

SECTION 07545 – DURAGARD I INDUSTRIAL COATED FOAMED ROOFING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes a roof system consisting of zero ozone depleting spray-applied polyurethane foam insulation, **Energy Star** rated and **LEED** compliant protective coating and impact resistant **Energy Star** rated and **LEED** compliant **DURAGARD** cementitious traffic topping.

1.3 SUBMITTALS

- A. **Product Data:** For each type of coated foamed roofing product indicated, include manufacturer's technical data, including physical and performance properties.
- B. **Samples for Verification:** Samples on rigid backing, showing polyurethane foam of thickness required and stepped coatings in colors required to illustrate build-up of coated foamed roofing.
- C. **Installer Certificates:** Signed by manufacturer certifying that the contractor and installers are approved for the **DURAGARD** roof system and warranty specified for this project.
- D. Submit evidence that the polyurethane insulation, together with the specified waterproofing system or approved equal, has been tested as a composite roof covering in accordance with UL-790, ASTM E-108 and UBC 32-7 test methods.
 - 1. System shall meet UL - 1256 (UBC 17-4) tests at unlimited foam thickness as applicable to UL Const. No. 206 over metal B deck construction.
 - 2. System shall meet UL 790 Class A @ 1" thickness over combustible deck.
 - 3. System shall have UL P904 2 hr. fire rating over concrete deck construction and UL P733 over metal deck construction.
 - 4. Protective coating shall be Factory Mutual Class I per 4470 standards.
 - 5. Submit evidence that the protective coating and the cementitious traffic topping are **CRRC** listed and **Energy Star** rated and meet **LEED** EB requirements for SS7.2 Urban Heat Island Reduction Roofs

1.4 QUALITY ASSURANCE

- A. **Installer/Applicator Qualifications:** Engage a contractor who has successfully completed within the last three years at least five spray applied foam roofing systems with **DURAGARD** cementitious traffic topping similar in type and size to that of this Project and who will assign mechanics from these earlier applications to this Project, of which one mechanic will serve as on-site lead mechanic and/or foreman at all times when roofing work is in progress.
- B. Manufacturer of foam and coating shall not own or operate any portion of the certified applicator's company.
- C. A qualified roofing consultant shall conduct quality control inspections for specified system in conjunction with approved third party inspection firms. Mandatory inspections include pre-start deck inspection, unannounced interim inspection and final inspection. Material manufacturer shall provide technical assistance as requested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
- B. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.
- C. Remove and replace material that cannot be applied within its stated shelf life.

1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Apply coated foamed roofing within the range of ambient and substrate temperatures recommended by roofing material manufacturers, but not below 50°F. Do not apply to damp or wet surfaces. Do not apply when relative humidity exceeds 95 percent or when temperatures are less than 5°F above dew point.
 - 1. Do not apply roofing foam in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period.
 - 2. Do not apply polyurethane foam when wind conditions result in surface finish textures not complying with requirements.
 - 3. Do not apply roof coatings when wind conditions prevent uniform coating application.

1.7 WARRANTY

- A. **Special Warranty:** Roof coating manufacturer's standard form in which manufacturer agrees to repair or replace coated foamed roofing that does not comply with requirements or that does not remain watertight within specified warranty period.
 - 1. Warranty Period: 12 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS AND MANUFACTURERS

- A. **Manufacturers:** Material manufacturer shall be ISO 9001-2000 certified by an approved independent ISO Audit Agency.
- B. **Primer:** Manufacturer approved primer, if applicable for the project, installed per manufacturer instructions.
- C. **Polyurethane Foam Insulation:** SPF insulation shall be a two component spray applied polyurethane foam specifically manufactured for roofing. Foam thickness shall be as noted on the plans at roof decks and parapet walls. Refer to Drawings for other Conditions. Application shall result in a high quality seamless layer of polyurethane foam insulation meeting the following requirements:

Minimum Physical Properties

*Density in Place	ASTM D-1622 @ 74°F	3.0 lb/ft
Compressive Strength	ASTM D-1621 @ 74°F	55 PSI min.
Tensile Strength	ASTM D-1623 @ 74°F	85 psi
"K" Factor (initial)	ASTM C-177 @ 75°F	.15
Closed Cell Content	ASTM D-2856 @ 74°F	98% min
Moisture	ASTM C-355	0.8 (perm/inch)
Spread of Flame	ASTM E-84	<75

- D. **Fluid Applied Waterproofing:** Protective coating shall be a one component elastomeric coating tested specifically with the **DURAGARD** roof system.

1. Shall be fire rated by Underwriters Laboratories as a UL790 Class A composite roof system with the foam specified for this project.
2. Shall result in a total dry film thickness of 25 mils in a two coat minimum application.
3. Application of fluid applied waterproofing shall result in a high quality seamless, pinhole free membrane meeting the following physical property requirements:

Minimum Physical Properties

Tensile Strength	ASTM D-412	440 psi @ 0°F 250 psi @ 75°F
Elongation	ASTM D-412	330% @ 0°F 280% @ 75°F
Hardness	ASTM D-2240 ASTM C-661	55-65 Shore A
Permeance	ASTM E-398	3.0 Perm @ 20 dry mils
Color		Grey or White
Viscosity		110-130KU
Solar Reflective Index	ASTM E-1980	104
Accelerated Weathering	ASTM D-822 ASTM G-23	8000 hrs - No surface checking, cracking no delamination, no color fade

- E. Aggregate shall be washed, screened and sized specifically for use in roof system:
Crushed limestone #6.
- F. **DURAGARD** Cementitious Coating:
 1. Part A shall consist of a dry, cementitious, asbestos-free powder compound specifically formulated for the **DURAGARD** roof system.
 2. Part B shall be a pure acrylic emulsion containing no styrene or styrene butadiene.
 3. Shall be applied in two separate passes resulting in an average 200 mil thickness.

Physical Properties

Color		White
UV Resistance	ASTM D-822	2,000 hrs/No Effect
High Temperature Stability	ASTM D-794	No Effect
Solar Reflective Index	ASTM E-1980	98

- G. **Fluid applied flashing at vertical surfaces:**
 1. Protective coating shall be one component acrylic elastomeric coating.
 2. Protective coating shall be spray applied in a minimum three coat application.
 3. Protective coating installation shall result in a total dry film thickness of 35 mils at vertical surfaces
 4. Application of fluid-applied waterproofing shall result in a seamless membrane with the following performance requirements:

Minimum Physical Properties

Tensile Strength	ASTM D-412	440 psi @ 0°F 250 psi @ 75°F
Elongation	ASTM D-412	280% @ 75°F 330% @ 0°F
Hardness	ASTM D-2240 ASTM C-661	55-65 Shore A
Permeance	ASTM E-398	3.0 Perms @ 20 mils
Color		Grey or White
Viscosity		110-130 KU
Solar Reflective Index	ASTM E-1980	104
Accelerated Weathering	ASTM D-822 ASTM G-23	8000 hrs - No surface checking, cracking no delamination, no color fade

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Verification of Conditions:** Examine subsurface to receive Work and report detrimental conditions in writing to Architect.
1. Prior to the application of roofing materials, the Contractor shall examine the roof deck, flashings, and other surfaces that are to receive roofing materials 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 the starting of work.
 3. The Contractor shall report in writing to the Owner anything or condition not to the Contractor's satisfaction prior to proceeding with the work of this section.
 4. Application of roofing material shall constitute the roofing Contractor's acceptance of surfaces and flashings to receive the materials.
- B. **Commencement of Work** will be construed as acceptance of sub-surfaces.
- C. **Coordination:** Coordinate with other work which affects, connects with, or will be concealed by this work.

3.2 SURFACE PREPARATION

- A. **Built-Up Roof Membrane**
1. Remove all loose and poorly embedded aggregate surfacing material, if present, by use of a wet vacuum, power broom, hand broom, power vacuum, and/or other suitable means. Do not accumulate large amounts of aggregate surfacing material in one location that may overload the roof deck structure.
 2. Remove all wet insulation under existing built-up roof membrane. Clean and dry the area and install new similar compatible insulation, or apply polyurethane foam insulation to the level of the adjacent existing membrane.
 3. Repair all built-up roof membrane defects, such as blisters, ridges, splits, punctures and felt delamination by cutting, removing, nailing or properly adhering to form a solid substrate. BUR repairs shall be made using hot process BUR or modified bitumen products, cut-back products shall not be used. Make sure the adjoining roof materials around these defects are dry.
 4. Remove all loose stones, dust, dirt, debris and other contaminants from the built-up roof membrane that may impair the adhesion of the polyurethane foam.
 5. Ensure existing BUR roof meets local wind uplift requirements.
 6. Primer - Install primer per manufacturer's recommendations. Make sure all surfaces are clean and dry prior to primer and/or polyurethane foam application.

B. Metal Decks

1. The metal roof deck should be a minimum of 22-gauge and be securely installed to conform to local building code requirements. Deflections shall not exceed 1/240 of the span.
2. Remove any loose scale, rust and weathered or chalking paint using a wire brush, scraper, sand blasting or other suitable means. Prime, if necessary, as recommended.
3. Remove all dust, dirt and debris using air pressure, a hand or power broom and/or a power washer. Other contaminants such as oil and grease must be removed with appropriate cleaning solution, and rinsed with clean water. (New metal will have a thin film of milling oil on it, which must be removed.)
4. Fluted metal roof decks should be covered with gypsum, urethane or fiberglass board that is mechanically fastened or adhered with low rise polyurethane foam adhesive per Factory Mutual or UL testing for local wind uplift resistance. The boards shall be firmly butted together along all edges. Board joints greater than ¼ inch shall be taped or filled with SPF prior to foam application.
5. Factory painted metal surfaces will not normally require an additional application of primer.
6. Make sure all surfaces are clean and dry prior to foam application.

C. Concrete Surfaces

1. The concrete shall be cured a minimum of 28 days at temperatures above 50°F and must be free of any laitance. The moisture content of the concrete shall be less than 15 on a Delmhorst moisture meter.
2. Remove all loose dirt, dust and debris using air pressure, a hand or power broom and/or a vacuum. Oil, grease, release agents and other contaminants must be removed using the appropriate cleaning solution.
3. All joints or cracks greater than ¼ inch shall be caulked or grouted prior to polyurethane foam application.
4. Make sure all surfaces are clean and dry prior to application of an approved primer and polyurethane foam application.
5. Lightweight concrete insulation, fill material - If present in the existing roof assembly, recommendations will be made on a per job basis, please contact foam manufacturer's technical services.

D. Wood Surfaces

1. Plywood shall be exterior grade not less than ½ inch thick, nailed firmly in place. Attachment must meet building code requirements for resistance to wind uplift. Deflections should not exceed 1/240 of the span.
2. The plywood shall contain no more the 18 percent moisture by weight, as measured in accordance with ASTM D-2016.
3. All untreated and unpainted surfaces shall be primed with an appropriate, approved primer to minimize moisture absorption and aid in the polyurethane foam adhesion.
4. Tongue and groove sheathing and planking decks shall be overlaid with a minimum of ¼ inch exterior grade plywood, insulation board or a base sheet securely attached to meet building code requirements.
5. Any joints greater than ¼ inch shall be caulked or taped prior to the polyurethane foam application.
6. Remove all loose dirt, dust and debris using air pressure, a hand or power broom and/ or a vacuum. Power washing is not recommended as it may introduce water into the substrate. Oil, grease and other contaminants must be removed using appropriate cleaning solution.
7. Make sure all surfaces are clean and dry prior to polyurethane foam application.

E. Other Surfaces

1. Contact material manufacturer for recommendations on surface preparations on other surfaces to receive the SPF roof system specified for this project.

3.3 INSTALLATION

- A. Prior to beginning installation procedure, insure that all product material containers are UL labeled in accordance with the material manufacturer UL follow up service agreement.

Install materials in conformance with manufacturer's printed recommendations and these specifications. If a conflict exists, inform Architect in writing prior to start of installation.

- B. Apply primer to surfaces before proceeding with polyurethane foam installation, as determined by the qualified roofing consultant and the material manufacturer.
- C. Sprayed polyurethane Insulation:
1. Sprayed polyurethane foam shall be metered to material supplier specifications through proportioning equipment, which provides thermostatically controlled material temperatures. Hoses between the proportioner and spray gun shall be temperature controlled.
 2. Refer to Environmental Limitations above. Foam shall not be applied when wind velocities exceed 15 miles per hour, as measured by a wind velometer, unless suitable wind barriers are employed.
 3. Surface texture of installed foam shall range from a smooth to medium coarse (orange peel) finish. Surface textures that may be defined as "popcorn" or "tree bark" are not acceptable.
 4. Tapering of foam to such items as parapet walls, vents, or roof mounted equipment, shall provide a relatively smooth transition to the roof deck, shall be of uniform cross-section thickness and shall meet all other foam surface texture requirements.
 5. Areas which fail to meet Specification requirements with respect to thickness and foam quality, shall be repaired and resprayed at the expense of the foam contractor.
 6. Areas shall be kept clear of traffic from other trades during and for 48 hours after completion of application.
 7. Mask off metal and other surfaces not to receive foam.
 8. Provide all procedures or means as required to prevent damage from fugitive overspray of polyurethane foam insulation. Caution shall be taken to protect those areas not to receive spray foam, including vehicles nearby.
 9. Application in lifts of 1/2" minimum to reach the specified thickness is required. The finished foam surface shall be of sufficient overall uniformity and pitch so as to have no gross ponded water. Foam thickness shall be a minimum thickness as specified on the roof plan for the horizontal roof surface and vertical surfaces.
 10. Minimum slope of 1/4" per foot is required.
 11. Where foam surface has been sanded, planed or trimmed, and surface skin removed, such areas shall be given two additional applications of coating at the rate of 1.5 gallons per 100 square feet per coat before applying normal base coat to entire area.
 12. Apply spray foam insulation in accordance with manufacturer's instructions.
- D. **Waterproofing and Protection System:**
1. **Fluid Applied Waterproofing:**
 - a. Spray-apply single component elastomeric membrane over insulation at a rate of 1-1/2 gallons per 100 square feet in one application.
 - b. Spray-apply final application of component elastomeric membrane at a rate of 1-1/2 gallons per 100 square feet.
 - c. Total dry thickness of acrylic elastomeric membrane, exclusive of aggregate, shall be a minimum of 25 mils.
 - d. Spray and back roll a fluid applied coating over all parapet walls and other vertical surfaces in three applications to yield 35 dry mil (4-1/2 gallons) thickness at vertical surfaces.
 2. **Aggregate:** Broadcast #6 aggregate at horizontal roof surfaces into final wet fluid membrane coat at a rate of 65 lbs. per 100 square feet. Terminate aggregate two feet back from drains, scuppers and drip edges.
 3. **DURAGARD Traffic Topping Surface:** Apply polymer modified cementitious **DURAGARD** roof topping into embedded aggregate at average 1/4" thickness to provide a tough, reflective final surface.
 4. No traffic shall be permitted on completed roof surface for minimum of two days.
 5. Clean all excess materials from roof area and project site.

- E. The roofing application shall be performed under manufacturer's supervision and manufacturer's "Duragard Letter of Compliance" shall be provided before substantial completion is approved indicating that all work has been performed in strict accordance with manufacturer's printed instructions and by an approved applicator.
- F. Roof system will be tested for specified physical properties of the polyurethane foam insulation and the waterproofing system. The Owner will pay for these tests.

3.4 **PROJECT CLOSEOUT**

- A. Submit warranty as specified in Paragraph 1.7 above.
- B. Provide manufacturer's "Duragard Letter of Compliance."
- C. Provide certification that product does not contain asbestos.

END OF SECTION 07545