Specifications for Concrete Embedment Liner

Part 1: GENERAL

1.01 SECTION INCLUDES

A. Specifications and guidelines for MANUFACTURING high-density polyethylene embedment liners.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. **D 1505 Test Method for Density of Plastics by the Density-Gradient Technique.**
2. **D 1603 Test Method for Carbon Black in Olefin Plastics**
3. **D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembrane.**
4. **D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.**
5. **D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.**
6. **D 1204 Standard Test Method for Linear Dimensional Changes of Nongrid Thermoplastic Sheeting or film at Elevated Temperature**
7. **D 696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30º C and 30º C With a Vitreous Silica Dilatometer**
8. **D 746 Standard test Method for Brittleness Temperature of Plastics and Elastomers by Impact**
9. **D 570 Standard Test Method for Water Absorption of Plastics**
10. **E 96 Standard Test Method for Water Vapor Transmission of Material**

1.03 POST AWARD AND SUBMITTALS

A. All work for and in connection with the installation of the lining, field seaming and welding joints shall be completed in strict conformity with all applicable instructions and recommendations of the liner manufacture.

B. All surfaces in contact with corrosive or erosive environments or environments susceptible to mechanical damage shall be lined with an approved HDPE independent anchor embedment liner.

C. At the request of the Engineer, Pre-Caster or End User, samples, datasheets, installation instructions, etc. will be provided.

D. Included with the shipment of liner, submit certified test reports that the liner and material are manufactured in accordance with standards specified herein.

1.04 QUALIFICATIONS

A. The HDPE liner specified in this section shall be furnished by a Manufacture that is fully experienced, reputable and qualified in the manufacturing of the materials. The manufacture must have at least 10 years manufacturing experience.

B. Locking independent anchors must be of the same material as that of the Liner, and shall be integrally extruded with the sheet in a one step process.

C. Liner shall demonstrate minimum pull-out strength of 14,000 p.s.f.

D. HDPE liner exposed to U.V. must be protected with 1.5- 3% carbon black and comply with ASTM D1603, and D 5596.

E. Liner in below grade installations, not exposed to U.V. should be light in color to facilitate camera inspections, U.V. protection is not required.

2.02 Material Properties

A. The material used in the embedment liner, and in all welding strips shall be made from 97-98% virgin high density polyethylene.

B. Plasticizer shall not be added to the resin formulation.

C. Embedment sheet, and welding strips shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

D. The cap strips shall be made from HDPE, and have good impact resistance and have an elongation sufficient to bridge up to ¼ inch settling cracks.

E. Cap strip shall be approximately 4 inches wide or greater, and shall be equivalent to the liner.

F. Material shall maintain a repairable state through it's lifecycle by methods approved, and recommended by the manufacturer.

G. Embedment sheets shall have the following physical properties when tested in accordance with Table 1.

H. Raw resin shall have the following properties when tested in accordance with Table 2.

2.03 Material Supply

A. Embedment sheets shall be supplied in roll form, pre-fabricated tubes or panels.

B. Cap strips shall be supplied in 4 inch widths or greater.

2.04 Material Handling

A. Materials are to be handled as to prevent damage.

B. The on-site storage location for geomembrane material, provided by the Contractor to protect the liner from punctures, abrasions and excessive dirt and moisture. Storage area should have the following characteristics:

1. **Level (no wooden pallets**
2. **Smooth**
3. **Dry**
4. **Protected from theft and vandalism**

2.05 Welding Procedures

A. Only welding techniques approved by the manufacture are to be used. Approved welding techniques are as follows.

1. **Factory butt welding.**
2. **Wedge welding**
3. **Extrusion welding**
4. **Electro-fusion welding.**

B. Hot air welding is not allowed except for the purpose of temporarily Tack welding sheets together, and will not be considered a permanent weld.

C. Horizontal Pipe joints should be welded using the Electro-Fusion process as developed by GSE Lining Technology, and DemTec, whenever possible. Vertical Structures may be Extrusion Welded or Electro Fusion Welded as the contractor sees fit.

D. Welding contractors must be approved by the manufacture, and be able to demonstrate welding proficiency

E. Field welded joints must be made water tight prior to the weld. Any joints leaking should be repaired using SealGuard® 2 expanding foam grout or equivalent before weld is attempted.

E. Proper surface preparation is required on all field welds in accordance with the Manufacture recommendations.

2.06 Weld Testing Program

A. A suitable weld testing program should be instituted that meets the approval of the owner, the contractor, and the liner manufacture before start of any welding procedures. Testing methods should include both destructive and non destructive testing.

B. Testing on embedded material must be non-destructive.

C. Test methods may include spark testing, vacuum testing, and pull testing.

D. Holidays found in welds should be ground out re-welded and tested.

E. Only non destructive testing is allowed on embedded material.

F. Destructive testing on weld samples should be done at the start of every shift, and consist of 1" sample welds pulled to failure using an approved potentiometer. Welds should have a minimum of 80% base material strength.

G. Vacuum testing should be done on all practical field welds.

H. Spark testing may be done on field welds where vacuum testing is not practical.

I. Factory butt welds are exempt from testing.