PART 1 – GENERAL

1.1 SUMMARY

A. Coated foam roofing, as shown on drawings and specified herein.

1.2 SYSTEM DESCRIPTION

A. Roofing System shall be UL-790 (ASTM E1 08) Class A to conform to CBC Sections 1501-1510 and CBC Code Standard 15-2. System shall meet UL-1256 Construction Methods 136, 181, and 206. Roofing system shall meet UL-1897 Standard for Wind Uplift and UL-2218 Standard Impact Resistance. Roofing System shall meet required FM Global approval standards, and "Energy Star" Guidelines and CRRC Guidelines.

B. Roof system shall be Class A Roof System on non-combustible deck with Class B rating over Combustible Deck that conforms to ASTM Test Standards, ICC, UBC, CRCC and California Title 24, Energy Code requirements; and may provide LEED credits depending upon use. This cementitious specification is drafted from the SWD Ever-Gard U.L. Classified Roof System."

C. 20 Year Warranty System
1. One inch (minimum) of sprayed polyurethane foam (additional inches may be added an/or sloped depending upon desired insulation value) on the deck surface with (25) mil thickness of white, reflective 100% acrylic roof coating and 1/8" to 1/4" of cementitious coating with embedded aggregate for the final surface.
2. The low cost sustainable foam roof system is easily maintained, repaired and upon inspection, may be re-coated with an "Ever-Gard" cementitious protective coating after ten (10) years.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's material specifications, installation instructions and evidence of UL, CRRC, "Energy Star" and/or FM ratings for roofing system.

B. Provide specimen copy of the applicable warranty for this project, as specified herein.

C. Submit evidence that Coated Foam Insulating System is approved in accordance with UL-790 Class A testing.

D. Submit evidence that Coated Foam Insulated Roof System is approved in accordance with UL-2218 Impact Resistance Testing.

E. Submit evidence that coated Foam Insulated Roof System is approved in accordance with UL Reports P-733, P-826, or P-904 for Hourly Fire Resistance Design Ratings on specific decks, where applicable.

F. Submit evidence that polyurethane foam with HFC 245fa blowing agent in Coated Foam Roof System is approved in accordance with Montreal Protocol and U.S. EPA non-depleting ozone requirement.

G. Submit evidence that top coatings in Cementitious Coated Foam Insulated Roof System are approved in accordance with "Energy Star", LEED SSc7.2 Solar Reflectance Index (SRI), CRRC, California Title 24, and Solar Reflectance and Thermal Emittance Testing.

1.4 QUALITY ASSURANCE

A. Qualification:
1. Manufacturer: Company specializing in manufacturing products, specified with minimum 5 years documented experience.
2. Applicator: Roofing applicator with 5 years experience in work of similar scope and nature to that specified and approved by manufacturer of roofing material.

B. Pre-Installation Conference:
1. Convene a pre-installation conference to review roofing specifications and procedures with the Design/Builder, roofer, and other trades relative to the work two weeks prior to installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Deliver materials to site intact with labels showing UL.
2. Deliver so that stocks of materials on the site will permit uninterrupted progress of the work.

B. Storage and Handling
1. Adequately protect against damage while stored at the job-site.
2. Comply with manufacturer's instructions,

1.6 PROJECT/SITE CONDITIONS

A. Polyurethane foam shall not be sprayed during inclement weather and when the following conditions exist:
1. If surface temperature is above 160 degrees F or below 40 degrees F or when the dew point is less than 5 degrees F above the surface temperature.
2. If surface moisture is present.
3. If wind velocity is above 12 miles per hour, windscreens are required, for wind velocity at or above 25 miles per hour, work shall be suspended.

1.7 WARRANTY

A. Warranty: Furnish written 20 Year No Leak Warranty on Coated Foam Insulated Roof System. Warranty shall cover repairs necessary to maintain roofing work in a water-tight condition during the warranty period. Warranty is to cover workmanship, materials, and repair during the period covered.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Roofing products shall be manufactured by the following accepted manufacturer:
1. SWD Urethane Company, www.swdurethane.com.
2. Henry Company, Resin Technology (RTC), 909-947-7224.
3. BASF PFE, www.basf-pfe.com.
4. Substitutions: In accordance with the conditions of the contract and the Division 1 specification sections.

2.2 MATERIALS

A. Primer/Sealer
1. Neoprene based primer formulated to be airless sprayed and designed expressly to enhance adhesion of SWD Urethane foam to various surfaces.
2. SWD-1000 Primer/Sealer Is acceptable.

B. Polyurethane Foam Roofing/lnsulation
1. Two component rigid foam, designed to be applied with foam dispensing equipment, meeting the following Minimum Physical Properties:
   a. Primer/Sealer is not usually needed on new wood deck.
   b. Primer/Sealer is almost always needed on metal deck and metal roof.

2. Polyurethane Foam Roofing/lnsulation
   a. Fire hazard classification: This material meets UL 1256 requirements as a class A roof system when used with SWD Ever-Gard System over combustible deck.
   b. Polyurethane foam density and compressive strength shall be uniform and consistent with specification. Minimal physical properties shall not allow for multiple foam densities or compressive strengths to be applied within multiple inches of specific foam.
   c. SWD Polyurethane foam shall contain EPA-approved 245fa blowing agent and meet U.S. non-ozone depleting requirements of the U.S. EPA mandate and international Montreal Protocol.
   d. SWD Urethane Company, SWD 125 polyurethane foam with HFC 245a blowing agent is acceptable.

PHYSICAL PROPERTIES

| Property | ASTM Procedure | Values |
|---|---|---|
| Core Density, pcf nominal* | D-1622 | 2.5 - 3.0 |
| Compressive Strength, psi | D-2621 | 40.1 |
| Tensile Strength, psi | D-1623 | 85.5 |
| Open Cell Content % | D-2856 | 17.7 |
| Closed Cell Content % | D-2856 | 82.3 |
| Water Vapor Transmission, ppi | E-96 | 1.0 |
| R Value | C-177 | 6.8 |
| K-Factor (initial) | C-177 | 0.148 |

C. Protective Coatings:
1. 100% elastomeric, ASTM D-6083, UL-723, Class 1 rated 1929F Kool-Kote TM white, acrylic coating meets EPA Energy star and CRRC requirements and is listed for Solar Reflectance and Thermal Emittance. The coating can be applied by brush,

roller or conventional airless spray equipment with exceptional Physical Properties test results.
2. One Gallon acrylic, elastomeric base coat and two gallons acrylic, elastomeric top coat applied per 100 square feet (Dry mill thickness 30 mils).
3. SWD 1929F Kool-Kote TM acrylic, elastomeric coating is acceptable. Note: SWD Urethane Company is an original Energy Star Charter partner and is CRRC listed and approved. In addition: SWD Urethane Company coatings are California Title 24 Compliant.
4. Cementitious white coating with 64 lbs of #6 white limestone granules is spread on top of the coated Foam Roof system at 1/8 Inch per 100 square feet.
5. SWD Ever-Gard Cementitious coating is acceptable over the acrylic coating, as the top coating of the SWD Cementitious Coated Foam Roof System.

PHYSICAL PROPERTIES

| Property | ASTM Procedure | Values |
|---|---|---|
| Fire Resistance | E-84 | |
| Flame Spread | E-84 | 15 |
| Smoke Developed | E-84 | 10 |
| Solids Content | | |
| By Weight | D-1353 | 70% |
| By Volume | D-2697 | 60% |
| Solar Reflectance | E-903 | 82% |
| Thermal Emittance | E-408 | 91% |
| Tensile Strength: psi | D-412 | 280 |
| Elongation psi | D-412 | 355 |
| Water Vapor Transmission, ppi | E-96 | 1 |
| Hardness - Shore A Durometer | D-2240 | 60 |
| Colors: | | Grey, Buff, White |

ASTM D-6083 - Standard Specification for Liquid-Applied Acrylic Coating - Used in Roofing
(ALL FOLLOWING TESTS PASSED)
Liquid requirements/Film Properties:
Viscosity, Volume Solids, Weight Solids, Initial Tensil Strength, Initial Elongation, Permeance, Water Swelling, Wet Adhesion, Tear Resistance, Fungi Resistance.

D. SWD Urethane Company "Kool-Kote" TM 1929F acrylic, elastomeric coatings are acceptable".

E. Cementitious Protective-Reflective Coating.
1. Shall be manufactured specifically for use with SWD 125 polyurethane foam and 1929F Kool-Kote acrylic elastomeric coating and SWD 1000 or SWD 2000 primer/sealer.
2. Part A shall consist of Cementitious dry-mix asbestos-free powder compound.
3. Part B shall be 100% acrylic, emulsion containing no styrene or Styrene Butadiene.
4. The Cementitious coating shall be applied in two separate passes resulting in 1/8" to 1/4" total (7-8 gallons per 100 square feet) thickness.
5. Aggregate topcoat shall include #6 crushed limestone at 64 lbs. per 100 square feet, embedded in the wet coating.

6. Fire hazard classification: This system meets UL-790 requirements as a Class A roof.

PHYSICAL PROPERTIES

| Property | ASTM Procedure | Values |
|---|---|---|
| Solar Reflectance | E-903 | 81% |
| Thermal Emittance | E-408 | 87% |
| UV Resistance | D-822 | 2,000 hr/No Effect |
| High Temperature Stability | D-794 | No Effect |

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification and Conditions:
   1. Roofing contractor shall examine the roof deck, flashings, and other surfaces that are to receive roofing materials, prior to the application to ensure that surfaces are true, even, dry, clean, and in proper condition to receive the roofing system.
   2. All penetrations through roofing including drains, scuppers, miscellaneous pipe, and vent penetrations and electrical conduits shall be completed prior to starting of work. Post-installation of penetrations after roofing section is completed requiring repairs shall constitute costs added above contracted scope of work.

B. Application of roofing material shall constitute the roofing contractor's acceptance of surfaces and flashings to receive the materials.

C. Coordinate with other work, which affects, connects with or will be concealed by this work.

3.2 PREPARATION

A. General Area:
   1. Notify the University’s representative and visitors to the job-site of potential fugitive overspray.
   2. Cars, etc. should be moved or covered to prevent inadvertent spraying. Design/Builder shall coordinate traffic with subcontractor during roof operations.
   3. Use appropriate barricading methods to shelter walking traffic from the work area's equipment and overspray.
   4. Mask work area as necessary to protect building walls, adjacent structures, and vegetation, etc. from possible overspray.

B. Surface Preparation for Different Roof Decks:
   1. Concrete Deck
      a. Remove loose dirt, dust, and debris by using compressed air, vacuum equipment or a broom. Oil and grease from release agents or other contaminants shall be removed with proper cleaning solutions.
      b. All joint openings in concrete decks that exceed 1/4" shall be grouted or caulked by others, prior to application of polyurethane foam.

c. Priming is required on concrete surfaces and it is recommended that due to hydration that is present, poured concrete decks be permitted to cure for twenty-eight (28) days prior to the application of sprayed polyurethane foam.
d. Sprayed polyurethane foam is not recommended for application to lightweight or insulating concrete materials unless underlayment and/or vent pans are installed. (Check with manufacturer prior to installation of PUF roof system over lightweight concrete).

2. Other Surfaces (Le. Mineral Fiber Board, Gypsum Board, Isocyanurate Board, Plywood)
   a. Such materials used over fluted metal decks must be installed with mechanical fasteners or adhesives.
   b. Fasteners shall be installed to meet Factory Mutual wind uplift criteria or the appropriate local building code criteria.
   c. Boards shall be firmly butted together along edges without gaps or openings. Joints exceeding 1/4" shall be caulked by others with suitable sealant material.
   d. Care shall be taken to prevent mineral or gypsum board from getting wet in storage on the job-site and after installation, prior to being protected by foam. Moisture exposure may damage these materials and require replacement.
   e. Remove loose dirt and debris by using compressed air, vacuum or broom. No power-broom is permitted due to possibility of damage.
   f. The installed materials shall be protected from spills of contaminants.

3.3 INSTALLATION – GENERAL

A. Install all materials in strict compliance with all published safety, weather or applicable instructions from the manufacturer and/or regulations of local, state and/or federal agencies which have jurisdiction.

B. No work shall be commenced over defective area until advised in writing by Design/Builder of the action to be taken in such areas.

C. Spray polyurethane foam shall be installed when the deck, parapet walls, rough openings, and curbs are completed. The type of skylight used will determine when skylights should be installed and plumbing vents, drains, and electrical penetrations shall be in place prior to foam installation. No trades-people shall be allowed to work on the roof when the spray polyurethane foam and coating are being installed. HVAC units shall not be installed until after the foam and coating roof system is in place.

D. Substrate shall have sufficient structural strength and integrity without substrate deformation, and sufficient Slope-to-Drain per Code Requirements of 1/4 inch/foot to eliminate excessive pending water. Excessive pending is defined as "an area of 100 square feet or more which holds in excess of 1/2" of water, as measured 48 hours after a rainfall" per the Orca Roofing and Waterproofing Manual - Fourth Edition.

E. Metal: Install metal foam stop at all roof edges, as required.

F. Crickets and Cants:
   1. The required drainage slope gradients are required to meet the various drainage sources.
   2. Crickets to be constructed using spray polyurethane foam (within certain sloping requirements).
   3. Cants formed with spray polyurethane foam shall transition from the deck surface up the parapet wall.

G. Parapets
1. The polyurethane foam shall extend a minimum of 4" and/or to 12" up the vertical wail at a thickness of 3/4 inch to one-inch (1-112 inch at the cant).
2. If it is required that polyurethane foam extend all the way up the parapet wall then foam termination shall be detailed via straight line and tapered foam or optional sheet metal flashing that is acceptable to architectural standards.

3.4 INSTALLATION - PRIMER/SEALER

A. All surfaces should be clean and free from moisture, oil, grease, loose particles, dust, debris, and any other materials that shall prevent maximum adhesion.

B. Spray primer/sealer to decking at a rate of 1/2 gallon per 100 square feet.

C. Application of spray foam over primer shall be manufacturer's recommendations.

3.5 INSTALLATION - POLYURETHANE FOAM

A. Foam shall be applied in minimum 1/2" thick passes to achieve the 1-1/2 inch minimum thickness.

B. Spray only the area each day that can be completed to the specified thickness that same day. Before resuming spraying operations on subsequent days, inspect the exposed leading edge of the foam for possible surface moisture that could cause blistering. The foam edge shall be considered dry when there is no indication of moisture when blotted with an absorptive material.

C. Surface texture and quality cured polyurethane foam shall range from a smooth to heavy "orange peel" finish. Textures described as "popcorn" or "tree bark" surfaces, which exhibit crevices, voids and widespread defects, are not acceptable.

3.6 INSTALLATION - PROTECTIVE ELASTOMERIC COATING

A. Preparation:
1. Foam surface and adjacent surfaces to be coated, shall be completely free of degraded foam, foam over-spray, grease, oil, or other contaminants which would interfere with proper coating adhesion.
2. Surface shall be dry and frost-free before coating. Do not apply coating materials when surface temperature is less than 50 degrees F.
3. Any physical damage to the polyurethane foam shall be repaired before coating.
4. Operator should wear soft-soled shoes to avoid damaging the skin of the foam.
5. An additional application of base coat shall be applied where foam surface has been sanded, planed, or trimmed and the skin removed prior to applying normal base coat to the entire area.
6. The polyurethane foam shall be inspected for suitability of base coat application, prior to application of the protective coating and be free of UV oxidation and contaminants.

B. Base Coat:
1. Shall be contrasting color from the top coat to insure adequate coverage.

2. Shall be applied on the same day as the polyurethane foam application, when possible.
3. The polyurethane foam shall be inspected for UV oxidation if more than 72 hours has elapsed prior to application of base coat.
4. Spray-apply elastomeric base coat over insulation at the rate of 1 gallon per 100 square feet in one application.

C. Top Coat:
1. Coating shall be a contrasting color from the base coat to ensure adequate coverage.
2. Do not apply top coat until base coat has cured properly. Normally, 24 hours is sufficient time for the base coat to properly cure.
3. Spray-apply elastomeric top coat over the base coat at the rate of 1.5 gallons per 100 square feet in one application.
4. Coating shall extend up and over all polyurethane foam on vent pipes, parapets, and other penetrations and shall terminate a minimum of 4 inches above the foam. All top coat termination points shall be straight-lined on walls, parapets, vent pipes, and other penetrations.

D. Cementitious Coating:
1. Cementitious coating with #6 limestone granules shall be applied as a wet final coating at the rate of 64 Ibis. Per 100 square feet.
2. Cementitious coating including #6 limestone granules, shall cover all acrylic coating and terminate just under acrylic top coating termination points, preserving straight-lines of acrylic top coat on parapets, walls, vent pipes and other penetrations, as the final straight-line appearance of the roof.

## 3.7 CLEANING

A. Remove and dispose of excess materials, equipment, and debris from premises during work and/or upon completion of work.

B. Leave work in clean condition in accordance with generation conditions requirements.

## 3.8 FIELD QUALITY CONTROL AND INSPECTION

A. Provide two (2) inspections of the installation by the manufacturer during the installation of the roofing system.

B. Provide roof drainage test. Water ponding of 2 square inch by 1/4 inch deep and greater are unacceptable.

END OF SECTION