**INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS**

**UNIFORM EVALUATION SERVICES**

**EVALUATION CRITERIA FOR**

**POLYURETHANE FOAM PLASTICS (INJECTED OR SPRAYED) FOR FOUNDATION OR**

**SLAB LEVELING, LIFTING, AND STABILIZATION**

**EC 048-2024**

**(Adopted November 2024)**

1. **INTRODUCTION**

**1.1 Purpose:** The intent of these criteria is to establish requirements for polyurethane foam plastics used for foundation or slab leveling, lifting, and stabilization. Based on 2024 IBC Section 104.2.3, 2021 and 2018 IBC Section 104.11, and IRC Section 104.1.1, products meeting these criteria shall be recognized in a report that has been independently reviewed by an approved evaluation service agency for compliance with the 2024, 2021, and 2018 International Building Code (IBC) and the 2024, 2021, and 2018 International Residential Code (IRC). Recognition is based on 2024 IBC Section 104.2.3, 2021 and 2018 IBC Section 104.11, and IRC Section 104.11. Applicable code sections to be used for determining compliance include:

* 1809 (Shallow Foundations)
* 2603 (Foam Plastic Insulation)
* 2024 Section 303, 2021, 2018 and 2015 IRC Sections R316 (Foam Plastic)
* R401 (Foundations- General)
* R402 (Foundations - Materials)

It is not the intent of these criteria to prevent the use of a different set of requirements for polyurethane plastics used in a similar manner that are, at a minimum, comparable to those specified in this document or to the code or codes that apply to their use.

**1.2 Scope:** These evaluation criteria apply to polyurethane foam plastic that is designed

for spraying or injection into hollow spaces beneath foundations and concrete slabs in order to elevate, level or add stability to them.

**1.3 Limitations:** The polyurethane foam plastic shall only be used as a supplemental material in order to enhance the structural integrity of a foundation.

**1.4 Definitions:** For terms not defined in this section, applicable codes or referenced

standards shall have the ordinary, accepted definition for the context for which they are intended as established by the following:

* 2024, 2021, and 2018 International Building Code© (IBC), International Code Council.
* 2024, 2021 and 2018 International Residential Code© (IRC), International Code Council
* SPFA-119 Glossary of Terms
* SPFA-157 Spray Polyurethane Foam for Concrete Lifting (Slab Jacking)

**1.4.1 Core Sample:** A sample taken from an actual cross-section of roofing material showing the surface areas and various substrates in it.

**1.4.2 Confined Density:** A measurement of density in a core sample of polyurethane foam plastic applied inside a rigid, confining volume in order to simulate a similar effect caused by soil or other barriers that limit its expansion.

**1.4.3 Unconfined or “Free Rise” Density:** A measurement of density in a core sample of polyurethane foam plastic formed on a flat, open surface that allows it to expand freely.

**1.4.4 Spray Polyurethane Foam (SPF):** SPF is a plastic material resulting from the

reaction between an isocyanate and a polyol formed into a cellular structure by a blowing agent used as an applicator that is commonly used for insulation, air barriers, roofing membranes and various geotechnical applications. It can be a two-component reactive system mixed at the spray gun or a single-component system cured by moisture and can be designed to be application specific by varying physical properties that include density, compressive strength, closed cell content and R-value.

**2.0 REFERENCED STANDARDS**

**2.1** Standards shall be applied consistently with the specific edition of the following code or codes for which the evaluation report is prepared unless otherwise approved by the evaluation service agency.

**2.1.1 ASTM International**

* + - C273-20 Standard Test Method for Shear Properties of Sandwich Core

Materials, ASTM International

* + - D1621-16 Standard Test Method for Compressive Properties of Rigid Cellular plastics, ASTM International
		- D1622-20 Standard Test Method for Apparent Density of Rigid Cellular plastics, ASTM International
		- D1622-17 Standard Test Method for Tensile and Tensile Adhesion Properties of

Rigid Cellular Plastics, ASTM International

* D2482 Test Method for Water Absorption of Rigid Cellular Plastics, ASTM

International

**2.1.2 International Organization for Standardization**

* ISO/IEC Standard 17011:2017, Conformity Assessment – Requirements for accreditation bodies accrediting conformity assessment bodies
* ISO/IEC Standard 17020:2012, Conformity assessment -- Requirements for the operation of various types of bodies performing inspection
* ISO/IEC Standard 17025:2017, General Requirements for the Competence of Testing and Calibration Laboratories
* ISO/IEC Standard 17065:2012, Conformity Assessment – Requirements for bodies certifying products, processes, and services.

**3.0 BASIC INFORMATION**

**3.1** The following information and data shall be submitted for review for recognition of

injection or spray applied polyurethane foam plastics in an evaluation report.

**3.1.1 Product Description:** Quality documentation required under Section 6.0 of

this criteria shall include complete information regarding the material specifications and process of manufacturing polyurethane foam plastics.

**3.1.2 Test Reports:** Test reports submitted to the evaluation agency shall consist of

the following:

**3.1.2.1** A description of the test procedures, test results, observations, tested

 assemblies, load measurements and photographs of specimens and

 typical failure modes.

**3.1.2.2** A description of the test specimens.

**3.1.2.3** Information as required by the referenced test standard and these

 evaluation criteria.

**3.2 Product Identification:** As required by the certification body, the manufacturer’s name and address and the evaluation report number shall be included on the product identification label.

**3.3 Testing Laboratories:** Laboratories shall be accredited as ISO/IEC Standard 17025 compliant for the testing conducted and a statement describing the scope of their accreditation shall be included in their report. The laboratory’s accreditation shall be issued by an accreditation body conforming to ISO/IEC 17011 that is a signatory of the International Laboratory Accreditation Cooperation (ILAC), Mutual Recognition Arrangement (MRA), or another approved organization. The evaluation service agency may permit testing at a non-accredited laboratory provided that testing is conducted under an accredited laboratory’s supervision and the report is issued by the supervising laboratory.

**3.4 Product Sampling:** An accredited testing agency or testing laboratory shall verify that test specimens are representative of the product being manufactured at the time it is sampled and product specifications shall be within tolerance limits required by relevant standards and those reported in the quality documentation.

**4.0 TESTING AND PERFORMANCE REQUIREMENTS**

**4.1 General:** Prior to testing,a qualification test plan shall be submitted to and approved by IAPMO or the certification body.

**4.2** **Testing Methods:** The performance characteristics of each foam plastic material to be evaluated and documented based on the criteria in this section shall be based on the following:

**4.2.1** All tests shall be performed on foam plastic produced in an unconfined manner where it is allowed to free rise without simulating the confining effects of soils or rigid structures that restrict its expansion.

**4.2.2** An exception to 4.2.1 is that density samples shall be prepared in both an unconfined and confined manner as described in Sections 4.3.4.1 and 4.3.4.2 of this criteria.

**4.3 Physical Tests:** Physical property testing for the polyurethane foam plastic as shown in Table 1 shall include:

**4.3.1 Comprehensive Strength Testing:** A report detailing the modulus of elasticity shall be submitted in accordance with ASTM D1621. For specimens sampled in accordance with Section 4.0 of this criteria, the orientation of the specimen (parallel and perpendicular to the rise of the foam) shall be reported.

**4.3.2 Tensile Strength Testing:** A report detailing the modulus of elasticity shall be submitted in accordance with ASTM D1623. For specimens sampled in accordance with Section 4.0 of this criteria, orientation of the specimen (parallel and perpendicular to the rise of the foam) shall be reported.

**4.3.3 Sheer Strength Testing:** A report detailing the modulus of elasticity shall be submitted in accordance with ASTM C273. For specimens sampled in accordance with Section 4.0 of this criteria, orientation of the specimen (parallel and perpendicular to the rise of the foam) shall be reported.

**4.3.4 Density Testing:** Apparent density of the polyurethane foam plastic shall be submitted in accordance with ASTM D1622 with density reported for foam samples produced in both an unconfined and confined manner.

**4.3.4.1 Unconfined:** Where the foam plastic is allowed to  rise freely without simulating the effects of confining soils or rigid

 structures that limit expansion.

**4.3.4.2 Confined:** Where a specific volume of liquid is inserted

 into a rigid cavity of a specified volume.

 **4.3.5 Water Absorption Testing:** Water absorption of the polyurethane foam plastic

 shall be determined in accordance with ASTM D2642.

**TABLE 1**

**Physical Properties of Polyurethane Foam Plastics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **Tests** | **Value** | **Number of** **Samples** | **Sample Preparation** |
| **Compressive Strength** | **ASTM****D1621** | **As Reported** |  **5** | **Per Test Standard** |
| **Tensile Strength** | **ASTM D1623** | **As Reported** |  **5** | **Per Test Standard** |
| **Sheer Strength** | **ASTM C273** | **As Reported** |  **5** | **Per Test Standard** |
| **Core Density** | **ASTM D1622** | **As Reported** |  **5** | **Per Section 6.3 of the Test Standard** |
| **Water Absorption** | **ASTM D2842** | **As Reported** |  **5** | **Per Test Standard** |

**5.0 DESIGN**

 **5.1 Allowable Vertical Load:** The allowable vertical load for the polyurethane foam plastic

shall be based on the lesser of the values of Sections 5.1.1 and 5.1.2.

 **5.1.1** The average compressive strength parallel to the rise of foam or perpendicular

 to the rise of foam samples divided by 3.

 **5.1.2** Maximum presumptive load for the soil class being assessed.

**6.0 QUALITY CONTROL**

**6.1 MANUFACTURING**

**6.1.1 Quality Assurance:** Quality documentation complying with the UES Evaluation Standard for Quality Documentation (UES-010) shall be submitted that includes a complete description of the quality management system used in the factory to manufacture the *foam plastic product*.

**6.1.2** **Facility Inspections:** Inspections of manufacturing facilities shall be conducted for this product by agencies accredited for the required tasks in accordance with ISO/IEC 17020 or ISO/IEC 17065.

**6.1.3** **Quality Control Program:** Products shall be manufactured under an approved

quality control program with inspections performed by IAPMO UES or by a properly accredited inspection agency under contract with IAPMO UES.

  **6.1.4** **Quality Control Tests:** Quality control procedures shall require quality control

tests to be conducted on each batch of the polyurethane foam plastic raw materials. Conditions for accepting these tests shall be as follows:

**6.1.4.1**  **Density Testing:** Apparent density of the polyurethane foam plastic produced in the free rise or unconfined condition shall be determined in accordance with Section 4.3.4 of these criteria.

**6.1.4.2**  **Qualifying Values:** The foam density that is determined shall not be less than 90 percent of the lowest control sample values reported in the initial qualification test report.

 **6.2 INSTALLATION**

**6.2.1 Applicators:** Foundation or slab lifting or stabilization shall only be

performed by individuals who have been trained and determined to be competent by the manufacturer or the Spray Polyurethane Foam Alliance.

**6.2.2 Procedures:** The evaluation report on polyurethane foam plastics shall include a detailed description of installation procedures and include temperature requirements for processing and storage.

**7.0 CONDITIONS OF USE**

**7.1** **Conditions of Use:** The evaluation report shall include the following conditions of use for polyurethane foam plastics:

 **7.1.1** *The polyurethane foam plastic* shall be installed in

 accordance with this evaluation criteria report and the applicable code.

 **7.1.2** *The polyurethane foam plastic* is only to be used to

 resist bearing loads only and is not designed to resist lateral or uplift loads.

 **7.1.3** Product durability when exposed to hydrocarbons such as fuel contaminants in

soils have not been evaluated for *the polyurethane foam plastic*.

**7.1.4** Use of *the polyurethane foam plastic* in areas that have been subject to “heavy damage” fromtermites shall be in accordance with 2024, 2021, and 2018 IBC Section 2603.8, 2024 IRC Section R303.7,and 2021 and 2018 IRC Section R318.4, as applicable.

 **7.1.5** Allowable soil bearing pressure and vertical movement shall be

determined by a site-specific geotechnical investigation or evaluation in accordance with Section 1803 of the IBC or Section R401.4 of the IRC when *(trade name of polyurethane foam plastic product)* is used for foundation lifting. When required by the applicable code, a geotechnical investigation or evaluation must also be submitted to the building official for approval.

**7.1.6** Use of *the polyurethane foam plastic* for projects where a greater bearing capacity than that published in the evaluation report is required, or where lateral slope stabilization or liquefaction mitigation are necessary, shall be determined by a site-specific geotechnical investigation in accordance with Section 1803 of the IBC or Section R401.4 of the IRC. When required by the applicable code, this investigation shall include in-place testing of treated soils to determine properties for design use and must be submitted for approval by the building official.

**7.1.7** Conditions of use based on the structural integrity of the surface to be supported by *the polyurethane foam plastic* are outside of the scope of this report.