Spray Polyurethane Foam
for
Exterior Subgrade
Thermal and Moisture Protection

RECOMMENDED
DESIGN CONSIDERATIONS
AND GUIDE SPECIFICATIONS

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The mission of the Technical Committee is to provide a wide range of technical service to the Spray Polyurethane Foam industry such as, but not limited to:

1. Review existing documents and serve as a clearing house to ensure the "Continuity of Value" of technical information published by SPFA and others concerning the products and services of the SPF industry;
2. Review, research, develop and issue documents concerning new products, systems and services AND
3. To identify, explore, develop and communicate an understanding of technical issues facing the SPF industry.

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DESIGN CONSIDERATIONS

GENERAL CONSIDERATIONS

The performance of a spray applied polyurethane foam (SPF) thermal and moisture protection system can be affected by all the component parts of a foundation structure.

Building Codes may not approve the installation of foam plastics on building exteriors below grade in areas where termite infestation is considered "very heavy." Check with local building code authorities for the applicability of applying SPF below grade in your area.

Structural design, specification review, contractor and material selection, coupled with the compatibility and positioning of the various structural components, are necessary to produce a successful SPF thermal and moisture protection system.

The specifier should consult with the respective material suppliers and the contractor to receive written confirmation of their agreement to all facets of the thermal and moisture protection system.

There must be sufficient space in the trench to allow a minimum of 760 mm (2.5 feet) distance from the spray gun to the substrate wall. (Note: 1200 mm [4 feet] minimum space from the substrate wall to the trench wall should be sufficient).

DETERMINING SPF INSULATION THICKNESS

Determine the minimums for each of the situations described below and choose the method which prescribes the greatest insulation thickness:

1. Building and Energy Codes: Most code agencies require certain buildings to meet energy conservation standards. Check with local code authorities for requirements.

2. Condensation Control: Condensation can occur inside a building or a building cavity when a surface temperature is lower than the dew point of the air. SPF Insulation thickness to control this condensation must be based on the design dew point and the design exterior ambient temperature. See SPFA publication AY-118, "Moisture Vapor Transmission."

3. Economic Thickness: Greater insulation thickness decreases heat and cooling costs and the cost of HVAC equipment. An economic thickness calculation determines the added incremental insulation thickness, which meets a specified return on investment from energy cost savings. See *ASHRAE Handbook of Fundamentals*. The insulation contractor or supplier may also be able to assist in determining economic thickness.

4. Minimum Practical Thickness: SPF applications must be sprayed to a minimum thickness to uniformly cover the substrate and to achieve suitable physical properties. For relatively smooth substrates the minimum practical thickness is 25 mm (one inch) but corrugated or unusual substrate configurations may require greater thickness to achieve a suitable finished foam surface.

SURFACE PREPARATION

SPF can successfully be applied to most surfaces. However, the following general practices must be observed.

1. GENERAL SURFACE PREPARATION PROCEDURES

   A. The building assembly must be secure against delamination and movement that could affect the performance of the SPF thermal and moisture protection system.

   B. There must be full adhesion between the SPF and the substrate. Prior to application of SPF, the foundation wall must be dry and free of loose dirt or any contaminants that may interfere with adhesion.

2. WOOD FOUNDATION WALLS

   A. Priming may be required to achieve maximum adhesion of the SPF.

3. MASONRY AND CONCRETE FOUNDATION WALLS

   A. Concrete surfaces must be dry and free of laitance, release agents, and other contaminants that could affect the adhesion of SPF.

   B. Primers are typically not required on raw masonry or concrete; however, primers may be required under special circumstances.

SELECTION OF PRIMER

If circumstances require a primer, it should be considered in accordance to the type substrate to be sprayed, the intended end use of the wall assembly, and the recommendations of the spray polyurethane foam and/or primer manufacturer.

SELECTION OF A VAPOR RETARDER

If a vapor retarder is required, its selection should be based on the following criteria:

1. Perm rating required (based on moisture vapor drive and perm ratings of other components).

2. Compatibility with adjoining materials.

3. Manufacturer's recommendation.

SELECTION OF THE SPRAY POLYURETHANE FOAM SYSTEM

A wide range of SPF systems are available in various densities, each exhibiting different temperature limitations and physical properties.

Most published data is run on laboratory produced samples. The thickness of polyurethane foam sprayed, number of passes, temperature of substrate, ambient temperatures, etc., has a pronounced effect on all properties.

From a fire safety standpoint, SPF can be used safely. It is important, however, that all persons associated with the design, fabrication, storage and installation understands the materials and environments involved.

Polyurethane foam insulation is combustible and should be treated as such. Flame spread ratings provided for polyurethane products using small scale tests are not intended to reflect the hazards presented by this or any other materials under actual fire conditions. Care must be taken to ensure that the foam is not exposed to temperatures in excess of 93 °C (200° F).

SELECTION OF WATERPROOFING

SPF is resistant to water intrusion; however, under circumstances such as high water tables, water could accumulate in the SPF. If these circumstances are anticipated, waterproofing is recommended. Waterproofing must form a water resistant protective membrane over the SPF.

RECOMMENDED GUIDE SPECIFICATION FOR SUBGRADE THERMAL AND MOISTURE PROTECTION

This guide discusses the application of seamless sprayed-in-place polyurethane foam (SPF) for use as a subgrade thermal and moisture protection system. Your contractor, systems manufacturer, and local code agencies can assist you, as each project must be assessed individually.

PART 1 — GENERAL

SCOPE OF WORK

Furnish all labor, materials, tools and equipment necessary for the application of a spray-polyurethane-foam subgrade thermal and moisture protection system, including accessory items, subject to the general provisions of the contract.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A.	Cast-In-Place Concrete	Section 03300
B.	Masonry Construction	Section 04200
C.	Rough Carpentry	Section 06100
D.	Foundation Drainage	Section 02710
E.	Waterproofing	Section 07700
F.	Insulation	Section 07200

1.03 QUALITY ASSURANCE

Contractor Qualifications: The contractor should provide information concerning projects similar in nature to the one proposed, including location and person to be contacted. Some manufacturers of SPF systems have approval programs and/or licensing methods that could be applicable.

1.04 SUBMITTALS

A. Manufacturers to provide published data sheets or letter of certification that their products comply with the materials specified. This is to include primers (if required), SPF, and waterproofing.
B. Shop drawings on specific foundation and footer terminations.
C. Manufacturer's application or installation instructions.
D. Contractor/applicator certification from SPF manufacturer or other evidence of contractor qualification and experience. See Section 1.03.
E. Safety and handling instructions for storage, handling and use of the materials to include Materials Safety Data Sheets (MSDS).
F. Field Quality Control Procedures to be utilized by the contractor/applicator to ensure proper preparation and installation of SPF and protective coating, detail work and follow-up inspection.

1.05 MATERIALS, DELIVERY AND STORAGE

A. Materials shall be delivered in the manufacturers original, tightly sealed containers or unopened packages, all clearly labeled with the manufacturer's name, product identification, safety information and batch or lot numbers where appropriate.
B. Containers shall be stored out of the weather and direct sun, where the temperatures are within the limits specified by the manufacturer.
C. All materials shall be stored in compliance with local fire and safety requirements.

1.06 ENVIRONMENTAL CONDITIONS

Do not apply the SPF below the temperature or above humidity specified by the manufacturer.

1.07 SEQUENCE AND SCHEDULING

The SPF is installed when the foundation walls and penetrations have been completed. Subsequent penetrations must be resealed. There should not be any other trades working in the immediate area when SPF and waterproofing are being installed.

1.08 SAFETY REQUIREMENTS

A. See API Bulletin AX-119, *"MDI-Based Polyurethane Foam Systems: Guidelines for Safe Handling and Disposal."*
B. Refer to appropriate Material Safety Data Sheets (MSDS) for additional safety information.
C. Proper disposal of waste materials and containers must be done in compliance with the manufacturer's guidelines and/or federal, state and local regulatory agencies.
D. See OSHA 29 CFR 1926 "Safety and Health Regulations for Construction."

PART 2 — PRODUCTS

2.01 SPRAY POLYURETHANE FOAM

The polyurethane foam to be applied shall be a two component system made by combining an isocyanate (A) component with a polyol (B) component and shall possess the following physical characteristics:

PROPERTIES (Sprayed in Place)	ASTM TEST	SI UNITS	US UNITS
Density	D-1622	48 kg/m^3	1.5 - 3.0 lbs/ft^3
Compressive Strength	D-1621	100 kPa (min.)	15 lb/in^2 (min.)
Closed Cell Content	D-2856	90% (min.)	90% (min.)
R-Value °F•hr•ft^2/Btu	C-177, C-236, or C-518	1.1 K•m^2/W (min.)	6.0
Smoke*	E-84	< 450	< 450

***This standard is used solely to measure and describe properties of products in response to heat and flame under controlled laboratory conditions. This numerical flame spread rating is not intended to reflect hazards presented by this or any over material under actual fire conditions.**

2.02 WATERPROOFING

The waterproofing must be suitable for below grade application.

2.03 RELATED PRODUCTS

A. Drainage board, if specified, can be applied to the finished surface.
B. Protection board, if specified, to protect the finished installation prior to back filling.
C. Substrate primer, if required, shall be as recommended by the manufacturer of the SPF specified.

PART 3 — EXECUTION

3.01 APPLICATION OF PRODUCTS

The products intended for use in the building envelope insulation system must be applied within the manufacturer's guidelines for temperature, humidity, and other atmospheric conditions. They must be sequenced so as to take into consideration substrate preparation, proper cure times, and inter‐coat adhesion.

3.02 SUBSTRATE CONSIDERATION AND PREPARATION

A. Concrete/Masonry
   1. Remove loose dirt, dust, debris, or other contaminants prior to the application of the thermal and moisture protection system.
   2. If priming is required, the primer shall be applied in accordance with Section 3.03.

B. Wood
   1. Plywood shall contain no more than 18% water, as measured in accordance with ASTM D4449.
   2. Priming may be required to achieve maximum adhesion of the SPF. If required, apply in accordance with Section 3.03.
   3. The surface shall be free of contaminants prior to primer or SPF application.

3.03 PRIMER APPLICATION

When required, the primer shall be applied to the properly prepared substrate in accordance with the manufacturer's guidelines

3.04 SPRAY POLYURETHANE FOAM APPLICATION

A. Inspection
   1. Prior to the application of the SPF, the substrate surface shall be inspected to insure that conditions required by Sections 3.02 and 3.03 have been satisfied.
   2. Verify that temperature, humidity and other atmospheric conditions are within the SPF manufacturer's guidelines for the application of SPF.

B. Application
   1. The SPF components (A) and (B) shall be processed in accordance with the manufacturer's instructions.
   2. The SPF shall be sprayed in minimum 13 mm (1/2 inch) thick passes with the overall thickness to be a minimum of ____ mm (inches). The full thickness of SPF to be applied within any given area should be completed in one day.
   3. The SPF total thickness will be a minimum of 25 mm (one inch) or more if specified. The SPF shall be applied uniformly over the entire surface with a thickness tolerance of plus 7 mm per 25 mm (1/4" per inch) of specified thickness, minus zero.

4. Foamed in place fillets shall be smooth and uniform to allow positive drainage at the intersection of the foundation wall and the footing.
5. SPF shall be terminated in a clean, neat line.

C. Surface Finish
1. The final SPF surface shall be "smooth," "orange peel," "coarse orange peel," or "verge of popcorn." SPF surfaces designated as "popcorn" or "treebark" are not acceptable. These areas shall be removed and refoamed to an acceptable surface texture.
2. Damage or defects to the SPF surface shall be repaired prior to the application of the waterproofing.

3.05 WATERPROOFING APPLICATION

A. The SPF surface shall be free of contaminants that would impair the adhesion of the waterproofing.

B. The waterproofing shall be applied to all SPF surfaces and extended two (2) inches above the foam termination line.

C. Waterproofing shall be applied to achieve a minimum dry film thickness of ___ mm (mils).

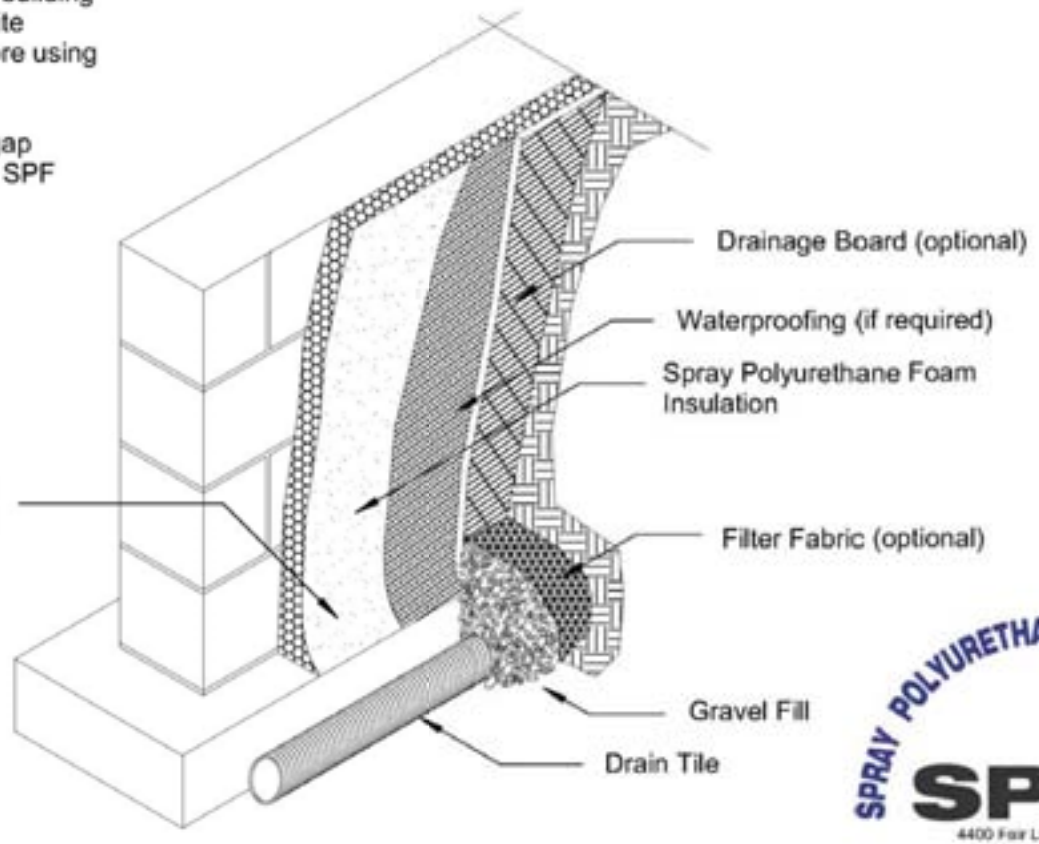
D. The waterproofing shall be allowed to fully cure prior to the installation of the protective board and backfill.

EXTERIOR SUBGRADE SPF
THERMAL & MOISTURE PROTECTION

Notes:

1. Check with your local building authority regarding termite infestation potential before using this detail.

2. Leave an inspection gap (6 inches min.) between SPF and wood framing.



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