

**SECTION 07 57 13
SPRAYED POLYURETHANE FOAM ROOFING**

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project. Also delete any other item or paragraph as required and renumber the paragraphs.
2. This roofing system is for application over structural concrete deck. If this system is considered for decks other than structural concrete, the manufacturers of the roofing materials should be consulted. This system should not be used on lightweight concrete, over cold storage areas or when other than light foot traffic is anticipated on the roof. Broomed finish should be specified for the concrete deck.
3. Use granules where appearance is important.

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies a roofing system consisting of a layer of sprayed in-place urethane foam roof insulation covered with two coats of silicone rubber protective coating //and surfaced with ceramic granules//.

//1.2 RELATED WORK:

- A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS.//

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

//B. Sustainable Design Submittals, as described below:

//1. Volatile organic compounds per volume as specified in
PART 2 - PRODUCTS. // //

C. Qualifications of manufacturers.

D. Qualifications of applicator.

E. Qualifications of inspector/testing agency.

F. Product data for spray polyurethane foam, protecting, coating, primers, sealants, walk pad, // ceramic granules //.

G. Manufacturer's Data: Showing complete instructions for installation.

//H. Samples: Ceramic Granules, // each color available // color as specified in Section 09 06 00, SCHEDULE FOR FINISHES.//

- I. Test Reports.
- J. Manufacturer warranty.

1.3 QUALITY ASSURANCE:

- A. Qualification of Manufacturer: Sprayed polyurethane foam roofing system manufacturer to have a minimum of five (5) years' experience in manufacturing sprayed polyurethane foam and elastomeric coating roofing products specified herein. Submit qualification.
- B. Qualification of Applicator: Roofing system applicator to be approved, authorized, or licensed in writing by the sprayed polyurethane foam roofing system manufacturer and to have a minimum of three (3) years' experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. Supply the names and locations of five (5) projects of similar size and scope that applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three (3) years. Submit qualifications.
- C. Inspector/Testing Agency Qualifications:
 - 1. Furnish services of inspector/testing agency that conforms with the criteria contained in ASTM E699 for agencies involved in quality assurance with a minimum of two (2) years' experience in construction field inspections of sprayed polyurethane roofing systems, products, and assemblies.
 - 2. Furnish inspection services that are completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector/testing agency qualifications.

1.4 DESIGN REQUIREMENTS:

- A. Fire Safety: Complete roof covering assembly to comply with the following:
 - 1. ASTM E108, Class A or UL 790, Class A classification; and
 - 2. Listed as part of Fire-Classified roof deck construction in UL Bld Mat Dir, or Class I roof deck construction in FM APP Guide. UL approved components of the roof covering assembly are to bear the UL label.
- B. Wind Uplift: Provide complete roof covering assembly rated Class // // in accordance with FM APP GUIDE capable of withstanding an uplift pressure of as determined by ASCE 7 and FM DS 1-49 for perimeter and flashing attachment.

//C. Energy Performance: Initial Solar Reflectance Index of not less than // 78 // // 29 // when calculated according to ASTM E1980 based on the testing of identical products by a qualified testing agency.//

1.5 WARRANTY:

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their sprayed polyurethane foam for a minimum of five (5) years // // from date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.6 DELIVERY AND STORAGE:

- A. Deliver materials to the job site in their original unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents.
- B. Store materials in clean, dry areas, away from excessive heat, sparks, and open flame.
- C. Ventilate storage areas to prevent build-up of flammable gases.

1.7 COORDINATION:

- A. Coordinate roofing operations with the work of other trades and with sheet metal work so that flashings are installed to permit continuous roofing operations.

1.8 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. ASTM International (ASTM):
 - C177-13.....Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - C920-14a.....Elastomeric Joint Sealants
 - C1029-13.....Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
 - D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-Tension
 - D1622/D1622M-14.....Test Method for Apparent Density of Rigid Cellular Plastics
 - D2240-05(R2010).....Rubber Property-Durometer Hardness

- D4263-83(R2012).....Test Method for Indicating Moisture in Concrete
by the Plastic Sheet Method
- D5469/D5469M-12.....Guide for Application of New Spray Applied
Polyurethane Foam and Coated Roofing Systems
- D6694/D6694M-08(R2013)..Liquid-Applied Silicone Coating Used in Spray
Polyurethane Foam Roofing Systems
- E84-14.....Test Method for Surface Burning Characteristics
of Building Materials
- E108-11.....Test Methods for Fire Tests of Roof Coverings
- E699-09.....Evaluation of Agencies Involved in Testing,
Quality Assurance, and Evaluating of Building
Components
- E1980-11Calculating Solar Reflectance Index of
Horizontal and Low-Sloped Opaque Surfaces
- C. American Society of Civil Engineers (ASCE):
ASCE 7-10.....Minimum Design Loads for Buildings and Other
Structures
- D. Factory Mutual System (FM):
App Guide.....Latest Edition Approval Guide including
Supplements
- DS 1-49.....Roof Perimeter Flashing
- E. National Roofing Contractors Association (NRCA):
RoofMan.....Quality Control Guidelines in the Application
of Polyurethane Foam Roofing
- F. Underwriters Laboratories, Inc. (UL):
790-08(R2014).....Test Methods for Fire Tests of Roof Coverings
Bld Mat Dir(2012).....Building Materials Directory
- G. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission
Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 MATERIALS:

SPEC WRITER NOTE: Use R value at 5.56 per
25 mm (1 inch) for calculating thickness
required.

- A. Primer: Polyurethane foam manufacturer's standard factory-formulated
primer for substrate to be covered.
- B. Urethane Foam:

1. ASTM C1029, Type III.
 2. Thermal Conductivity conforming to ASTM C177.
 3. Comply with ASTM D6694.
 4. In-Place Density: ASTM D1622, 44.9 to 48.1 kg/cu. m (2.8 to 3.0 lb./cu. ft.).
 5. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 75 or less.
- C. Elastomeric Protective Coating: Silicone rubber, two-coat system (base coat of dark color and top coat of light color), specifically formulated to bond to urethane foam and have the following properties:

PROPERTY	ASTM TEST METHOD	VALUE
Tensile Strength	D412	3.8-6.5 MPa (550 - 650 psi)
Elongation, percent (of original benchmark distance)	D412	150 - 200
Hardness (points)	D2240	65

- //D. Ceramic Granules: No. 11 screen size, color as selected in construction documents, dry and free from dust.//
- E. Sealant: ASTM C920, Class 25, Use NT, Grade NS // Type M, multicomponent urethane // // Type S, one-component, neutral- or acid-curing silicone //, and as recommended by coated foamed roofing manufacturer for substrate and joint conditions and for compatibility with roofing materials.
- //1. Sealant to have a VOC content of // 250 // // // g/L or less when calculated according to 40 CFR 59, (EPA Method 24). //
- F. Walkpads: Breathable UV stabilized material as recommended by the roof system manufacturer, minimum 0.91 m by 1.2 by 8 mm (3 ft. by 4 ft. by 5/16 inch).

PART 3 - EXECUTION

3.1 GENERAL:

- A. Installation to comply with the manufacturer's instructions, except as otherwise specified.

SPEC WRITER NOTE: The allowable
coefficient of heat transmission or

U-value, will be inserted in the blank space. Roof slope should be obtained by sloping the structural deck. When slope is accomplished by varying the thickness of insulation, delete the last sentence of the paragraph and substitute "The U-value is to be based on the average thickness of the insulation".

3.2 THICKNESS OF INSULATION

- A. Thickness of insulation: Provide a coefficient of heat transmission or U-value, of // //.
- B. Use R factor of 0.38/cm (5.56 per inch) of the insulation in the computation of the overall R value.
- C. The minimum thickness of insulation:
 - 1. 25 mm (1 inch) on common roof areas.
 - 2. 13 mm (1/2 inches) at drains.

3.3 PREPARATION:

- A. Surfaces to receive elastomeric roofing: Dry and free of loose coatings, surface curing agents, wax or other contaminants.
- B. Prime substrate as recommended by foam roofing manufacturer.
- C. Where foam roofing is being installed over concrete substrate, test for capillary moisture by plastic sheet method according to ASTM D4263 at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet.
- D. Wear clean, soft-soled sneaker-type shoes.

3.4 PROTECTION OF ADJACENT SURFACES:

- A. Protect surfaces near roofing operations from spray or roofing materials. Secure and vent protective coverings to prevent collection of moisture on covered surfaces. Provide protective barriers when spraying along open roof edges and walls to prevent uncontrolled overspray. Restore or replace surfaces damaged by roof system products to the satisfaction of the Contracting Officer Representative (COR) at no additional expense to the Government.

3.5 INSTALLATION OF INSULATION:

- A. Comply with requirements and recommendations of ASTM D5469/D5469M and NRCA Roof Man.
- B. Spray foam on the prepared surface in 13 mm (1/2-inch) lifts. Time between lifts to not exceed 4 hours.

- C. The finished surface to be smooth, free of voids blisters and crevices and free draining.
- D. Extend foam up walls and around roof projections to form cants and flashings that terminate at least 50 mm (2 inches) above finished roof surface.
- E. Cured foam: Free from water, dust, oils and other materials which would impair adhesion of the protective coating.
- F. No foam is to be allowed to stand overnight without a base protective coating. Cure foam at least one hour before application of protective coating.
- G. Correct locations of non-adherence of foam to substrate and finish pinholes flush with an approved sealant before final coating is applied.
- H. Do not overspray to correct an unacceptable surface condition.
- I. The finished roof surface to not vary more than 13 mm (1/2 inch) when measured with a 3048 mm (10 foot) straight edge parallel and perpendicular to the roof slope. Finished roof surface to have no ponding low spots and provide for free drainage of the roof area.
- J. Remove and replace polyurethane foam not complying with specified limitation. Remove defective thickness, prepare, and reapply polyurethane foam with acceptable, uniform results.

3.6 PROTECTIVE COATING:

- A. Allow polyurethane form to cure for a minimum of two (2) hours before applying protective coating.
- B. Coating to consist of a base coat and a top coat.
- C. Clean base coat exposed for more than 24 hours with a detergent solution, thoroughly rinse and dry, then give another covering of base coating before applying the top coat.
- D. No traffic allowed on finished areas for 24 hours after installation.
- E. Base coat to have a dry film thickness of not less 0.2 mm (8 mils).
- F. Coating to completely cover the foam and extend up vertical surfaces two inches beyond foam.
- G. Coating to be dry and clean before application of top coat.
- H. Top coat applied at right angles to the directions of the base coat application and to fully cover the base coat.
- I. Total dry film thickness to be not less than 0.5 mm (20 mils).
- //J. Granules:

1. Apply within five minutes of top coat application, using pressure equipment, at a rate of 2.4 kg per sq. m (50 pounds per 100 sq. ft.).
2. Apply a minimum of two passes made at right angles to each other.
3. Finished granule system to be uniform over entire surface with no apparent void areas.//

K. Service Walkpads:

1. Install roof walkways in pattern and locations indicated on construction documents.
2. Apply after the protective coating system has been completed and cured unless recommended otherwise by the manufacturer.
3. Adhere walkway pads to substrate with compatible adhesive according to coated foamed roofing manufacturer's written instructions.

3.7 EQUIPMENT CALIBRATION:

A. Spray equipment for two-component system:

1. Calibrated each day at start of operations and;
 - a. After each restart if spraying operations have been terminated for more than one (1) hour.
 - b. Whenever there is a change in fan pattern or pressure.
 - c. Whenever slow curing areas are noticed.
 - d. Whenever a change is made in hose length or working height and after change-over between materials.

B. Calibration to consist of demonstrating to COR that the equipment is adjusted to deliver component in the proper proportions.

3.8 FIELD QUALITY CONTROL:

A. Inspector/Testing agency to perform tests for product characteristics specified for the following frequencies:

1. Two (2) core samples will be required for roof areas up to 929 sq. m (10,000 sq. ft.), and one (1) core sample will be required for each additional 929 sq. m (10,000 sq. ft.) or part thereof. Submit lab tests to verify thickness conditions and material properties, including compressive strength, density, and cell structure by test methods outlined in ASTM D5469/D5469M.
2. Six (6) slit-test samples will be required for each 929 sq. m (10,000 sq. ft.) of roof area to determine, as a minimum, the number of coats applied and dry film thickness of coating. Submit results.

B. Testing agency to verify that surfaces slope to drain.

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