SP-150873
(New)

# SPECIAL PROVISIONS
# FOR
# EXPANDED POLYSTYRENE FILL

**Pottawattamie County**
**IM-NHS-080-1(447)5--03-78**

**Effective Date**
**July 19, 2022**

**THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAILOVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

## 150873.01 DESCRIPTION.

**A. General.**
The work provided herein consists of furnishing all labor, material, and equipment for furnishing and placement of EPS fill, also referred to in this specification as expanded polystyrene (EPS), as specified herein, shown on the plans, or as directed by the Engineer. The work also includes construction of sand bedding and drainage system.

**B. Reference Standards.**
Some or all of the publications referred to in this specification form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of the referenced American Society of Testing Materials (ASTM) publication shall govern.

- C203, Standard Test Method for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
- C272, Standard Test Method for Water Absorption.
- D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- D1623, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- D2863, Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index).
- D3345, Standard Test Method for Laboratory Evaluation of Solid Wood for Resistance to Termites.
- D6817, Standard Specification for Rigid Cellular Polystyrene Geofoam.
- D5199, Standard Test Method for Measuring the nominal Thickness of Geosynthetics.

**C. Contractor Work.**

The Contractor is responsible for setting, maintaining, and resetting all alignment stakes, slope stakes, and grade stakes necessary for the construction of EPS Fill. This includes, but is not limited to subgrade preparation, and all appurtenances such as sand bedding and drainage system within the limits of the EPS fill.

**D. Qualifications.**

1. Manufacturer Qualifications: A firm experienced in manufacturing Expanded Polystyrene similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required quantity.

2. Installation Qualifications: A firm experienced in the installation and handling of Expanded Polystyrene with a minimum of three projects of similar size within a 5 year period shall install the EPS portion of this project.

**E. Submittals.**

1. Product Data Submittals: The Manufacturer's product data, installation instructions, use limitations and recommendations for each material specified herein shall be submitted for review by the Engineer.

2. Preconstruction Submittals: Prior to the start of work, submit for review the following:
   - **a.** Shop drawings, to scale, showing the proposed location, layout and dimensions of all EPS blocks, sand bedding after overexcavation, and all accessory items to be used. The submitted drawings shall include, but not limited to, plans, elevations, cross-sections showing profiles and cross-slopes, connections, and accessory items as necessary. The submitted drawings shall show the details regarding how the EPS blocks will be constructed around the foundations, pipes, manholes, and other features.
   - **b.** In the shop drawings, a step-by-step description of the installation and construction procedures proposed shall be included. Installation and construction sequence, supplemented by drawings, as necessary, of the EPS blocks and utilities shall be included. EPS block sizes and laying pattern as well as methods of temporary ballasting and stabilizing EPS blocks to prevent movement at all times during construction, prior to placement of the overlying fill and structures shall be identified.
   - **c.** Shop drawings, working drawings, installation and construction procedures and supporting calculations shall all be stamped by a professional engineer licensed in the State of Iowa.
   - **d.** All details different than those depicted on the contract documents, required in support of the construction procedures shall be engineered by the Contractor.
   - **e.** The layout of all EPS blocks and attachments shall be in conformance with the design details shown on the contract documents.
   - **f.** Prior to the delivery of the EPS blocks, the Contractor shall furnish to the Engineer a copy of the test reports performed by a third party that certify that the EPS blocks meet the physical properties and standards listed in Table 1 below.
   - **g.** The Contractor shall submit to the Engineer the Manufacturer's Certificate of Compliance for the first 100 cubic yards and for every 10,000 cubic yards thereafter before the EPS is delivered to the site.
   - **h.** The Certificate of Compliance shall include current inspection reports showing that the EPS manufacturer is in compliance with a UL (Underwriters Laboratories) follow-up service program for both flame and physical properties. The certification shall include test results that verify conformance with the material properties discussed in this specification. In addition, computer generated stress-strain data and the accompanying curves shall be produced from the compressive testing and supplied to the Engineer. The curves and/or data shall clearly indicate the stress at 1% strain and the modulus of elasticity.

**F. Source Quality Control.**

**1. Quality Control Requirements:**

**a.** The following are testing procedures required by the Contractor for project specific requirements.
- ASTM D1622 - Standard Test Method for Density.
- ASTM D1621 - Standard Test Method for Compressive Resistance.

**b.** The following are testing procedures required by EPS Manufacturer/Contractor for Industry specific requirements.
- ASTM C203 - Standard Test Method for Flexural Strength.
- ASTM D1623 - Standard Test Method for Tensile Strength.
- ASTM C272 - Standard Test Method for Water Absorption.

**2. Sampling and Testing:**

One set of ten samples shall be tested and evaluated prior to shipment of the first EPS delivery to project site. A minimum of one set of ten samples per 1500 cubic yards of material delivered to the project site shall be tested. Testing can be performed with either 2 inch cubes or 12 inch cubes.

**G. Quality Assurance.**

**1.** Quality assurance testing and sampling, to monitor the conformance of the EPS fill with the specification requirements, will be completed as directed by the Engineer. Density and geometry (dimensional tolerances) testing shall be conducted using full-sized blocks. Blocks in conformance with contract requirements can be used to make required fills.

**2.** Testing to monitor the quality of the EPS shall be done at the discretion of the Engineer. Engineer has the right to random sample the manufacturing plant. If any block does not conform to the physical requirements or if it is damaged in any way, it may be rejected by the Engineer.

## 150873.02 MATERIALS.

**A. Expanded Polystyrene.**

**1.** The general extent of the EPS fill and the type of EPS blocks required are shown on the Contract Drawings. Each EPS block shall be marked with the manufacturer's identification and type.

**2.** EPS may be fabricated using material with recycled content provided the physical properties of Table 1 are met. EPS blocks shall have a height of at least 32 inches (16 inch half block), a width of at least 48 inches, and length of at least 96 inches. All blocks shall be shop-trimmed as necessary so that all surfaces are smooth and flat, and within tolerances of 0.5% of respective height, width and length dimensions. Additional field and/or shop-trimming and cutting will be required as necessitated by the geometry of the fill being constructed.

**3.** EPS blocks shall conform to the specified type category in ASTM D6817 and have the following physical properties:

**TABLE 1: Physical Properties of EPS Geofoam (ASTM D6817)**

| TYPE (ASTM D6817) | EPS12 | EPS15 | EPS19 | EPS22 | EPS29 | EPS39 | EPS46 |
|---|---|---|---|---|---|---|---|
| Density, min., kg/m$^3$, (lb/ft$^3$) (ASTM D1622) | 11.2 (0.70) | 14.4 (0.90) | 18.4 (1.15) | 21.6 (1.35) | 28.8 (1.80) | 38.4 (2.40) | 45.7 (2.85) |
| Compressive Resistance | 15 (2.2) | 25 (3.6) | 40 (5.8) | 50 (7.3) | 75 (10.9) | 103 (15.0) | 128 (18.6) |

| TYPE (ASTM D6817) | EPS12 | EPS15 | EPS19 | EPS22 | EPS29 | EPS39 | EPS46 |
|---|---|---|---|---|---|---|---|
| @ 1 PCT deformation, min. kPa (psi) (ASTM D1621) | | | | | | | |
| Flexural Strength min., kPa (psi) (ASTM C203) | 69 (10.0) | 172 (25.0) | 207 (30.0) | 276 (40.0) | 345 (50.0) | 414 (60.0) | 517 (75.0) |
| Elastic Modulus, min., kPA (psi) (ASTM D1621) | 1500 (220) | 2500 (360) | 4000 (580) | 5000 (730) | 7500 (1090) | 10300 (1500) | 12800 (1860) |
| Oxygen Index, min., volume % (ASTM D2863) | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 |

**4.** The EPS for this project shall consist of EPS29.

**5.** The EPS shall contain a flame retardant additive and shall have UL Certification of Classification as to External Fire Exposure and Surface Burning Characteristics. EPS should be considered combustible and should not be exposed to open flame or any source of ignition.

**B. Sand.**
Sand fill and sand blanket shall be natural sand meeting the requirements of Section 4110 or 4134 of the Standard Specifications.

**C. Geomembrane.**
Geomembrane shall meet the requirements of the Special Provisions for Geomembrane over Expanded Polystyrene Block Geofoam.

**D. Subdrains.**
Drain lines at the base of the EPS fill shall be 4 inch nominal diameter perforated plastic pipe meeting the requirements of Article 4143.01, C of the Standard Specifications.

**150873.03 CONSTRUCTION.**

**A. Protection.**

**1.** Prevent damage to the EPS during delivery, storage, and construction. Prior to delivery of EPS fill to the project site, review and be thoroughly knowledgeable with the manufacturer's care, transportation and handling recommendations. Cover any EPS fill to be exposed to sun light for more than 90 days with opaque material which prevent ultraviolet light degradation. Any damage to the EPS resulting from the Contractor's vehicles, equipment, or operations, shall be replaced.

**2.** Construction of the overlying fill and structures will require special procedures and careful selection of appropriate construction equipment to prevent damage to the EPS fill. No heavy construction equipment or vehicles shall be allowed directly on the EPS.

**3.** Correct damage to EPS as follows:
- **a.** Slight damage (less than 0.12 cubic feet with no linear dimension greater than 1 foot) may be left in place as-is.
- **b.** Moderate damage (damage greater than slight damage, but less than 0.35 cubic feet with no linear dimension greater than 3.3 feet) at the discretion of the Engineer shall be removed or left in place.

**c.** EPS blocks with excessive damage (i.e., exceeding the “moderate” category) shall be replaced with EPS blocks which meet the damage criteria. EPS blocks not meeting the damage criteria may be cut to eliminate the excessive damage and the remaining undamaged portion of the block may be used within the fill, provided the undamaged portion of the block meets all other requirements.

**B. Placement.**

**1.** The natural soil subgrade shall be cleared of vegetation and any large or sharp-edged soil particles, any kinds of debris, and be reasonably planar prior to placing the sand bedding layer. Reasonably planar is defined as +/-1 inch over 10 feet. Overexcavate existing soils as required by the contract documents.

**2.** The sand bedding layer shall have a minimum thickness of 12 inches and have a required smoothness of no more than + 3/8 inch over 10 feet prior to the placement of the first layer of EPS blocks.

**3.** A minimum of 6 inches of sand bedding shall be placed surrounding the perforated underdrain pipes. Overexcavate, as necessary, to provide the minimum thickness of sand bedding surrounding the perforated underdrain pipes.

**4.** There shall be no debris of any kind on the sand bedding surface at the time the EPS blocks are placed.

**5.** There shall be no standing water or accumulated snow or ice on the sand bedding layer within the area where EPS blocks are placed at the time of block placement.

**6.** EPS blocks shall not be placed on frozen subgrade and de-icing salts shall not be used except as directed by the Engineer.

**7.** EPS blocks shall be placed at the locations shown on the shop drawings submitted by the Contractor.

**8.** There shall be no debris of any kind between adjacent EPS block surfaces at the time adjacent EPS blocks are placed.

**9.** There shall be no standing water or accumulated snow or ice on the previously placed EPS block layer within the area where subsequent EPS blocks are to be placed at the time of block placement.

**10.** EPS blocks shall be placed so that all vertical and horizontal joints between blocks are tight.

**11.** While placing successive layers of EPS blocks, exercise care to guarantee that all placed blocks are supported over their entire bearing area. In the event the top constructed surface of an assembly of blocks become uneven or where rocking of the blocks is observed, notify the Engineer and propose a remedial procedure for corrective action. Such procedure shall be submitted for review and approval by the Engineer prior to resuming construction.

**12.** All blocks shall accurately fit relative to adjacent blocks. No gaps greater than 2 inches will be allowed on vertical joints and where the blocks fit around foundations, manholes, pipes, abutments, and other features. The finished surface of the EPS fill shall be constructed to within the tolerance of 0.0 to -2.5 inches of the indicated grade.

**13.** Blocks placed in a row in a particular layer shall be offset a minimum of 2 feet relative to blocks placed in adjacent rows of the same layer. In order to avoid continuous joints, each

subsequent layer of blocks shall be rotated on the horizontal plane 90 degrees from the direction of placement of the previous layer placed. Connector plates are not necessary or recommended for this project, unless required by the manufacturer. Blocks shall be cut using a hot wire.

**14.** Because of the light unit weight of the EPS material, it is the Contractor's responsibility to provide temporary weighting and/or tiedowns as necessary to resist wind and uplift from precipitation until all the blocks are built into a homogeneous mass, overlying fill, and structures are in place.

**15.** Caution shall be exercised when removing temporary shoring adjacent to the EPS block structure and during placement of backfill. No physical damage, loss of backfill, or misalignment shall be permitted. The Contractor shall be required to make provisions to prevent loss of backfill during shoring removal.

**16.** No construction equipment shall be allowed to traverse directly on the EPS blocks. Damage to the EPS blocks resulting from the Contractor's vehicles, equipment, or operations shall be replaced or repaired with new materials to the satisfaction of the Engineer at no additional cost to the owner.

**17.** During placement of the structures over the top surface of the EPS, it is permissible to use rebar supports (dobies) to support the reinforcing steel during concrete placement.

**18.** In the areas where utilities or manholes are placed in the EPS, provide space in the EPS to accommodate pipe and flowable fill. Flowable fill shall be in accordance with Section 2506 of the Standard Specifications.

**19.** Provide all construction surveys as required.

**20.** The Contractor shall assume total responsibility for disposal of EPS block material or portions of unused blocks resulting from testing or construction by returning it to the Supplier/ Molder for recycling. Such process shall be conducted on a regular basis or as instructed by the Engineer.

**150873.04 METHOD OF MEASUREMENT.**

The item for EPS fill will be the cubic yards in place within the limits indicated in the plans. The Engineer will measure the quantity of EPS fill in cubic yards.

**150873.05 BASIS OF PAYMENT.**

The Contractor shall be paid the contract unit price per cubic yard for EPS Fill. This payment shall be full compensation for design submittal preparation, furnishing, trimming, and placing the EPS fill, providing pre- construction certification and construction site testing of the EPS material, and all labor, equipment and incidentals needed to complete the work. Incidentals include items used for storage and protection of the EPS blocks; sand fill and sand blanket; sand for filling gaps between EPS blocks or between the EPS fill and sides of overexcavation or overlying Class 10 fill; flowable fill around both vertical and horizontal penetrations through EPS blocks; pumping of excess water or runoff from the EPS excavations; and removal of all leftover materials, blocks, cuttings from blocks, equipment and supplies at the completion of the project. In addition, all costs associated with Contractor surveying shall be considered to be included in the unit bid prices for the individual items of work.