

SECTION 075416 – KETONE ETHYLENE ESTER (KEE) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. All products in bold italics, listed in Part 2 – Products, and on “Attachment A”, will be furnished by Capistrano Unified School District using its authority under the CMAS Contract. All remaining products listed within the Part 2 section, and any additional needed quantities of the products listed on “Attachment A”, shall be furnished by the Roofing Contractor.
- B. CMAS Contract #: 4-21-03-1001 Supplement 3.
- C. Section Includes:
 - 1. Mechanically-fastened thermoplastic KEE roofing system on wood deck, including:
 - 2. Crickets and substrate board.
 - 3. Walkway material.
- D. Related Sections:
 - 1. Division 07 Section "Preparation for Re-Roofing".

1.2 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review drawings and specifications.
 - 3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 5. Examine substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 6. Review structural loading limitations of roof deck during and after roofing.

7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
 1. Product Test Reports for Solar Reflectance: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 2. Product Data and Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-VOC/low-emitting materials.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 1. Base flashings and membrane terminations.
 - a. Indicate details meet requirements of NRCA required by this Section.
- D. Samples for Verification: For the following products:
 1. Sheet roofing, of color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Product Certificate: Submit certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.
- B. Qualification Data: For Installer, Manufacturer and Roofing Inspector.
 1. Include letter from Manufacturer written for this Project indicating approval of Installer.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 1. Submit evidence of compliance with performance requirements.
 - a. Include: UL listing certificate and Energy Performance.
 2. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing membrane, flashing sheets, adhesives, and sealants.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

- E. Warranties: Unexecuted sample copies of special warranties.
- F. Inspection Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.
 - 1. Submit reports within 24 hours after inspection.

1.6 CLOSEOUT SUBMITTALS

- A. Executed copies of warranties.
- B. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor, and employees, and qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.
- B. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
 - 1. An authorized full-time technical employee of the manufacturer.
 - 2. An independent party certified as a Registered Roof Observer by the International Institute of Building Enclosure Consultants (formerly the Roof Consultants Institute) retained by the Contractor or the Manufacturer and approved by the Manufacturer.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site access to manufacturer's written recommendations and instructions for installation of products.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT / FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.

1.10 WARRANTY

- A. Manufacturer's Warranty: Roof System Manufacturer's standard form in which Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within warranty period, as follows.
 - 1. Form of Warranty: Manufacturer's standard warranty form.
 - 2. Scope of Warranty: Work of this Section and including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.
 - 3. Warranty Period: 30 years from date of completion.
- B. Manufacturer Inspection Services: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's inspections is included in the Contract Sum.
 - 1. Inspections to occur in following years: 2, 5, 10, 15, 20, and 25 following completion.
- C. Installer Warranty: Installer's warranty signed by Installer, as follows.
 - 1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.
 - 2. Scope of Warranty: Work of this Section.
 - 3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Tremco, Incorporated.
- B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Flashings and Fastening: Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
 - 1. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.
 - 2. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.
- C. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- D. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.3 MATERIALS, GENERAL

- A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

2.4 THERMOPLASTIC MEMBRANE MATERIALS

- A. KEE Roof Membrane:
 - 1. Thermoplastic Ketone Ethylene Ester (KEE) coated polyester fabric-reinforced sheet, ASTM D6754.
 - a. **Tremply KEE 60 mil.**
 - b. Breaking Strength, minimum, ASTM D751: Machine direction, 500 lbf (87 kN/m); Cross machine direction, 400 lbf (70 kN/m).
 - c. Tear Strength, minimum, ASTM D751: Machine direction, 125 lbf (21 kN/m); Cross machine direction, 145 lbf (25 kN/m).
 - d. Elongation at Break, ASTM D751: 20 percent.
 - e. Dynamic Impact/Puncture Resistance, ASTM D5635: Pass.

- f. Minimum Membrane Thickness, nominal, less backing, ASTM D751: 60 mils (1.5 mm).
 - g. Thickness over fiber, optical method: 0.014 inches.
 - h. Accelerated Weathering, ASTM G155 and ASTM G154: Not greater than 5,000 hr., no cracking or crazing.
 - i. Abrasion Resistance, ASTM D3389: Not greater than 2,000 cycles, H-18 wheel, 1,000 g load.
 - j. Color: Tan.
 - k. Solar Reflectance Index (SRI), ASTM E1980: 88 (Tan, initial), 76 (Tan, 3-yr aged).
- B. Sheet Flashing: Manufacturer's standard, smooth-backed, sheet flashing of same material, type, reinforcement, thickness and color as KEE roof membrane.

2.5 AUXILIARY MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
- 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Flashing Membrane Adhesive:
- 1. Bonding adhesive, solvent based fast drying, VOC-compliant, for bonding KEE smooth-backed single ply membranes and flashings to substrates.
 - a. VOC, maximum, ASTM D 3960: 200 g/L.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 mm by 3 mm) thick; with anchors.
- D. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.
- E. Metal Stress Plates: Manufacturer's standard AZ50 Galvalume-coated steel formed plates, 0.047 inch thick, with radial corners and membrane-engaging barbs engineered to enhance wind resistance for mechanically-attached KEE membrane roofing systems. FMG approved.
- F. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.
- 1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.
- G. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- H. Counterflashing: 22-gauge skirt metal.
- I. Wood:

1. Fascia: Construction or No. 2 grade lumber of any species.
 - a. Select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 2. Decking: Match existing type, thickness, and attachment.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
1. Tremply Coated Metal.
 2. Tremply KEE Strip-In.
 3. Tremply KEE Non-Reinforced.

2.6 ROOF INSULATION MATERIALS

- A. Roof Insulation, General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes on the high side of all curbs.
- B. Cricket Material:
1. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.
 - a. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).
 - b. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

2.7 SUBSTRATE BOARDS

- A. Gypsum panel, glass-mat-faced, ASTM C1177/C1177M.
1. Thickness: 1/2 inch.
- B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.8 WALKWAY MATERIALS

- A. Walkway / Protection Mat Material:
1. Walkway roll, reinforced KEE membrane roll with serrated slip-resistant surface, fabricated for heat welding to compatible KEE membrane surface.
 - a. Roll Size: 30 inches by 50 ft (760 mm by 15.2 m).
 - b. Thickness: 0.047 inch (0.6 mm).

- c. Breaking strength: 56 lbs (9.8 kN/m).
 - d. Color: Light yellow.
- B. Rubber blocks: 100% rubber blocks with steel channels and reflective strips designed for supporting conduit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
- 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Wood Roof Deck: Verify that deck is sound and dry and securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Raise height of curbs lower than 6" off the finished roof surface to a minimum of 10" off the finished roof.
- D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSTALLATION, GENERAL

- A. Install roofing system in accordance with manufacturer's written instructions and approved details.
- B. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details and perimeter fastening requirements.

3.4 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
- 1. Fasten substrate board to deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.5 MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION

- A. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
- B. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- E. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- F. In-Seam Attachment: Secure one edge of membrane sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten membrane sheet to roof deck.
- G. Metal Stress Plate Installation:
 - 1. Locate plates in grid pattern in accordance with membrane manufacturer's instructions.
 - 2. Install plates in straight rows in the specified number and spacing to achieve the required wind uplift resistance in the main field, edges and corners of the roof.
 - 3. Install plates and separation pads using fasteners that comply with the specified applicable building code wind uplift rating and the fastener and membrane manufacturer's requirements. Ensure that all fasteners are properly driven normal to the surface of the sub-structure. Do not over-drive fasteners; plates that are recessed into and/or not flush with the surface of the insulation are not acceptable.
- H. Welded Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
 - 1. Seal vertical edge of flashing sheet with a termination bar and TF Tape.
 - 2. Install skirt metal counterflashing at curbs where equipment cannot be lifted.

- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Install clad metal pelican hood flashing for multiple lines coming through the same opening in the deck and for insulated lines. Include insulation in void and insect screens.
- E. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- F. Seal top termination of base flashing with a metal termination bar and a continuous bead of joint sealant.
- G. Skylights:
 - 1. Remove existing skylights and skylight frames.
 - 2. Install 2 x 6 blocking around perimeter of opening and 2 x 6 rafters at 16" oc.
 - 3. Install plywood decking matching the existing the over opening.
- H. Fascia:
 - 1. Remove gutters and fascia metal.
 - 2. Replace deteriorated fascia board.
 - 3. Re-install fascia metal and gutters.
 - 4. Clean gutters and downspouts of all debris. Seal gutter seams and outlets with acrylic sealer and polyester reinforcement.

3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway pads at locations to be determined at preconstruction meeting. Heat weld to substrate according to roofing system manufacturer's written instructions.
- B. Install rubber blocks to support all conduit. Include a block every 8' and additional blocks at changes in direction and where needed for proper support. Use block manufacturer's risers for high conduit.
 - 1. Set rubber blocks on oversized single ply walkpad sections.
 - 2. Loosely secure clamps to allow for conduit movement.

3.8 FIELD QUALITY CONTROL

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for full time inspection to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with applicable criteria established in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roofing Systems."
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

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

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075416