

SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Welded seam single ply PVC roofing over rigid roof insulation.
- B. Related Sections:
 - 1. Division 1 – Finish and Materials Legend, Designation
 - 2. Division 16-TBD – LEED Product Requirements and Volatile Organic Compound (VOC) Restrictions (If applicable)
 - 3. Division 18-TBD – Sustainable Design Requirements (if applicable)
 - 4. Division 7 – Thermal and Moisture Protection
 - 5. Section 07-84-00 – Firestopping
 - 6. Division 9 – Finishes
- C. Cal Poly Project Manager to identify if this Project is pursuing certification under US Green Building Council “LEED” v4.
- D. Comply with CAL-Green VOC requirements for single ply roof adhesives.
- E. Comply with CAL-Green Appendix A5

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Conform to NRCA - Roofing and Waterproofing Manual, except where more stringent requirements are indicated.
- B. Performance Requirements:
 - 1. Provide a system of components which will meet FM wind uplift rating of FM1A-90 in accordance with Loss Prevention Data Sheets and Building Materials Approval Guide.
 - 2. Provide roofing system to comply with ANSI/SPRI Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems and ANSI/SPRI Standard Field Test Procedure for Determining The Withdrawal Resistance of Roofing Fasteners.
- C. Fire Resistance Requirements:
 - 1. Class A.
 - 2. Test method: ASTM E108 and UL 790.
- D. Fully Adhered Membrane on Concrete Deck.
 - 1. Furnish and install completed welded seam single ply sheet roofing assembly consisting of following layers indicated from top down:
 - a. Fully adhered welded seam membrane.
 - b. Fully adhered Densdeck roof board, 1/4 inch thick or as specified.
 - c. Two layers of Polyisocyanurate roof insulation or as specified.
 - d. Adhere insulation and roof board in low-rise foam.
 - e. Vapor retarder
 - 1. Basis of Design: Sarnavap SA self-adhered vapor retarder.
 - 2. Or approved equal as required by membrane manufacturer
 - 2. Structural concrete deck.
- E. No asphalt roofing permitted on new construction or renovations/replacements.

1.3 SUMMARY OF WORK

- A. The work includes but is not limited to the installation of:
 - 1. Removal of Existing Roofing and Insulation
 - 2. Substrate Preparation

3. Roof Drains
4. Vapor Barrier
5. Wood Blocking
6. Fire Rated Wood Blocking (Where required)
7. Insulation
8. Separation Layers
9. Roof Membrane
10. Fasteners
11. Adhesive for Flashings
12. Roof Membrane Flashings
13. Walkway Protection
14. Metal Flashings
15. Sealants

1.4 SUBMITTALS

- A. Product Data: Submit product data for each product.
- B. Listed documentation from State Fire Marshal approved listing agency (i.e. UL, Intertek, FM) that clearly identifies the listed system that is being submitted.
- C. Shop Drawings:
 1. Submit details for this specific project indicating construction at all penetrations, terminations, and flashings.
 2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 3. Indicate vapor barrier placement and method of installation.
 4. Outline of roof with roof size and elevations shown.
 5. Walkway protection and perimeter warning tape dimensional layout identified (if applicable)
 6. Technical acceptance by roofing manufacturer.
- D. Samples for Verification: Of following products:
 1. 12-by-12-inch square of welded seam single ply roofing membrane, of color selected, including T-shaped side and end lap seam.
 2. 12-by-12-inch square of roof insulation.
 3. 12-by-12-inch square of roof sheathing board.
 4. 12-inch length of metal termination bars.
 5. 6 fasteners of each type, length, and finish.
- E. LEED Data: Refer to Sustainable Design Requirements for submittal requirements to achieve overall LEED v4.0 goals if applicable.

1.5 QUALITY ASSURANCE

- A. General:
 1. Obtain primary roofing materials from single manufacturer. Manufacturer's name shall appear on containers.
 2. Provide secondary materials as required by manufacturer of primary materials.
 3. Manufacturer's technical representative shall visit Project site to advise applicator of procedures and precautions for installation of roofing materials and upon completion of roofing to verify warranty requirements.
- B. Owner reserves right to hire an independent roofing consultant to review submittals, procedures, and installation.
- C. Installers Qualifications:
 1. Approved, authorized, or licensed by roofing membrane manufacturer prior to execution of this Contract, and that is eligible to receive manufacturer' special warranty. Installer must

- have documented experience on at least 5 projects using submitted roofing system and 10 years on projects of similar size and scope.
2. Foreman of field crew: 5 years minimum experience with roofing system and who is on the jobsite during roofing work.
- D. Certifications: Manufacturer's Certification on manufacturer's letterhead:
1. Certify roof system design; penetration, transition, and perimeter details; and system specifications are appropriate and satisfactory for this particular project.
 2. Certify products proposed for use comply with referenced standards; with listed documentation attached.
 3. Certify materials ordered and supplied are compatible with each other, suited for locale and purpose intended and shipped in sufficient quantity to ensure proper timely installation.
 4. Verify that the roofing system is manufactured directly by roofing system provider/supplier with the current formulation in use for past 20 years minimum to match the term of the warranty.
 5. Certify roofing materials have express warranty of merchantability and fitness for particular purposes of this Project.
 6. Certify manufacturer has reviewed Project and will issue warranty upon successful completion of installation.
 7. Certify materials shipped to site meet membrane manufacturer's published performance standards and requirements of this Specification.
 8. Membrane manufacturer's approval of insulation type and method of installation in writing.
 9. Manufacturer's approval of installer.
- E. Industry Standards: Conform to NRCA - Roofing and Waterproofing Manual, except where more stringent requirements are indicated.

1.6 PRE-INSTALLATION CONFERENCE

- A. Conduct pre-installation conference prior to commencing work in accordance with Section 013119, 1.6. Coordinate with Cal Poly Project Manager to schedule with the appropriate campus Trade Shops to attend the roof deck tour.
- E. Conduct tour of roof deck and review substrate surfaces to receive roofing and flashings. Report on substrate acceptability, possible problem areas, and recommended remedies. The meeting shall discuss all aspects of the project including, but not limited to:
1. Safety.
 2. Review approved Submittals and Shop Drawings. If items are outstanding, discuss what additional information is required and when it will be provided.
 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. Review governing regulations and requirements for insurance and certificates if applicable.
 6. Review temporary protection requirements for roofing during and after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the following requirements:
1. Store materials in weather protected environment, clear of ground and moisture.
 2. Protect membrane from cuts, tears, punctures, and abrasions.
 3. Protect light sensitive insulation from direct sunlight exposure.
 4. Store materials (except membrane) between 60 degrees F and 80 degrees F. If exposed to lower temperatures, restore to proper temperature before using.
 5. Stand roll materials as required by manufacturer.

6. Do not store materials on roof in such concentrations as to cause deck or structural membranes to be overloaded.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements: Proceed with roofing work only when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer's requirements.
 1. Comply with more restrictive of following or manufacturer's written requirements under which products can be applied.
 2. Verify substrate is free of water, dew, and frost.
 3. Ambient temperature is above 0 degrees F.
 4. Open fires and spark producing equipment are not and will not be in application area until vapors have dissipated.
 5. Application areas must be well ventilated.

1.9 SEQUENCING

- A. Do not install greater amount of insulation than can be covered by membrane in same day. Complete with night seals and appropriate tieoffs.
- B. Sequence work to avoid traversing over completed areas in order to continue roofing operations.
- C. Manufacturer is responsible for details and dimensions not shown on Drawings and shall furnish necessary details and field measurements to ensure roofing is covered by warranty. Coordinate with responsible trades to establish, verify and maintain field dimension and Project conditions.

1.10 WARRANTY

- A. Comply with provisions of Section 017833 requirements.
- B. **Manufacturer's Warranty:** Manufacturer's standard or customized form, without monetary limitation ("NDL"), and non-prorated for full replacement cost of completed installation in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 1. Warranty includes membrane roofing, base flashings, fasteners, roofing accessories, walkways, and other components of the membrane roofing system.
 2. Warranty Period: 30 years from date of Substantial Completion.
- C. **Applicator/Roofing Contractor Warranty:** In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner.
 1. Warranty Period: 30 years from date of Substantial Completion.
- D. Provide material required for warranty including penetrations, terminations, flashings, sealants, roof sheathing board, expansion joints, vapor barriers, membrane, insulation, adhesives, and fasteners. Defects include (but are not limited to) unadhered membrane and flashings, moisture blisters, open seams, and weld scuffs.

PART 2 - PRODUCTS

2.1 MEMBRANE

- A. Reinforced PVC Thermoplastic Membrane:
 1. Standard: ASTM D4434, Classification: Type II, Grade I
 2. Standard: ASTM D4434, Classification: Type III, fabric reinforced and fleece backed.
 3. Thickness: 0.070 inch (70 mils) minimum, exclusive of fleece backing.
 4. Size: 76 inches minimum wide by longest possible sheets as determined by Project conditions.
 5. Seams: Hot-air weldable.

6. Non-wicking fiberglass or polyester reinforced membrane.
7. Membrane remains pliable, weldable, and watertight throughout its useful life, minimum of warranty period.
8. At least 48 percent of membrane above scrim reinforcing or as specified.
9. Color: White to obtain EPA Energy Star rating for low sloped roofs.
10. White Membrane Solar Reflectance Values:
 - a. Energy Star: U.S. Environmental Protection Agency certification, 78 percent or better, ASTM E903.
 - b. Emissivity: 0.90 or better when tested per ASTM E408 and ASTM C1371.
 - c. Solar Reflective Index (SRI) ASTM E1980 -- 100.
11. Products and Manufacturers:
 - a. Sika Sarnafil, Johns Manville, or approved equal.
 - b. Basis of Design: G410 – SA, Sika Sarnafil Roofing Systems.
 - c. No “Private Label” or third-party membrane manufacturers will be approved as Substitutes.

2.2 INSULATION

- A. Polyisocyanurate Insulation Materials:
 1. Polyisocyanurate Insulation:
 - a. Type: ASTM C1289, Class 1, Type II, Grade 2 (20 psi) complying with Green Guard Gold Certification.
 - b. Zero ozone depletion potential (ODP) from blowing agent.
 - c. Long Term Thermal Resistance (LTTR) R-value based on ASTM C1303: 5.7 per inch, regardless of published values complying with PIMA Quality Mark Certification.
 - d. Thickness: R=40 average in multiple layers with joints offset.
 - e. Facers: Both faces finished with fiberglass mat facers.
 - f. Manufacturer: Approved by membrane manufacturer.
 2. Roof Cover Board: 1/4 inch Dens-Deck Prime, or approved equal, or as specified.
 3. Roof to provide positive roof drainage and slope to drains. Minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2% slope). Provide tapered polyisocyanurate insulation boards where crickets are shown or as required at edge strips and crickets for proper drainage.

2.3 ACCESSORIES

- A. Base Flashing, Reglet, Stack Flashing, and Patching Materials:
 1. Manufacturer’s standard system compatible with and matching color of roof membrane.
 2. Metal Clad Flashing: PVC clad sheet metal; SarnaClad or approved equal.
 3. All flashing materials approved by manufacturer and covered by warranty.
- B. Sealants, Adhesives, and Primers: As required by membrane manufacturer.
 1. Provide single ply roof membrane adhesives complying with Cal-GREEN Table 5.504.4.1 - Adhesive VOC Limits (250 g/L max).
 2. Provide single ply roof membrane sealants complying with Cal-GREEN Table 5.504.4.2 - Sealant VOC Limits (450 g/L).
 3. Provide primers complying with Cal-GREEN Table 5.504.4.3 - VOC Content Limits for Architectural Coatings.
- C. Insulation Adhesive or Fasteners:
 1. Adhesive: Dual component, low-rise polyurethane foam adhesive, used to adhere insulation panels to the substrate as well to other insulation panels. Sarnacol 2163 by Sika Corporation-Roofing, Insta-Stik Professional Roofing Adhesive by Dow Chemical Corporation; Joliet, IL or equal as approved by roofing manufacturer and covered under warranty.

- D. Vapor Barrier: Sarnavap SA self-adhered vapor retarder or equal as required by membrane manufacturer.
- E. Roof Board: Glass Fiber Faced Gypsum, ASTM C1177; Type X; FM approved; silicone treated core with filled, heat-cured coating on one side.
 - 1. 4 feet by 8 feet.
 - 2. Thickness:
 - a. 1/4 inch roof cover board for application over roof insulation as indicated.
 - b. 5/8 inch Type X for use over metal deck.
 - c. Provide 5/8 inch thickness Dens-Deck Prime for parapet wall studs with fully adhered membrane on parapet.
 - 3. Flame spread: 0.
 - 4. Acceptable Product: Dens-Deck Prime Roof Board, Georgia-Pacific Corporation, or approved equal.
- F. Crossgrip Flexible PVC Walkway Mats:
 - 1. Heavily textured and profiled, rolled-out walkway protection mat.
 - 2. Used for walkway and protection from membrane from mechanical abuse.
 - 3. Thickness: 9/16 inch thick flexible PVC with heavily textured surface.
 - 4. Loose laid on top of completed roof assembly.
- G. Perimeter Warning Tape: Designed for use on PVC membranes as a reflective, highly visible pressure sensitive tape used to draw attention to roof perimeters and potential hazardous areas. The tape is available in 2 inch wide rolls by 30 feet long and comes on a release liner for easy application. Perimeter Warning Tape exceeds reflectivity 3 requirements and Federal spec. L-S-300, Class 1
- H. Roof Drains: Retrofit roof drains are not to be installed. Coordinate with Project Manager and Cal Poly Plumbing Shop on acceptable roof drains to be used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Material verification inspection by Cal Poly designee is required prior to installation. Material to match the listed system that is included in the reviewed submittal.
- B. Ensure required fire treated wood blocking has been placed at proper elevations around perimeter of each roof level and at penetrations.
- C. Verify work which penetrates deck has been completed.
- D. Verify deck is clean and smooth, free of depressions, waves or projections, properly sloped to drains.
- E. Verify roof openings and penetrating elements through roof are solidly set, and wood blocking, nailing strips, and reglets are in place.
- F. Do not apply roofing materials to damp, frozen, dirty, dusty, or other deck surface conditions which are unacceptable to manufacturer and applicator.

3.2 PREPARATION

- A. Clean substrate of dust, debris, 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. Substrate is to be inspected by Cal Poly designee prior to installation of roof system.
- D. Wood Nailers:

1. Install wood nailers, underlayment, membrane, and accessories in accordance with FM, UL, and manufacturer's requirements.
 2. Install at roof perimeter and at base of penetrations over 18 inches long or in diameter.
 3. Thickness equal to insulation or greater where indicated.
- E. Vapor Retarder:
1. Prime the deck and adhere the vapor barrier directly over the concrete deck in accordance with roof manufacturer's requirements.
 2. Lap and seal joints; offset endlaps.
 3. Extend vapor retarder under blocking.
- F. Insulation and Roof Cover Board:
1. Place 2 layers of insulation and offset joints in accordance with insulation manufacturer's instructions to achieve FM wind uplift rating.
 2. Install insulation in parallel courses with end joint staggered and adjacent boards butted together with no joints greater 1/4 inch. Do not install cracked or broken boards.
 3. Cut insulation to fit neatly to perimeter blocking and protrusions through roof.
 4. Lay tapered boards to provide minimum 1/4 inch per foot slope drainage at crickets and other areas where structure has not provided slope to drains, gutters or roof edge.
 5. Provide 1/4 inch roof cover board over insulation with joints offset from insulation joints or as specified.
 6. Low Rise Foam Adhesive (Insulation and Roof Cover Board on Concrete Deck):
 - a. Apply using manufacturer's approved equipment over properly installed and prepared substrates at rate according to manufacturer's requirements meeting FM wind uplift requirements and covered by roof membrane manufacturer's warranty.
 - b. Clean vapor barrier prior to application of the insulation to ensure no excessive dirt or dust remains on substrate.
 - c. Apply adhesive in a smooth, even coating with no gaps, globs, puddles or similar inconsistencies. Only areas that can be made completely watertight in the same day's operations shall be coated.
 - d. For multiple layers of insulation spray adhesive or apply in beads over the base layer once fully secured and follow procedures above for attachment of each insulation layer.
 - e. Installation Guidelines:
 - 1) Follow manufacturer's installation and environmental requirements.
 - 2) Adhesive shall not be applied to wet or damp surfaces.

3.3 INSTALLATION

A. General:

1. Do not apply roofing materials to surfaces which are unacceptable to manufacturer and installer.
2. Do not install greater amount of insulation than can be covered by membrane in same day.
3. Sequence work to avoid traversing over completed areas in order to continue roofing operations.
4. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.
5. Install night cut-off sealer and appropriate tieoffs at end of day's work.

B. Fully Adhered Membrane:

1. Install sheet according to ASTM D5036.
2. Unroll membrane over prepared substrate in approximate final position. Allow to relax.
3. Cut sheets to maximum length possible to minimize seams.
4. Overlap sheets at edges and ends as required by manufacturer.

5. Apply bonding adhesive to substrate as required by manufacturer. Do not apply adhesive with seam welding area.
6. Weld seams with hot air welder of type approved by manufacturer. Prime seams if necessary to achieve proper weld. Ensure that fastener plates and seams are located in accordance with manufacturer's requirements.
7. Overlap joints on sloped substrate in direction of drainage where possible.
8. Eliminate fishmouths, wrinkles, bubbles, or other type voids.
9. Heat weld membrane to adjoining surfaces.

C. Flashing and Accessories:

1. Install base flashing, terminations, and fascia trim as indicated and required by manufacturer. Use longest pieces practicable.
2. Install base flashing up vertical surfaces minimum 8 inches above edge strip unless otherwise noted. Fasten top of base flashing with devices and at locations and frequency as recommended by manufacturer.
3. Coordinate installation of base flashing with Division 7 - Thermal and Moisture Protection.
4. Bond base flashing to substrate in accordance with manufacturer's requirements to obtain water tight bond.
5. Take measures to ensure base flashing is not ridging where there is change of direction.
6. Fasten top of base flashing under metal counterflashing at manufacturer's recommended spacing.
7. Flash penetrations passing through membrane.

D. Walkway Mats:

1. Install walkway products in locations indicated.
2. Loose lay on substrate according to roofing system manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Request site attendance of roofing manufacturer technical representative during following stages of installation of roof assembly at a minimum:
 1. As required per the manufacturer's requirements or waterproofing consultant.
- B. Quality Control of Welded Seams - Check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane.
- C. On-site evaluation of welded seams shall be made daily at locations as directed by the Owner's Representative or Manufacturer's representative. Take one inch wide cross-section samples of welded seams at least three times a day. Correct welds that display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.
- D. Install the new roof system in such a manner as to maintain watertight integrity on a daily basis. If water is allowed under the completed roof remove the roofing and dispose of all wet and damaged insulation and coverboards. Provide and reinstate new dry roofing materials once the roof deck has been allowed to dry.
- E. Interim and Final Inspections - Upon completion of the installation and the delivery to Manufacturer by the Applicator of a certification that all work has been done in strict accordance with the contract specifications and Manufacturer's requirements, a warranty inspection shall be made by the manufacturers Specialist Technical Representative no personnel with a sales role/function within the company shall be permitted to inspect contractors work.
- F. Manufacturer's Field Services:
 1. Provide inspection to ascertain specified material and workmanship quality is being maintained and for purposes of warranty verification.

2. Perform final inspection after roof completion.
 3. Field Reports: Submit summary of Project site observations, instructions and monitoring activities.
- G. Site Tests and Inspections:
1. Inspect cooled seams with probe or similar device to ensure welds are consistent.
 2. Correct defective seams.
 3. Take 2 seam cuts daily; one in the morning before starting work and one again before starting work after lunch. Retain the sample cuts for roofing inspector verification.
 4. The Contractor shall provide electrical and water connections at test locations as identified by the waterproofing consultant at no cost to the Owner.
- H. Correct identified defects or irregularities.

3.5 CLEANING

- A. Clean as recommended by manufacturer. Do not use materials or methods which may damage membrane, flashing, or surrounding construction.

3.6 PROTECTION

- A. Provide temporary roof protection as recommended by manufacturer in areas of anticipated roof traffic during remainder of construction.
- B. Prevent traversing roof without temporary protection.
- C. Remove protection when no longer needed.

END OF SECTION