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USACE / NAVFAC / AFCEC / NASA **UFGS-07 27 36 (August 2023)**

Preparing Activity: NAVFAC **Superseding:**
UFGS-07 27 36 (May 2017)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

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08/23

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SECTION 07 27 36

SPRAY FOAM AIR BARRIERS
08/23

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NOTE: This guide specification covers the requirements for open cell and closed cell sprayed polyurethane foam (SPF) materials used in wall, ceiling, and roof assemblies. The spray foam barrier may serve one or more of the following functions: 1) as a thermal barrier, 2) a vapor barrier, and 3) as the primary component of the air barrier. The designer must determine whether a vapor permeable or a vapor retarding system is appropriate for the project.

If a vapor permeable barrier is required, do not use a closed cell SPF system. While open cell can be vapor permeable, it is not appropriate for use in humid site locations or building environments. Open cell SPF is only appropriate for use in arid climates, in well vented assemblies, where vapor permeability is permissible. Open cell SPF is cost effective and less toxic than closed cell SPF but has very limited appropriate use; specify accordingly. Closed-cell foam is water-resistant. In applications where the insulation may be in contact with water (below-grade or exterior applications), only closed-cell foam should be used.

Compatibility with other materials and components are critical to the success of the air barrier. Coordinate with other building enclosure components (such as wall assemblies, doors, and windows) to ensure a complete barrier system that meets assembly and system air leakage requirements. Coordinate with products and systems that will penetrate the air barrier such as flashing, embedded items, and ties for brick veneer.

Use this section in conjunction with Section 07 27 10 BUILDING AIR BARRIER SYSTEM and Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING and coordinate requirements across these sections. Also coordinate

this section with products and systems that will penetrate the air barrier such as flashing, embedded items, and ties for brick veneer.

This guide specification is intended for both new construction and renovation, repair, and retrofit of existing buildings. Performance requirements for products herein must contribute to the sustainable goals of the project, including but not limited to Energy Policy Act of 2005 (EPACT 2005), Energy Independence and Security Act of 2007 (EISA 2007), Executive Order (EO) 14057, UFC 1-200-02 High Performance and Sustainable Building Requirements, UFGS Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, and other energy and water conservation requirements applicable to the project.

Specify SPF where the type of construction favors its economical use and where application would be less difficult than other air/vapor/thermal barrier applications. Due to the toxic and flammable nature of this product, specify it when the benefits of SPF surpass the benefits of other barrier systems. Coordinate encapsulation of the SPF application as required for the project and in accordance with architectural details. Follow strategies related to safe SPF Applications and specify accordingly. EPA has a tool to assist in identifying safe practices and technologies; this document can be found at: https://www.epa.gov/saferchoice/self-evaluation-tool-professional-spray-polyurethane-foam-contractors-and-project.

Do not use Section 07 11 13 BITUMINOUS DAMPPROOFING in conjunction with this section.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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NOTE: The use of SPF must meet the Flame Spread (FS) and Smoke Developed (SD) index requirements for insulation in accordance with UFC 3-600-01 Fire Protection Engineering for Facilities. FS and SD

ratings must be no higher than 75 for FS and 150 for SD when tested in accordance with ASTM E84 (NFPA 255) or UL 723. The SD rating is more stringent than Class A ratings indicated in NFPA 101 or IBC and most SPF vendors cannot meet it. However, this UFC allows exceptions to these limits in certain types of installations and construction types. Exceptions are described in paragraphs directly below the primary paragraph in this UFC titled "Insulation" and the subparagraphs therein. For applications where these values are required, the product can still be used, however, it requires the addition of a thermal or an ignition barrier to encapsulate it. Thermal barriers are described in IBC Chapter 26 "Plastics." When such barriers are required, choose bracketed items throughout this specification section accordingly.

IBC includes requirements for the location within wall cavities of class I, II and III vapor retarders depending on the project's climate zone to avoid condensation within wall assemblies. See IBC Section 1404.3, and the International Energy Conservation Code (IECC) referenced by this section of the IBC, coordinate dewpoint with mechanical design, and specify type and location within the cavity accordingly. Also verify the cavity is sized to accommodate the barrier thickness required to provide the specified R-Value plus a minimum 25 mm one inch air space. R-value must reflect compliance with energy requirements of IgCC and ASHRAE 90.1 as mandated by UFC 1-200-02 High Performance and Sustainable Building Requirements.
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NOTE: Determine minimum required R-values and calculate the insulation thickness based on the aged R-value of 6.24 per 25 mm one inch thickness for closed cell SPF and 3.8 per 25 mm one inch for open cell SPF.

On the drawings, show:

1. Locations, type and permeance of barriers, retarders and insulation required.

2. Transitions between various materials of the building air barrier system.

3. Thermal resistance (R-value) and U-factor for each assembly and location. Provide long term thermal resistance (LTTR) values if available.

4. Locations of interfaces of SPF with other insulation systems, air barriers, and vapor retarders if applicable. Clearly define transition and sealing requirements between systems.
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NOTE: Ventilation

1. Provide net, unobstructed ventilation areas recommended by ASHRAE Handbook of Fundamentals, Chapter 21, 29 CFR 1910, 29 CFR 1926, and as follows:

2. For insulation of cathedral-type ceilings, provide at least a 50 mm 2 inch gap between upper face of barrier and underside of roof sheathing. Provide ventilation openings at bottom and top of ventilated cavity; show on drawings.

3. OSHA requires engineering controls to be used to reduce exposures to isocyanates (29 CFR 1910.1000 and 29 CFR 1926.55 - Air contaminants) which is the major component of SPF. Coordinate requirements accordingly:
http://www.osha.gov/dep/greenjobs/weather_ventilation.html

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NOTE: Specific Safety Plans

1. Spontaneous combustion from exothermic heat build-up of SPF components during curing can occur when SPF is applied at pass thicknesses exceeding those defined in the manufacturer installation instructions. Require a written jobsite fire prevention plan; see Safety Provisions herein.

2. Due to the potential health hazards associated with installation of SPF systems, personal protective equipment (PPE) requirements are critical to worker protection. Require a respirator plan for SPF installation; see Safety Provisions herein.

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically

be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

ABAA Accreditation	Accreditation

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2	(2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems
ASSP Z88.2	(2015) American National Standard Practices for Respiratory Protection

ASTM INTERNATIONAL (ASTM)

ASTM C518	(2021) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C1029	(2020) Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
ASTM C1060	(2011a; R 2015) Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
ASTM C1153	(2010; R 2015) Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging
ASTM C1303/C1303M	(2022) Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
ASTM C1338	(2019) Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D1622	(2020) Apparent Density of Rigid Cellular Plastics
ASTM D1623	(2017) Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid

	Cellular Plastics
ASTM D2126	(2020) Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2842	(2019) Water Absorption of Rigid Cellular Plastics
ASTM D4541	(2022) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D6226	(2021) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2022a; E 2023) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E119	(2022) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E283/E283M	(2019) Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E736/E736M	(2019) Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E2178	(2021a) Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials
ASTM E2357	(2018) Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies

INTERNATIONAL CODE COUNCIL (ICC)

ICC 1100	(2019) Standard for Spray-applied Polyurethane Foam Plastic Insulation
ICC IBC	(2021) International Building Code
ICC IECC	(2021) International Energy Conservation Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022; ERTA 1 2021) Standard for Portable Fire Extinguishers
NFPA 31	(2020) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2021) National Fuel Gas Code
NFPA 70	(2023) National Electrical Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 268	(2022) Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
NFPA 275	(2022) Standard Method of Fire Tests for the Evaluation of Thermal Barriers
NFPA 285	(2023) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components

SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

SPFA TechDocs	(2015) SPFA Technical Documents Library, four categories: General, Insulation, Roofing, Specialty

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 6, 2021) Fire Protection Engineering for Facilities

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.132	Personal Protective Equipment
29 CFR 1910.133	Eye and Face Protection
29 CFR 1910.134	Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

UL 723	(2020) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

1.2 RELATED REQUIREMENTS

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NOTE: Include the first bracketed option and include Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING when airtightness testing of the air barrier is required by UFC 3-101-01. Include the other air barrier UFGS sections when those types of air barriers are in the project.
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Coordinate the requirements of Section 07 27 10 BUILDING AIR BARRIER SYSTEM[, Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING][, Section 07 27 19.01 SELF-ADHERING AIR BARRIERS,][SECTION 07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS,] and other building envelope sections to provide a complete air barrier system. Submit all materials, components, and assemblies of the air barrier system together as one complete submittal package.

1.3 DEFINITIONS

1.3.1 Long Term Thermal Resistance (LTTR)

The thermal resistance value of a closed cell foam insulation product measured using accelerated aging ASTM C1303/C1303M equivalent to the time-weighted average thermal resistance value over 15 years. Loss in thermal resistance is attributable to changes in cell gas composition caused by diffusion of air into and blowing agent out of the foam cells.

1.3.2 SPFA TechDocs

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NOTE: SPFA technical documents include definitions common to the industry. For a complete list of TechDocs, see https://www.sprayfoam.org/SPFA_techdocs
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Reformatted documents, named SPFA TechDocs (https://www.sprayfoam.org/SPFA_techdocs), is a repository of technical information containing common definitions used in this Section. The site is organized in four categories for easy reference and identification: Roofing, Insulation, Specialty and General.

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NOTE: Choose bracketed vapor below when using closed cell SPF.
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Spray Polyurethane Foam: Thermal and air[/vapor] barrier system consisting of sprayed polyurethane foam (SPF).

1.4 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification

technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualification of Manufacturer; G[, [_____]]

Qualification of Installer; G[, [_____]]

Quality Control Plan; G[, [_____]]

Safety Plan; G[, [_____]]

Fire Prevention Plan; G[, [_____]]

Respiratory Protection Plan; G[, [_____]]

SD-02 Shop Drawings

Spray Foam Air Barrier System Shop Drawings

Fire-Rated Assemblies; G[, [_____]]

SD-03 Product Data

Blowing Agents; G[, [_____]]

[Closed Cell SPF; G[, [_____]]

][Open Cell SPF; G[, [_____]]

] Transition Membrane; G[, [_____]]

Primers, Adhesives, and Mastics; G[, [_____]]

Sealants; G[, [_____]]

Safety Data Sheets; G[, [_____]]

[Thermal Barrier Materials; G[, [_____]]

][Ignition Barrier Coatings; G[, [_____]]

] Accessories; G[, [_____]]

[Recycled Content for Closed Cell Spray Foam Air Barrier; S

][Recycled Content for Open Cell Spray Foam Air Barrier; S

] SD-04 Samples

Spray Foam Air Barrier Mockup; G[, [_____]]

SD-06 Test Reports

Mockup Peel Adhesion Test; G[, [_____]]

Thermographic Test; G[, [_____]]

Air Barrier Test; G[, [_____]]

[Fire-Ratings Of [Thermal][Ignition] Barrier Materials; G[, [_____]]

] Flame Spread and Smoke Developed Index Ratings of SPF Products; G [, [_____]]

Flame Propagation of Wall Assemblies; G[, [_____]]

Site Inspections Reports; G[, [_____]]

SD-07 Certificates

Indoor Air Quality for Spray Foam Air Barrier; S

SD-08 Manufacturer's Instructions

SPF Handling, Storage, and Spray Procedures; G[, [_____]]

Substrate Preparation; G[, [_____]]

[Thermal Barrier; G[, [_____]]

][Ignition Barrier; G[, [_____]]

] Transition Membrane Manufacturer's Installation Instructions; G[, [_____]]

Manufacturer's Printed Installation Instructions for Primers, Adhesives, and Mastics; G[, [_____]]

SD-09 Manufacturer's Field Reports

Core Samples; G[, [_____]]

Daily Work Record; G[, [_____]]

Visual Inspection and Thermal Scanning; G[, [_____]]

1.5 MISCELLANEOUS REQUIREMENTS

For the spray foam air barrier system provide the following:

1.5.1 Shop Drawings

Submit spray foam air barrier system shop drawings showing locations, detailing, and extent of spray foam air barrier assemblies. Provide details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings. Provide details for fire-rated assemblies and indicate materials for [thermal barriers][ignition barriers]. Show details for bridging of gaps in construction, treatment of inside and outside corners, expansion joints, methods of attachment of materials covering the SPF without compromising the barrier. Indicate how miscellaneous penetrations such as conduit, pipes, electric boxes, brick ties, and similar items will be sealed.

1.5.2 Product Data

Submit manufacturer's technical data indicating compliance with performance and environmental requirements, manufacturer's printed instructions for evaluating, preparing, and treating substrates, temperature and other limitations of installation conditions, safety requirements for installation, and Safety Data Sheets. Indicate flame and smoke spread ratings for all products. Submit [thermal barrier][ignition barrier] literature including material description, physical properties, fire-ratings, and manufacturer's printed installation instructions. Also include manufacturer's printed installation instructions for primers, adhesives, and mastics.

1.5.3 Mockup

Provide a spray foam air barrier mockup of each foam system specified. Apply foam in an area designated by the Contracting Officer. Apply an area of not less than 5 square meters 50 square feet. Include all components specified for the finished assembly including primers, support components, expansion and contraction joints,[ignition barriers,][thermal barriers,] and other accessories as representative of the complete system. Isolate the area and protect workers as required by 29 CFR 1910.132, 29 CFR 1910.133 and 29 CFR 1910.134. Notify the Contracting Officer a minimum of 48 hours prior to the test application. Select a test area representative of conditions to be sprayed including window or door openings, wall to ceiling transitions, flashings, and penetrations, as applicable.

1.5.4 Test Reports

Submit test reports indicating that mockup peel adhesion tests on all materials have been performed and the changes made, if required, in order to achieve successful and lasting adhesion. Submit test reports for flame spread and smoke developed index ratings of SPF products tested in accordance with ASTM E84 or UL 723. Submit test reports for flame propagation of wall assemblies tested in accordance with NFPA 285.[Submit test reports for fire-ratings of [thermal][ignition] barrier materials tested in accordance with ASTM E84 or UL 723.]

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Inspect materials delivered to the site for damage; unload and store out of weather. Deliver materials to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand designation, description of contents, and shelf life of containerized materials. Store and handle to protect from damage. Submit SPF Handling, Storage, and Spray Procedures in accordance with submittal procedures.

1.6.2 Storage

Store materials in clean, dry areas, away from excessive heat, sparks, and open flame. Maintain temperatures in the storage area below the materials' flash point(s) and within limits recommended by the manufacturer's printed instructions. Provide ventilation in accordance with ASSP Z9.2 to prevent build-up of flammable gases. Store all chemicals in locations that limit the risk of contact with water, acids, caustics (such as lye), alcohols, and strong oxidizing and reducing agents.

1.6.3 Handling

Handle materials and containers safely and in accordance with manufacturer's recommendations. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials. Do not expose foam component containers to direct sunlight. Containers exposed to long periods of cold may also exhibit separation and poor performance. Do not use materials from containers with content temperatures exceeding limits specified in the manufacturers installation instructions.

Mark and remove from job site all chemicals which have been contaminated with moisture, that exceed shelf life limits, or that have been exposed to temperature extremes.

1.6.3.1 Venting and Handling of Material Containers

Partially unscrew material container and drum caps to gradually vent the containers prior to opening. Do not inhale vapors. Follow drum decontamination and disposal procedures recommended by the manufacturer or the American Chemistry Council's Center for the Polyurethanes Industry.

1.7 MOCKUP PEEL ADHESION TEST

Perform a field peel adhesion test on the construction mockup. Test the SPF for adhesion in accordance with ASTM D4541 Method B using a Type II pull tester except use a disk that is 57 mm 2.25 inches in diameter and cut through the foam to separate the material attached to the disk from the surrounding material. Perform test after curing period in accordance with manufacturer's written recommendations. Record mode of failure and area which failed in accordance with ASTM D4541. Compare adhesion values with the manufacturer's established minimum values for the particular combination of material and substrate. Indicate on the inspection report whether the manufacturer's requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product and substrate combination, the inspector must record actual values.

1.8 AIR BARRIER TESTING

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NOTE: Choose first bracketed specification section to address air barrier requirements of the building enclosure. Choose the second bracketed option for projects where the particular Service branch requires pressure testing the building enclosure for airtightness. See UFC 3-101-01 for more information.
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Perform air barrier testing in accordance with[Section 07 27 10 BUILDING AIR BARRIER SYSTEM][and Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING].

1.9 SAFETY PROVISIONS

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NOTE: Coordinate minimum quantities of fire extinguishers with the fire department having jurisdiction over the project.
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1.9.1 Fire Prevention

Provide a written fire prevention plan for the SPF application. Address specific fire hazards such as spontaneous combustion from exothermic heat build-up of SPF components during curing. Provide a continuous fire watch during mixing and spraying of SPF and for a minimum of [two hours][30 minutes] after completion of work at the end of each day. Maintain fire watch for additional time as required to ensure no potential ignition conditions exist.

1.9.1.1 Fire Extinguishers

Provide [two][_____] fire extinguishers of minimum 7 kg 15 pounds capacity each, in accordance with NFPA 10, in the immediate vicinity of the work. CAUTION: Do not discharge high pressure carbon dioxide extinguishers where explosive vapors exist since the discharge can cause a spark which will ignite the vapors.

1.9.2 Respiratory Protection Plan

Provide a written respiratory protection plan in accordance with OSHA

regulation 29 CFR 1910.134 that protects installers during application and addresses separation of the area to prevent other workers from entering the work area during spraying.

1.9.3 Isolation

Isolate the work area as recommended by spray foam manufacturer's written requirements. Prevent workers without respiratory, skin, and eye Personal Protective Equipment (PPE) or training from entering the work area or otherwise being exposed to airborne chemicals from off-gassing of the insulation in excess of permissible exposure limits. Display appropriate warning signage at all work area entry points. Provide negative pressure ventilation of the spray area to minimize chemical exposure for all workers.

1.9.4 Respirators and Eye Protection

Respiratory protective devices (respirators) must meet the requirements of ASSP Z88.2. Eye and face protective equipment must meet the requirements of ANSI/ISEA Z87.1. Additionally, sprayers and workers in the immediate vicinity of the spray during indoor installation of high-pressure SPF must wear NIOSH-approved, full-face, supplied air respirators (SAR) or hoods operated in positive pressure or continuous flow mode. Workers not in the immediate vicinity of the sprayer must wear air purifying respirators (APR) with an organic gas / P100 particulate cartridge. During outdoor installation of high-pressure SPF, sprayers and workers in the immediate vicinity of the spray must wear air purifying respirators (APR) with an organic gas / P100 particulate cartridge.

Instruct personnel in the use of personal protective equipment. Maintain such equipment and inspect regularly. All workers using respirators are required to have undergone pulmonary function testing and fit testing and must provide certification that they have done so. Change APR cartridges in accordance with manufacturer's written recommendations.

1.9.5 Clothing and Gloves

Sprayers and workers must wear protective clothing and gloves in accordance with OSHA requirements during materials application. Disposable, chemically-resistant coveralls must be worn and must cover all exposed skin. Sprayers and workers must wear fabric gloves coated with nitrile, neoprene, butyl or PVC.

1.9.6 Additional Requirements

Require personnel to review the Health, Safety and Environmental Aspects of Spray Polyurethane Foam and Coverings published by the Spray Polyurethane Foam Alliance (SPFA) (https://www.sprayfoam.org/) and the American Chemistry Council Center for the Polyurethanes Industry. Verify compliance prior to allowing personnel on site for installation work.

1.10 QUALITY CONTROL

1.10.1 Qualification of Manufacturer

Submit documentation verifying that the manufacturer of the SPF is currently accredited by the Air Barrier Association of America (ABAA Accreditation https://www.airbarrier.org/) or by the Spray Polyurethane Foam Alliance (SPFA) Professional Certification Program

(PCP)..

1.10.2 Qualification of Installer

Submit documentation verifying that installers of the spray foam air barrier are currently certified to properly install SPF materials. Acceptable certifications include those provided by the approved product manufacturer, by ABAA/BPQI (Building Performance Quality Institute) or by the Spray Polyurethane Foam Alliance (SPFA) Professional Certification Program (PCP). Installers must provide photo identification certification cards for inspection upon request.

1.10.3 General Quality Requirements

Provide all products and installation in accordance with the approved product manufacturer's installation instructions. SPFA TechDocs requirements (https://www.sprayfoam.org/SPFA_techdocs) may be used if manufacturers installation instructions do not address specific applications and documented best practices.

1.11 PRECONSTRUCTION MEETING

Conduct a preconstruction meeting after approval of submittals and a minimum of two weeks prior to commencing work specified in this Section. Attendance is required by the Contracting Officer's designated personnel, Contractor, and representatives of related trades including covering materials, substrate materials, adjacent materials, and materials and components of the air/vapor/thermal barrier system. Agenda must include, at a minimum, the following items:

a. Drawings, specifications and submittals related to the SPF work;

b. Sequence of construction;

c. Coordination with substrate preparation work and responsibility of repairing defects in substrates. Determine method of ensuring SPF work does not begin until substrates have been inspected and accepted;

d. Ensure that all penetrations of the substrate by other trades are completed prior to SPF air barrier installation where possible; responsibility of sealing penetrations after SPF air barrier installation should be addressed.

e. Compatibility of materials;

f. Construction and testing of construction mockup;

g. Application of self-adhering air barrier transition strips and primer as required for sealing the spray foam air barrier system at openings including but not limited to windows, doors and louvers;

h. Spray foam air barrier system installation; including methods to be used to provide a continuous barrier at thru-wall flashing, penetrations, and covering of embed items;

i. Quality control plan including methods of applying the product so that a consistent thickness across the face of the substrate is achieved.

j. Procedures for SPF manufacturer's technical representative's onsite

inspection and acceptance of substrates, contact info for the representative, frequency of visits, and distribution of copies of inspection reports. Determine where core samples will be taken and review procedures for daily documentation of SPF application.

k. Property protection measures[, including isolation of the work,] and prevention of overspray and clean-up should overspray occur.

l. Safety requirements, including review of PPE, fire prevention, safety plan, respirator plan, ventilation and separation of the work area, fall protection, and posting of warning signs. Provide a complete schedule and a detailed, written fire protection plan[including temporary isolation of the product and the work area until permanent isolation or thermal barrier is in place].

1.12 PROJECT/SITE CONDITIONS

1.12.1 Temperature and Weather

Install SPF within the range of ambient and substrate surface temperatures in accordance with manufacturer's written instructions. Do not apply SPF to damp or wet substrates. Do not apply SPF during inclement weather or when ice, frost, surface moisture, or visible dampness is present on surfaces to be covered, or when precipitation is imminent. Do not apply SPF to exterior building surfaces when wind speeds exceed 40 kilometers 25 miles per hour. Use moisture measuring methods and equipment to verify that the moisture conditions of substrate surfaces are in accordance with SPF manufacturer requirements prior to application. Substrate temperatures must be within limits recommended by the manufacturer's printed instructions.

1.12.2 Conditions for Primers

Follow manufacturer's printed application and curing instructions regarding ambient temperature minimum limits.

1.12.3 Conditions for Ignition Barriers

Ensure that sprayed surfaces comply with manufacturer's written requirements for application coverage, thickness, and curing prior to application of ignition barrier coatings.

1.12.4 Temporary Ventilation

Provide temporary ventilation for work of this Section in accordance with manufacturer's written instructions and with OSHA requirements for this type of application.

1.13 FOAM SPRAY EQUIPMENT

1.13.1 Applicator

Install spray foam with a plural-component proportioner, hoses and spray gun system approved by the spray foam manufacturer

Use a foam spray gun approved by the foam manufacturer that does not require a flushing solvent during the spray operation.

1.13.2 Equipment Calibration

Fully calibrate the foam metering equipment to monitor each liquid component to within 2 percent of the SPF manufacturer's required metering ratio. Calibrate spray equipment each day at the start of operations, after each restart if spraying operations have been terminated for more than one hour, whenever there is a change in fan pattern or pressure, whenever slow curing areas are noticed, whenever a change is made in hose length or working height, and after changeover between materials. Calibration consists of demonstrating that the equipment is adjusted to deliver components in proper mix and proportion. Conduct calibration tests on cardboard or plywood on a wall adjacent to the area to be sprayed.

1.13.3 Metering Equipment Requirements

Use foam metering equipment capable of developing and maintaining the SPF manufacturer's required liquid component pressures and temperatures. Foam metering equipment must have gages for visual monitoring. Equipment must provide temperature control of foam components to within the temperature ranges recommended by the foam manufacturer's printed instructions.

1.13.4 Moisture Protection

Protect surfaces of supply containers and tanks used to feed foam metering equipment from moisture.

1.13.5 Compressed Air

Supply compressed air that is in contact with SPF during mixing or atomization through moisture traps that are continuously bled.

1.13.6 Dispense Excess Materials

Do not deposit materials used for cleaning of equipment or materials dispensed for calibration purposes and establishment of spray gun pattern onto the ground. Dispense such materials into scrap containers or onto plastic film, or cardboard, and dispose of in accordance with safety requirements and jobsite regulations.

PART 2 PRODUCTS

2.1 SPRAY FOAM AIR BARRIER

****

NOTE: Use of SPF must meet the Flame Spread (FS) and Smoke Developed (SD) index requirements for insulation in accordance with UFC 3-600-01 Fire Protection Engineering for Facilities. FS and SD ratings must be no higher than 75 for FS and 150 for SD when tested in accordance with ASTM E84 (NFPA 255) or UL 723. The SD rating is more stringent than Class A ratings indicated in NFPA 101 or IBC and most SPF vendors cannot meet it. However, this UFC allows exceptions to these limits in certain types of installations and construction types. Exceptions are described in paragraphs directly below the primary paragraph in this UFC titled "Insulation" and the subparagraphs therein. For applications where these values are required, the

product can still be used, however, it requires the addition of a thermal or an ignition barrier to encapsulate it. Thermal barriers are described in IBC Chapter 26 "Plastics." When such barriers are required, choose bracketed items throughout this specification section accordingly.

IBC includes requirements for the location within wall cavities of class I, II and III vapor retarders depending on the project's climate zone to avoid condensation within wall assemblies. See IBC Section 1404.3, and the International Energy Conservation Code (IECC) referenced by this section of the IBC, coordinate dewpoint with mechanical design, and specify type and location within the cavity accordingly. Also verify the cavity is sized to accommodate the barrier thickness required to provide the specified R-Value plus a minimum 25 mm one inch air space. R-value must reflect compliance with IgCC and ASHRAE 90.1 as mandated by UFC 1-200-02 High Performance and Sustainable Building Requirements.

****

2.1.1 General

Provide [an open cell,][a closed cell,] sprayed in place, SPF that forms a continuous air[/vapor]/thermal barrier at the building enclosure. Provide in accordance with ASTM C1029, with the requirements of UFC 3-600-01, ICC IBC Chapter 26, ICC 1100, and NFPA 285. In the event of a conflict, the most stringent requirement applies. Provide all system components necessary for a complete, code compliant installation, whether indicated or not, including material support components, expansion and contraction joints,[ignition barrier coatings,][thermal barrier materials,] and accessories.

2.1.2 Physical Properties

[Provide a closed cell product with the following characteristics:

a. Core Density (ASTM D1622): 24 to 40 Kg per m3 1.5 to 2.5 lb per cf, nominal

b. Thermal Resistance (ASTM C518)

(1) Initial R-value per inch thickness: 1.2 K·m2 per W 7 sf·degrees F h per Btu

(2) Aged R-value per inch thickness (180 days at 23 degrees C 76 degrees F): 1.17 square Km per W 6.6 sf·degrees F·h per Btu

c. Material Air Permeance (ASTM E2178): [In accordance with Section 07 27 10 BUILDING AIR BARRIER SYSTEM][Less than 0.02 L per s-m2 at 75 Pa 0.004 CFM per sf at 1.57 psf] at the minimum installed thickness.

****

NOTE: Choose first bracketed specification section to address air barrier requirements of the building enclosure. Choose the second bracketed option for

projects where the particular Service branch requires pressure testing the building enclosure for airtightness. See UFC 3-101-01 for more information.
****

d. Assembly Air Leakage (ASTM E2357, ASTM E283/E283M): [In accordance with Section 07 27 10 BUILDING AIR BARRIER SYSTEM[and Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING]][less than 0.2 L per s-m2 at 75 Pa 0.04 CFM per sf at 1.57 psf] at the minimum installed thickness.

e. Compressive Strength (ASTM D1621): Minimum 195 kPa 28.3 psi

f. Tensile Strength (ASTM D1623)

(1) Medium density: 103 kPa 15 psi

(2) Roofing: 276 kPa 40 psi

g. Water Vapor Permeance (ASTM E96/E96M, water method): less than 69 ng per Pa sm2 1.2 US Perms at 25 mm one inch thickness

h. Vapor Retarder (ICC IBC, ICC IECC) Class III

i. Surface Burning Characteristics (ASTM E84 or UL 723) 100 mm 4 inch thickness:

(1) Flame Spread (FS) Index Rating less than [75 [_____],][_____].

(2) Smoke Developed (SD) Index Rating less than [150. When fully encapsulated, SPF with an SD rating greater than 150 but less than 450 is permitted. Approval of SPF product is contingent upon approval of encapsulation products and assemblies.][_____].

j. Closed Cell Content (ASTM D6226): minimum 90 percent

k. Dimensional Stability (Humid Aging) (ASTM D2126): 15 percent at 28 days at 70 degrees C 158 degrees F with 97 percent relative humidity.

l. Water Absorption (ASTM D2842): Maximum 5.0 per volume

m. Fungi Resistance (ASTM C1338): Pass, with no growth

n. Recycled Content: Minimum 9 percent (pre- and post-consumer). Provide data identifying percentage of recycled content for closed cell spray foam air barrier.

][Provide an open cell product with the following characteristics:

a. Density (ASTM D1622): 6.4 to 24 Kg per m3 0.4 to 1.5 lb per cf, nominal

b. Thermal Resistance (ASTM C518)

(1) Initial R-value per inch thickness: .70 K·m2 per W 4 sf·degrees F·h per Btu)

(2) Aged R-value per inch thickness (180 days at 23 degrees C 76 degrees F): .68 K·m2 per W 3.8 sf·degrees F·h per Btu

c. Material Air Permeance (ASTM E2178): [In accordance with Section 07 27 10 BUILDING AIR BARRIER SYSTEM][less than 0.02 L per s-m2 at 75 Pa 0.004 CFM per sf at 1.57 psf] at the minimum installed thickness.

****
NOTE: Choose first bracketed specification section to address air barrier requirements of the building enclosure. Choose the second bracketed option for projects where the particular Service branch requires pressure testing the building enclosure for airtightness. See UFC 3-101-01 for more information.
****

d. Assembly Air Leakage (ASTM E2357, ASTM E283/E283M): [In accordance with Section 07 27 10 BUILDING AIR BARRIER SYSTEM[and Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING]][Less than 0.2 L per s-m2 at 75 Pa 0.04 CFM per sf at 1.57 psf at] the minimum installed thickness.

e. Compressive Strength (ASTM D1621): 6.9-34 kPa 3-5 psi

f. Tensile Strength (ASTM D1623): minimum 2.3 kPa 1 psi

g. Water Vapor Permeance (ASTM E96/E96M, water method): Maximum 1300 ng per Pa sm2 22 Perms at 50 mm 2 inch thickness

h. Surface Burning Characteristics (ASTM E84 or UL 723) 100 mm 4 inch thickness:

(1) Flame Spread (FS) Index Rating less than [75][_____].

(2) Smoke Developed (SD) Index Rating less than [150. SPF with an SD rating greater than 150 but less than 450 may be used when fully encapsulated. Approval of SPF product is contingent upon approval of encapsulation products and assemblies.][_____].

i. Open Cell Content (ASTM D6226): Greater than 92 percent

j. Fungi Resistance (ASTM C1338): Pass, with no growth

k. Recycled Content: minimum 9 percent (pre- and post-consumer). Provide data identifying percentage of recycled content for open cell spray foam air barrier.

]2.1.3 Expansion and Contraction

Provide an assembly that allows for relative movement due to temperature, moisture, and air pressure changes. Provide expansion and contraction measures as required by the manufacturer's written recommendations.

2.1.4 Fire-ratings, Flame Spread and Smoke Developed Index Ratings

****
NOTE: Where required by UFC 3-600-01 Fire Protection Engineering for Facilities (by way of reference when smoke developed index requirements cannot be met), provide an ignition barrier (intumescent coating specifically for SPF) or a thermal barrier (various sheathing type of options) as required by IBC Chapter 26 "Plastics". If the

Authority Having Jurisdiction (AHJ) for the project does not recognize intumescent coatings as thermal or ignition barriers, do not use them to satisfy the requirements for thermal or ignition barriers. Choose bracketed options below.
****

Where fire-rated materials are indicated, provide products with the appropriate markings of a qualified testing agency on the containers. Submit fire-rating test reports. Fire-rating test reports must include flame spread (FS) and smoke developed (SD) index data. Where FS and SD values of foam products do not meet requirements, provide code-compliant [ignition][thermal] barrier products or alternate assemblies and verify complete encapsulation of the spray foam air barrier through product data or on shop drawings. Submit for approval in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

2.1.5 Prohibited Materials

Products that contain hexabromocyclododecane (HBCD) flame retardants are prohibited. Products that contain hydrochlorofluorocarbons (HCFCs), chlorofluorocarbons (CFCs), or other hydrofluorocarbons (HFCs), or other blowing agents with Ozone Depletion Potential (ODP) greater than 0.015 or Global Warming Potential (GWP) above 16 are prohibited. For a list of foam blowing agents with ODP and GWP values see https://www.epa.gov/snap/substitutes-rigid-polyurethane-spray. Provide validation of indoor air quality for spray foam air barrier that no prohibited materials are used.

2.1.6 [Thermal][Ignition] Barrier

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NOTE: Where required by UFC 3-600-01 Fire Protection Engineering for Facilities (by way of reference when smoke developed index requirements cannot be met), provide an ignition barrier (intumescent coating specifically for SPF) or a thermal barrier (various sheathing type of options) as required by IBC Chapter 26 "Plastics". If the Authority Having Jurisdiction (AHJ) for the project does not recognize intumescent coatings as thermal or ignition barriers, do not use them to satisfy the requirements for thermal or ignition barriers. Choose bracketed options below.
****

2.1.6.1 SPF at Exterior Wall Assemblies

At exterior walls which do not meet the exceptions listed in ICC IBC Chapter 26, separate the SPF from interior side of the wall assembly with continuous thermal barrier of 13 mm 1/2 inch glass mat gypsum wallboard (GWB) in accordance with ICC IBC Chapter 26 requirements. Provide assembly tested in accordance with NFPA 285 for fire propagation and no sustained ignition when tested in accordance with NFPA 268.

2.1.6.2 SPF at Other Locations

Provide a [thermal barrier][ignition barrier] in locations where SPF is exposed to the interior of the building, including attics and plenum

spaces. Provide [thermal][ignition] barriers in accordance with ICC IBC Chapter 26 "Plastics," with ICC 1100, ASTM E736/E736M, and NFPA 275. Choose one or more of the following methods of separation:

a. Building interior, other than fire-rated enclosures: [Separate the SPF from the occupied interior of a building by a continuous thermal barrier of 13 mm 1/2 inch glass mat gypsum wallboard (GWB) in accordance with ICC IBC Chapter 26 requirements.][Separate the SPF from the occupied interior of a building by an intumescent thermal barrier coating or thermal barrier board identical to a third party tested thermal barrier to limit the average temperature rise of the surface of the SPF to not more than 120 degrees C 250 degrees F after 15 minutes of fire exposure (using the standard time-temperature curve of ASTM E119)]. Provide in accordance with NFPA 275.

b. Building interior, fire-rated enclosures: At walls, ceilings and floors that are required to be fire-rated, separate the SPF from the occupied interior of a building with an ignition barrier consisting of 16 mm 5/8 inch, Type X, fire-rated GWB in the number of layers corresponding to required ratings. Include all accessories as necessary for complete fire-rated assemblies.

c. Unoccupied attics, crawl spaces: Where fire-rated enclosures are not required, and where entry is made only for service of utilities, separate the SPF from the attic or crawl space with a continuous ignition barrier in accordance with ICC IBC Chapter 26 requirements, and as approved by the Contracting Officer's Representative. Provide one of the following:

   (1) 38 mm 1-1/2 inch thick mineral fiber insulation

   (2) 38 mm 1-1/2 inch thick cellulose insulation

2.2 TRANSITION MEMBRANE

****
NOTE: Transition membrane materials typically consist of self-adhering membrane products therefore specifier must also edit and include Section 07 27 19.01 SELF-ADHERING AIR BARRIERS.
****

Provide as specified in Section 07 27 19.01 SELF-ADHERING AIR BARRIERS.

2.3 PRIMERS, ADHESIVES, AND MASTICS

Provide primers, adhesives, mastics and other accessory materials as recommended by spray foam manufacturer's printed literature.

2.4 FLASHING

As specified in Section 07 60 00 FLASHING AND SHEET METAL.

2.5 JOINT SEALANTS

As specified in Section 07 92 00 JOINT SEALANTS. Verify compatibility with other system products.

PART 3 EXECUTION

3.1 EXAMINATION

****

Note: For retrofit projects, inspect facility to determine conditions which may adversely affect execution of work or create safety hazards. Identify relevant conditions on the drawings and, if required, develop additional specification sections for corrective actions. Conditions that warrant investigation include, but are not limited to:

1. Discolorations or mold growth indicating previous water leaks.

2. Heat producing devices, such as recessed lighting fixtures, chimneys, and flues.

3. Faulty electrical systems:

(a) Lights dimming or flickering

(b) Fuses blowing

(c) Circuit breakers tripping frequently

(d) Electrical sparks and "glowing" from receptacles

(e) Cover plates on switches and outlets warm to touch.

****

Before installing the spray foam air barrier and with the installer present, examine substrates, areas, and conditions under which SPF will be applied, for compliance with requirements. Ensure that surfaces are structurally sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants. Ensure that concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions. Correct defects that adversely affect the spray foam application or performance. Verify that work by other trades is in place and complete prior to application of spray foam.

3.2 PREPARATION

3.2.1 Substrate Preparation

Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for spray foam application.

a. Prepare surfaces by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the SPF.

b. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the SPF.

3.2.2 Protection

Protect adjacent areas and surfaces from spray applied materials in accordance with the following:

a. Mask and cover adjacent areas to protect from overspray.

b. Ensure required foam stops and back up materials are in place to achieve a complete seal.

c. Seal off ventilation equipment. Install temporary ducting and fans to provide required negative-pressure exhaust of spray fumes. Provide make-up air as required.

d. Erect barriers, isolate area, and post warning signs to notify non-protected personnel of the requirement to avoid the spray area.

3.2.3 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed light fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: Minimum of [75 mm3 inches][_____] from outside face of fixtures and devices and in accordance with NFPA 70 and, if insulation is to be placed above fixture or device, 610 mm 24 inches above fixture.

b. Masonry chimneys or masonry enclosing a flue: a minimum of [51 mm2 inches][_____] from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances in accordance with NFPA 211.

c. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances in accordance with NFPA 211.

d. Gas Fired Appliances: Clearances in accordance with NFPA 54.

e. Oil Fired Appliances: Clearances in accordance with NFPA 31. Blocking is not required if chimneys or flues are certified by the manufacturer for use in contact with insulating materials.

3.2.4 Fire and Explosion Hazards

Prohibit open flames, sparks, welding, and smoking in the application area. Provide and maintain fire extinguishers of appropriate type, size and distance, as required by NFPA, in the application area. Apply SPF according to manufacturer's instructions regarding maximum pass thickness and curing time. Mix batches in small enough quantities to avoid spontaneous combustion from exothermic heat build-up of SPF components during curing.

3.2.5 Warning Signs

Post warning signs at ground level adjacent to the work area and a minimum of 45.72 meters 150 feet from the application area stating the area is off limits to unauthorized persons and warning of potential hazards. Place

clearly visible and legible warning sign at entrance to primary road leading to the project facility warning of presence of combustible materials, irritating fumes, and potential of overspray damage.

3.2.6 Prime Substrate

Provide as recommended by the manufacturer for each substrate to be primed. Use primers at full strength. Do not dilute primers unless required and as recommended in writing by the manufacturer. Do not use cleaning solvents for thinning primers or other materials. Ensure that diluted primer(s) meet VOC requirements.

3.3 INSTALLATION

3.3.1 Sequencing and Coordination

Sequence the work to prevent access to the work area by other trades during foam application and curing. Limit access of non-essential workers during application. Notify the Contracting Officer 24 hours in advance of spraying operations.[Sequence spray foam work with other trades to permit continuous self-flashing of the spray foam air barrier.] Ensure expansion and control joints are provided as detailed on the manufacturer's shop drawings to accommodate the expansion of each layer of the air[/vapor]/thermal envelope.[Provide temporary fire protection of uncured foam, and isolate the work area, until foam application is covered with a permanent thermal or ignition barrier.]

3.3.2 Installation of Transition Membrane

Install transition membrane materials in accordance with the details on the drawings, Section 07 27 19.01 SELF-ADHERING AIR BARRIERS, and the following:

a. Install transition membrane at all required locations prior to installation of the SPF air barrier.

b. Verify transition membrane is fully adhered to substrate and that its surface is clean, dry and wrinkle free prior to installation of the fluid-applied membrane air barrier.

c. Verify transition membrane completely covers all transition areas and will provide continuity of the finished SPF air barrier without gaps or cracks.

Submit transition membrane manufacturer's installation instructions.

3.3.3 Installation of Spray Foam Air Barrier

Install materials in accordance with paragraph SAFETY PROVISIONS, in accordance with manufacturer's recommendations, and in accordance with the following:

a. Use spray equipment that complies with foam manufacturer's recommendations for the specific type of application, and as specified herein. Record equipment settings on the Daily Work Record. Each proportioned unit can supply only one spray gun.

b. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.

c. Continuously connect the spray foam air barrier between walls, roof, floor, and below grade assemblies to form a continuous integrated air barrier system around the entire building enclosure. Extend the spray foam air barrier into rough openings such as doors, windows, louvers, and other exterior penetrations. Use self-adhering air barrier transition strips if necessary to achieve full extension and continuity of the barrier at these locations. Seal edges of barrier at junctures with rough openings.

d. Install within manufacturer's tolerances, but not more than minus 6 mm 1/4 inch or plus 13 mm 1/2 inch.

e. Sequence work to completely seal all penetrations resulting from pipes, vents, wires, conduit, electrical fixtures, structural members, or other construction. If penetrations through the spray foam air barrier are made after the initial SPF application, reapply in accordance with manufacturer's written instructions for such remedial work.

f. Do not install SPF within 75 mm 3 inches of heat emitting devices such as light fixtures and chimneys.

g. Finished surface of SPF must be free of voids and embedded foreign objects.

h. Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.

i. Trim, as required, any excess thickness that would interfere with the application of cladding and covering system by other trades.

j. Clean and restore surfaces soiled or damaged by work of other trades. Before cleaning and restoring damaged work, consult with other trades for appropriate and approved methods for cleaning and restoration to prevent further damage.

k. Complete connections to other components and repair any gaps, holes or other damage using material approved by the SPF manufacturer.

l. Provide expansion joints in the SPF application aligned with expansion joints in the building enclosure, where substrate materials change, and in accordance with manufacturer's recommendations.

m. Provide a continuous fire watch in accordance with paragraph SAFETY PROVISIONS.

3.4 FIELD QUALITY CONTROL

3.4.1 General Site Inspections and Testing

****

NOTE: Choose the bracketed option for projects where pressure testing the building enclosure for airtightness is required by UFC 3-101-01.

****

Provide site inspections and testing in accordance with the manufacturer's

instructions, Section 07 27 10 BUILDING AIR BARRIER SYSTEM,[Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING,] and this Section.

a. Conduct inspections and testing at 5, 50, and 95 percent of completion of this scope of work. Forward written inspection reports to the Contracting Officer within 5 working days of the inspection and test being performed.

b. If inspections reveal defects, promptly remove and replace defective work at no additional expense to the Government.

3.4.2 Manufacturer Site Inspections

Manufacturer's technical representative must visit the site during the installation process to ensure the SPF and accessories are being applied in compliance with requirements. At a minimum, manufacturer's technical representative must be present at work startup and perform field inspection of the first day's completed application and at substantial completion, prior to demobilization. After each inspection, submit an inspection report signed by the manufacturer's technical representative, to the Contracting Officer within five working days. The inspection report must note overall quality of work, deficiencies, and recommended corrective actions in detail. Notify the Contracting Officer a minimum of two working days prior to site visits by manufacturer's technical representative.

3.4.3 Contractor's Site Inspections

Establish and maintain an inspection procedure to ensure compliance of the foam installation with Contract requirements. Conduct inspections and testing at 5, 50, and 95 percent completion of application. Forward written inspection reports to the Contracting Officer within five working days of the inspection and test being performed. Work not in compliance must be promptly removed and replaced or corrected, in an approved manner, at no additional cost to the Government. Quality control must include, but is not limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers.

b. Verification of certification, listing, or label.

c. Verification of proper storage and handling of materials before, during, and after installation.

d. Inspection of SPF, support structure, primer, expansion joints,[ignition barrier,][thermal barrier,][vapor retarder,] and accessories.

3.4.4 Peel Adhesion Test

Conduct in accordance with test protocol indicated in Part 1 paragraph MOCKUP PEEL ADHESION TEST.

[3.4.5 Visual Inspection and Thermal Scanning

Following completion of installation, inspect the SPF surface or cavity using infrared (IR) scanning as specified in[ASTM C1060,][ASTM C1153][and]. Where the IR inspection indicates construction inconsistencies

including wet insulation, remove inconsistent portions of the assembly and replace insulation to correct thermal anomalies. Reinspect and document corrections to the satisfaction of the Contracting Officer.

3.4.5.1 Thermographic Test Report

Include thermographs in color and a color temperature scale to define the temperature indicated by the various colors. Identify the high temperature reading, the outdoor air temperature, the building indoor air temperature, and the wind speed and direction. Note areas of compromise in the building enclosure, and note actions required and taken to correct those areas. Final thermography test report must demonstrate that the problem areas have been corrected. Submit the complete test and analysis.

]3.5 CORRECTION OF DEFICIENCIES

Upon completion of inspection, testing, or sample taking, repair damaged construction, restore substrates and finishes, and protect repaired construction. Deficiencies found during inspection must be corrected within[5 working days][48 hours][_____] following notification.

3.6 CLEANUP OF SPILLS

Conduct cleanup of uncured product spillage in accordance with paragraph SAFETY PROVISIONS and the manufacturer's written safe handling instructions and SDS. In the event of a conflict, the most stringent requirement governs.

3.7 PROTECTION AND CLEANING

3.7.1 Protection of Installed Work

Protect SPF installation from damage during application and remainder of construction period in accordance with manufacturer's written instructions. Repair damaged areas to new condition.

3.7.2 Cleaning of Adjacent Surfaces

Clean overspray from adjacent construction using cleaning agents and procedures as recommended in writing by the manufacturer of each type of affected construction and as acceptable to same.

-- End of Section --