



FIBERGLASS UNDERGROUND STORAGE TANK BUOYANCY PREVENTION STRUCTURAL GEOCOMPOSITE

SPECIFICATION

1.0 Description

This work shall consist of furnishing and installing structural geocomposite reinforcement in accordance with these specifications and in reasonably close conformity to the lines, grades and dimensions shown on the plans or as directed by the Engineer.

2.0 Reference Documents

- ASTM D4355 Practice of Sampling Geosynthetics for Testing
- ASTM D6637 Standard Test Method for Determining Tensile Properties of Geogrids by the single or Multi-Rib Tensile Method
- ASTM D5262 Standard Test Method for Evaluating the Unconfined Tension Creep behavior of Geosynthetics
- ASTM D5818 Practice for obtaining Samples of Geosynthetics from a test section for assessment of Installation Damage
- ASTM D6706 Standard Test Method for Measuring Geosynthetic Pullout Resistance in soil

- GRI GG7 Carboxyl End Group Content of PET yarns
- GRI GG8 Determination of the number average Molecular Weight of PET yarns based on a relative viscosity value

3.0 Material

Geogrid shall consist of a regular network of integrally connected tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate or other material. Geocomposite shall be manufactured for soil reinforcement applications and all components shall be manufactured from Polyvinyl Alcohol (PVA) or high tenacity polyester (PET) conforming to GRI: GG7 and GG8. No changes in the required physical properties or means of evaluating these properties will be allowed within 30 days of the bid.

3.1 Certification

Prior to construction the Contractor shall submit to the Engineer the Manufacturer's certification that the geocomposite has been evaluated in full compliance with this Specification and is fit for use in long-term, critical soil reinforcement applications. The Contractor's submittal package shall include, but not be limited to, actual tests results for tension/creep, durability/aging, construction damage and quality control tensile testing. Site specific testing may be performed at the owner's discretion and expense.

3.2 Geocomposite

The geocomposite shall provide the following minimum allowable properties:

Property	Test Method	LTDS* Value	T _{ULTIMATE}
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Long Term Design Strength MD (lb/ft)			
	Per ASTM D-6637		7,535
Sand, Silt, and Clay	Per GRI GG4B	3,949	

$$*LTDS = T_{ULT} / FS_{ID} \times FS_{CR} \times FS_{CD} \times FS_{BD} \times FS_{JNT}$$

1. Geogrids must be manufactured under strict quality control procedures and certified up to ISO 9001.
2. For all geogrid types, the percent open area must be between 50% and 80%.
3. PET geogrids shall have a Molecular Weight $\geq 25,000$ g/m per GRI: GG8 and a carboxyl end group number ≤ 30 per GRI: GG7. PET geogrids not meeting this criteria shall use a minimum $RF_D = 2.0$.

3.2.1 T_{ULT}, Ultimate Tensile Strength, shall be the minimum average roll value (MARV) ultimate tensile strength as tested per ASTM D6637.

3.2.2 R_{FCR}, Creep Reduction Factor shall be determined in accordance with FHWA SA-96-071 Appendix B with results extrapolated for a 120-year design life. A minimum of one 10,000-hour creep tension test per ASTM D5262 is required to determine R_{FCR}. Short term testing by itself is insufficient. In the absence of actual test results, default values for R_{FCR} of 5.0 and 2.5 shall be used for HDPE and PET, respectively.

3.2.3 R_{FI}, Installation Damage reduction factor, shall be determined from construction damage tests for each product proposed for use with project specific, representative or more severe backfill and construction techniques. The backfill soil used for this testing, if other than project specific, shall have a $D_{50} > 0.6$ mm. Testing shall be consistent with ASTM D5818. Default R_{FI} value of 3.0 shall be used if such testing has not been conducted. The minimum R_{FI} shall be 1.10.

3.2.4 R_{FD}, Durability reduction factor, is the combined partial factor for potential chemical and biological degradation. The minimum R_{FD} shall be as follows:

PVA	1.0
PET (Coated)	1.1
PET (Uncoated)	1.6

3.2.5 Soil Interaction Coefficient, C_i value shall be determined from pullout tests per ASTM 6706. Site specific testing may be performed at the owner's discretion and expense. The maximum pullout force used to determine C_i should be limited to the lesser of T_a or the force that yields 1.0-inch displacement. The minimum C_i value in sand shall be 0.8 where the C_i value is determined as follows:

$$C_i = F / 2 L \sigma_N \tan \Phi$$

Where F = Pullout force (lb/ft), per ASTM 6706

L = Geogrid Embedment Length in Test (ft)

σ_N = Effective Normal Stress (psf) at a range of 500 to 1000 psf

Φ = Effective Soil Friction Angle, Degrees

3.2.6 Acceptable Products – TankAnchor® Type A, Type B, Type C, or Type D, Distributed by Fiberglass Tank Solutions, LLC, 1-573-317-9620.

3.3 Manufacturing Quality Control

The purpose of the QC testing program is to verify that the geocomposite being supplied to the project is representative of the geocomposite used for performance testing described above. The geocomposite manufacturer shall have a manufacturing quality control program that includes QC testing and is certified as an ISO 9001 facility.

4.0 Construction

4.1 Contractor shall check the geocomposite upon delivery to ensure that the proper material has been received. Each geocomposite roll shall be shipped in a protective bag and clearly marked with roll number, lot number, geocomposite style and principal strength direction. During all periods of shipment and storage, the geocomposite shall be protected from temperatures greater than 140°F and all deleterious materials that might otherwise become affixed to the geocomposite and adversely affect its performance. Follow manufacturer's recommendations in regards to protection from direct sunlight.

4.2 Foundation soil shall be excavated to the lines and grades as shown on the drawings or as directed by the Engineer. Over excavated areas shall be filled with compacted backfill material. As a minimum, foundation soil shall be successfully proof rolled or inspected by the Engineer prior to backfill and geocomposite placement.

4.3 Geocomposite shall be laid at the proper elevation and orientation as shown on the construction drawing or as directed by the Engineer. The Contractor shall verify correct orientation (roll direction) of the geocomposite. Geocomposite may be temporarily secured in-place with staples, pins, sand bags or backfill as required by fill properties, fill placement procedures, or weather conditions, or as directed by the Engineer. Geocomposite not meeting the minimum stiffness requirement or wider than 7 feet shall be staked on 10 foot centers along the roll edges to prevent wrinkling or other distortion of the reinforcement.

4.4 Geocomposite may be overlapped or connected mechanically to form splices in the primary strength direction. Overlapping is required between adjacent rolls and at the length of the engineer.

4.5 Backfill material shall be placed in lifts and compacted as directed under Section-Backfill. Backfill shall be placed, spread and compacted in such a manner that minimizes the development of wrinkles in and/or movement of the geocomposite. Construction equipment should not be allowed to operate directly on top of the exposed geocomposite. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geocomposite. Turning of vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geocomposite. Sudden braking and sharp turning shall be avoided.

4.7 The Contractor, at no additional cost to the Owner, shall replace any geocomposite damaged during installation.

5.0 Measurement/Payment

Measurement of geocomposite reinforcement is on a square yard basis and will be computed on the total area of geocomposite shown on the construction drawings, including the area of geocomposites used in specified overlaps. Incidental overlaps, for connections, etc. are not included in the pay item. The quantity of geocomposite, acceptably placed, measured as noted above, will be paid for at the contract unit price per square yard which shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete these items of work.