traffic on newly tested membrane systems. Do not store construction materials on unprotected membrane surfaces.
     7. Membrane areas that are observed to be trafficked or used as a storage/working platform shall be retested and immediately repaired and covered with insulation and drainage composite.

END OF SECTION