

(Specifier Note : *The purpose of this guide specification is to assist the specifier in correctly specifying AMVIC GEOFOAM products and execution. The specifier needs to edit the guide specifications to fit the needs of specific projects. You may contact an AMVIC Product Representative to assist in making the appropriate product selections.*)

EXPANDED POLYSTYRENE (EPS GEOFOAM) EMBANKMENT

DIVISION 31 – EARTHWORK

Special provisions

SECTION 31 24 13

1.0 SCOPE

This section covers the requirements for the supply and construction of the expanded polystyrene embankment fill/lightweight fill, including foundation preparation, excavation, leveling pad and associated works as shown on the contract drawings.

2.0 REFERENCES

This special provision refers to the following standards, specifications or publications.

National Standards of Canada

CAN/ULC S701-05 C578	Standard for Thermal Insulation, Polystyrene, Boards and Pipe Standard Specification for Rigid, Cellular Polystyrene Thermal
ASTM D6817	Standard Specification for Rigid Cellular Polystyrene GEOFOAM
ASTM C177	Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Apparatus
ASTM D2842	Test Method for Water Absorption by Rigid Cellular Plastics
ASTM D2126	Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Air

OPSS -Ontario Provincial Standard Specification

OPSS 212 Borrow
OPSS 501 Compaction
OPSS 517 Dewatering
OPSS 1010 Aggregates – Granular A, B, M, and Selected Subgrade Material
OPSS 1605 Expanded Extruded Polystyrene Pavement Insulation
OPSS 1860 Geotextiles

3.0 SUBSURFACE CONDITIONS

The subsurface conditions at the site are described in the Foundation Investigation Report for this Contract.

4.0 DEFINITIONS

For the purpose of this special provision, the following definitions apply:

Rigid Expanded Polystyrene

Molded rigid blocks produced by a process of pre-expansion, aging and forming of a petroleum based raw material.

Production Lot

The quantity of rigid polystyrene blocks produced in a continuous period of manufacturing the same grade and thickness of product within the same production day.

Quality Verification Engineer: means an Engineer with a minimum of five (5) years experience related to the design and/or construction of expanded polystyrene systems of similar scope to that in the Contract, or alternatively has demonstrated expertise by providing satisfactory quality verification services for the work at a minimum of two (2) projects of similar scope to the Contract. The Quality Verification Engineer shall be retained by the Contractor to ensure conformance with the contract documents and issue of certificate(s) of conformance.

5.0 QUALIFICATION

The Contractor shall have on site at the commencement of the work a representative of the supplier of the rigid expanded polystyrene to advise on recommended construction procedure.

The Contractor shall maintain liaison with the supplier throughout the construction of the embankment for advice and guidance as required. Periodic site visits by the supplier should be coordinated as required.

6.0 SUBMISSION AND DESIGN REQUIREMENTS

The Contractor shall submit to the Contract Administrator a Certificate of Conformance sealed and signed by the Quality Verification Engineer a minimum of one week prior to commencement of work under this contract. The Certificate shall state that the installation procedures are in conformance with the requirements and specifications of the contract documents. Quality test certificates for each production lot supplied, showing compliance with all requirements of this special provision shall be obtained by the Contractor and submitted to the Contract Administrator prior to installation. Upon completion of the Expanded Polystyrene Embankment the Contractor shall submit to the Contract Administrator a Certificate of Conformance sealed and signed by the Quality Verification Engineer stating that the Expanded Polystyrene Embankment has been constructed in conformance with the installation procedures and specifications of the contract documents.

6.1 Submission of Shop Drawings

At least three weeks before the commencement of work, the Contractor shall submit to the Contract Administrator six copies of the shop drawings and method statement that provides full details of materials and construction procedure.

6.2 Delivery, Storage, Handling and Protection

The Contractor shall submit the method of delivery, storage, handling and protection from damage by weather, traffic, construction staging and other causes as per the rigid expanded polystyrene manufacturer's requirements.

6.3 Construction

The contractor shall submit full details of the following:

- a) The method of foundation excavation and preparation.
- b) Construction of leveling pad.
- c) The method of placement of expanded polystyrene including temporary ballasting and protection of blocks during installation. The shop drawings shall indicate laying pattern and block dimensions on a layer by layer basis.
- d) The method of placement of subbase material.
- e) The method of placement of side slope cover.

7.0 Materials

7.1 Granular Leveling Pad

The leveling pad shall consist of a Granular 'A' or Granular 'B' material with gradation and physical requirements as specified elsewhere in the contract.

7.2 Rigid Expanded Polystyrene

7.2.1 General

7.2.1.1 The Contractor shall submit:

- a) A general statement as to the type, composition, and method of production of the material.
- b) The manufacturer's name, address, phone number, identification of a contact person and ~~of~~ experience background in the manufacturing of the, rigid expanded polystyrene.
- c) Certification of compliance of physical and mechanical properties.
- d) An identification of a laboratory accredited by the Standards Council of Canada to conduct the testing of the physical and mechanical properties of the expanded polystyrene.
- e) The physical and mechanical properties of the rigid expanded polystyrene including:
 1. Geometry
 2. Nominal Density
 3. Compressive Strength
 4. Flexural Strength
 5. Dimensional Stability
 6. Limiting Oxygen Index
 7. Water Absorption
- f) Aging and durability characteristics of the polystyrene including the chemical, biological and ultra-violet degradation resistance of the rigid polystyrene.

- g) A sample of the expanded polystyrene material to the Contract Administrator.
- h) To the Contract Administrator a Certificate of Conformance a minimum of one week prior to commencement of work under this item. The Certificate shall state that the expanded polystyrene material is in conformance with the requirements and specifications of the contract documents.
- i) Each block of the same production lot shall be stamped with the same production code showing plant identification, type and date of production. The polystyrene shall be free from defects affecting serviceability.

7.2.2 Detail Requirements

The polystyrene shall meet the physical properties as defined by ASTM D6817-02 as follows:

Physical Properties of GEOFOAM						
Test Procedure	Description	EPS 15	EPS 19	EPS 22	EPS 29	EPS 46
ASTM D1622-03	Density (Minimum)	14.4 kg/m ³ (0.90 lb/ft ³)	18.4 kg/m ³ (1.15 lb/ft ³)	21.6 kg/m ³ (1.35 lb/ft ³)	28.8 kg/m ³ (1.80 lb/ft ³)	45.7 kg/m ³ (2.85 lb/ft ³)
ASTM D 1621-04	Compressive Strength @ 1% strain	25 kPa (3.6 psi)	40 kPa (5.8 psi)	50 kPa (7.3 psi)	75 kPa (10.9 psi)	128 kPa (18.6 psi)
ASTM D 1621-04	Compressive Strength @ 5% strain	55 kPa (8.0 psi)	90 kPa (13.1 psi)	115 kPa (16.7 psi)	170 kPa (24.7 psi)	290 kPa (42.1 psi)*
ASTM D 1621-04	Compressive Strength @ 10% strain	70 kPa (10.2 psi)	110 kPa (16.0 psi)	135 kPa (19.6 psi)	200 kPa (29.0 psi)	341 kPa (49.5 psi)*
ASTM C 203-05a	Flexural Strength	172 kPa (25 psi)	207 kPa (30 psi)	276 kPa (40 psi)	345 kPa (50 psi)	517 kPa (75.0 psi)
ASTM D 2842-01	Water Absorption	Less than 6% (by volume)	Less than 5% (by volume)	Less than 4% (by volume)	Less than 2% (by volume)	Less than 2% (by volume)
ASTM D 2863-00	Limiting Oxygen Index	24% (by volume)	24% (by volume)	24% (by volume)	24% (by volume)	24% (by volume)
ASTM D 2126-04	Dimensional Stability	1.5% linear change (max)	1.5% linear change (max)	1.5% linear change (max)	1.5% linear change (max)	1.5% linear change (max)

*Estimate

7.2.2.1 Geometry

The expanded polystyrene shall be supplied in the form of rectangular parallel sheets bundled into minimum acceptable dimensions of 1200 mm x 600 mm x 100 mm.

The maximum deviation from the specified linear dimensions, flatness, squareness and thickness shall be $\pm 0.5\%$.

7.2.2.2 Compressive Strength

The minimum compressive strength, measured in accordance with ASTM D1621, Procedure A, shall be in accordance to section 7.2.2 depending on the type of product specified at a strain of not more than 5%. The maximum permissible permanent stress level should not exceed 30% of the compressive strength of the material at 5% strain.

7.2.2.3 Flexural Strength

The minimum flexural strength of the polystyrene shall be in accordance to section 7.2.2 depending on the type of product specified in contract documents. The flexural strength shall be determined in accordance to ASTM C203, Method 1, and Procedure B.2.7.4 Dimensional Stability.

7.2.2.4 Dimensional Stability

Dimensional Stability shall be determined in accordance with ASTM D2126, Procedure G. A tolerance $\pm 1.5\%$ shall be satisfied.

7.2.2.5 Flammability

The expanded polystyrene shall be classified as to surface burning characteristics in accordance with CAN/ULC-S102.2 having a flame spread rating less than 500. The expanded polystyrene shall have a minimum limiting oxygen index measured in accordance with ASTM D2863.

7.2.2.6 Water Absorption

The water absorption as measured by ASTM D2842 shall be limited to 4% by volume.

7.2.2.7 Chemical Resistance

The expanded polystyrene shall be resistant to common inorganic acids and alkalies. A table identifying the chemical resistance as either resistant, limited or not resistant shall be submitted.

7.2.2.8 Biological Resistance

The expanded polystyrene shall be resistant to biological degradation caused by organisms or enzymes.

7.2.2.9 Environmental

The expanded polystyrene shall be inert, non-nutritive and highly stable and shall not produce undesirable gases or leachate.

8.0 DELIVERY, STORAGE AND HANDLING

The product shall be suitably marked to identify its type, number and the manufacturer's name or trademark.

The Contractor shall protect the expanded polystyrene from exposure to sunlight to avoid ultraviolet degradation as per manufacturer's recommendation.

Protection of materials and works from damage by weather, traffic, construction staging, fire or ~~vul~~ and other causes shall be the responsibility of the Contractor,

9.0 CONSTRUCTION

9.1 Foundation Excavation

Foundation excavation shall be generally carried out to the elevations shown on the drawings, or as ~~q~~ to complete the repair and extension of the culvert. Any softened, loosened or deleterious materials at the foundation footing elevation shall be sub excavated and replaced with Granular 'A' or Granular 'B' material.

9.2 Leveling Pad

Place, level and compact a layer of Granular 'A' or Granular 'B' material in accordance with ~~CS~~501 to within ± 30 mm of the design elevation. The leveling pad shall not deviate by more than 10 mm at any place on a 3 m straight edge over the limits of the bottom course of blocks. The leveling pad shall not be placed on frozen ground.

9.3 Installation of Blocks

1. The individually marked blocks shall be placed on the prepared leveling pad. The top surface of the first layer of blocks is to be set plane and level. Local trimming of the blocks may be necessary.
2. Subsequent successive layers shall be oriented with the long axis of blocks positioned at 90° to the previous layer in order to avoid continuous joints. Block joints shall be offset and staggered ~~in~~ layers.
3. A continuous check shall be kept to ensure the evenness of the blocks is satisfactory in each layer. Blocks shall be laid with joints with maximum opening of 10 mm between blocks. Differences in heights between adjacent blocks in the same layer shall not exceed 5 mm.
4. Sloping end adjustments at the abutments shall be accomplished by leveling terraces in the subsoil in accordance with the block thickness.
5. Exposed blocks shall be covered prior to daily shutdown to avoid possible burrowing by animals.
6. Individually marked blocks shall be fabricated and placed to ensure the top surface matches ~~h~~ elevation and cross fall shown on the drawings.
7. The top surface and side surfaces of the expanded polystyrene shall be covered with 10 mil polyethylene sheeting extending onto adjacent work at the longitudinal ends of the embankment. ~~A~~ joints shall be lapped a minimum of 300 mm to provide a fully sealed enclosure.

8. The contractor shall install the concrete base pad as detailed elsewhere in the contract.
9. The side slope of the rigid expanded polystyrene embankment shall be covered with fill material as detailed elsewhere in this contract.

10.0 EQUIPMENT

All cutting of polystyrene materials shall be by electric equipment or by hand.

Heavy equipment shall be limited in weight and size and restricted in operation to avoid damaging the expanded polystyrene as per the manufacturer's requirement.

11. QUALITY ASSURANCE

11.1 Quality Assurance

Quality test certificates for each production lot supplied, showing compliance with all requirements of this special provision shall be obtained by the Contractor and submitted to the Contract Administrator prior to installation.

11.2 Sampling and Testing

11.2.1 General

The Contract Administrator may undertake an Independent testing program of the expanded polystyrene. Sampling and testing will be carried out in conformance with the relevant test procedure. The physical and thermal property testing identified in Table 1 will be conducted. The testing shall be conducted by a recognized testing laboratory accredited by the Standards Council of Canada.

11.1.2 Sampling Frequency

Sufficient sample material shall be obtained from blocks randomly selected by the Contract Administrator from each production lot as soon as the material arrives on site. As a minimum, three blocks shall be tested.

11.1.3 Acceptance/Rejection

Failure of any one of the sample blocks to comply with any requirements of this special provision shall be ~~ca~~ for rejection of the production lot from which it was taken. Replacement of the blocks shall be at ~~the~~ Contractor's expense.

12.0 Measurement for Payment

Measurement will be by volume cubic meters measured in its original position and based on cross-sections.

13.0 Basis of Payment

The granular leveling pad and concrete topping slab shall be included in the work and shall not be measured for separate payment.

Payment at the contract price for the above tender item shall be full compensation for all labour, materials ~~and~~ equipment to do the work.