TENCATE Geotube®

INDUSTRIAL FABRICS
Dewatering Systems

Geotube® Dewatering Technology Specifications V.11.0

Protective & Outdoor Fabrics
Aerospace Composites
Armour Composites
Geosynthetics
Industrial Fabrics
Synthetic Grass

TENCATE™
materials that make a difference

GEOTUBE® DEWATERING CONTAINER
(Standard Dewatering Specification)

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Note: Pages Numbered by Section

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DEWATERING CONTAINER
(Standard Dewatering Specification)

Version 11.0

PART 1 - GENERAL INFORMATION

1.1 Description

A. Scope. CONTRACTOR shall furnish all labor, materials, equipment, polymer, polymer feed system, and incidentals as shown, specified, and required in connection with deployment, and filling of the Geotube® container, in accordance with the lines, grades, design, and dimensions shown on the drawings as specified herein.

B. General. CONTRACTOR shall furnish the Geotube® container by positioning it on a prepared surface that is level across the width of the Geotube® container with a maximum slope of 0.5% in the overall length direction of the Geotube® container. Geotube® container to be filled with dredged or pumped material to a height not to exceed the manufacturer's specifications.

C. Related Sections. Section _____.

1.2 Quality Assurance

Manufacturer Qualifications. All Geotube® containers and ancillary products shall be the standard product of a manufacturer who has been regularly engaged in the integral design, manufacture, and fabrication of the products, and whose product has proven reliable in similar service for 5 years. The Geotube® container manufacturer must be ISO 9001 certified and can provide a current ISO certification. The Geotube® container manufacturer must have an internal testing lab that has a current A2LA accreditation.

1.3 Submittals

A. Plan of Construction

The contractor must submit prior to award of contract:

1. A detailed Plan of Construction. This plan shall include, but not be limited to, site plan, dewatering containment cell, Geotube® container layout, dredging or pumping methods, mass balance system showing density, percent solids, flow measurement all integrated into a real time controller, polymer type, polymer injection system/location, flocculation monitoring, filling method, covering in-place, beneficial use, or disposal alternatives.

2. A copy of the manufacturer's installation instructions detailed for this project.

3. A copy of the (RDT) Rapid Dewatering Test or (GDT) Geotube® Dewatering Test report for the specific material to be dewatered.

4. Submit shop drawings of the materials, equipment, and method of installation details for the complete system.

5. Submit manufacturer's product literature and specifications for material's) utilized to construct Geotube® containers, including Filling Port details, connection details, site layout, piping, manifold, and related components.

6. Provide a mass balance of the pumping flow rates, chemical make-down, amount of dilution water, filtrate volume, density measurement, and percent solids — all integrated into a real time control system, showing a method of collection, and discharge point. Examples of system components can be found under Supporting Technologies on TenCate Web Page

7. Details and layout of the dry or emulsion polymer make-down and metering system.

B. Materials Certification

Submit a signed certification from the Geotube® container manufacturer indicating that the materials utilized meet the project specification requirements and are designed specifically for this purpose. The manufacturer must be ISO 9001 certified and have an internal A2LA accredited laboratory.

1.4 Product Delivery, Handling, and Storage

A. Product Delivery

Geotube® container and related components shall be delivered to the project site in a protective wrap or cover. Each tube shall be clearly labeled for easy identification. All Geotube® containers greater than 1,000 lbs. gross weight or to be installed in water shall be rolled on a steel pipe with the ends fitted with protective caps.

B. Product Handling

No hooks, tongs, or other sharp instruments shall be used for handling Geotube® containers. Also, the container should not be dragged along the ground. Geotube® containers should be unrolled into position as recommended by the manufacturer.

C. Product Storage

Geotube® containers shall be stored in areas where water cannot accumulate, elevated off of the ground, and protected from conditions that will affect its properties or performance. Geotube® containers should not be exposed to temperatures in excess of 180° F. Duration of storage time shall not exceed manufacturer's recommendation.

PART 2 - PRODUCTS

2.1 Geotube® Container

A. Geotube® Container Material: The Geotube® container material shall be fabricated from GT500, a "Specially Engineered Dewatering Textile" manufactured from high tenacity polypropylene multifilament and monofilament yarns, which are woven into a stable network such that the yarns retain their relative position. The Geotube® container material shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

B. The Geotube® container shall be fabricated by sewing together mill widths of the GT500 woven engineered textile to form a tubular shape. The sewn seams shall be two parallel rows of 401 "lockstitch" with 3/8" to 1/2" spacing between rows. The sewing thread shall be multi-ply polyester.

C. Geotube® containers 45 ft. or greater in circumference must be fabricated with the mill roll length of the GT500 woven engineered textile and the adjacent seams being in the circumferential direction with the closure of the Geotube® container having a longitudinal seam on the bottom of the container. Each Geotube® container shall be fabricated with one or more PVC filling ports located along the top centerline of the Geotube® container. The filling port is comprised of approx. 1.5" thick (inside and outside) flange rings that sandwich the Geotube® GT500 woven engineered textile between 1/8" thick rubber gaskets and secured with ¾" bolts. The resulting connection strength exceeds that of a traditional sewn-in, textile filling port. In addition to the flanges, the fill port shall include a fabric sleeve that may be secured around the feed line to prevent leakage.

D. PVC Fill Ports are for the attachment of the dredge or pump discharge line to the Geotube® container and shall be located at intervals of no more that 100 feet, or as recommended by the manufacturer. Fill ports shall be ridged PVC with an inner port body and outer port body each comprising one or more cellular surfaces capable of distributing a force caused by the clamping of the inner port body and outer port body together with steel bolts and nuts. Fill ports shall be either **4" (GP4)** or **8" (GP8)** in diameter with a 30-inch long, flexible non-woven 8 oz. geotextile sleeve.

E. "Specially Engineered Dewatering Textile" material and factory-sewn seams utilized in the construction of the Geotube® container shall meet or exceed the values shown in Table 1.

Table 1:
GT500 Polypropylene - "Specially Engineered Dewatering Textile"

GT500 is composed of high-tenacity polypropylene yarns, which are woven into a stable network such that the yarns retain their relative position. GT500 is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Wide Width Tensile Strength (at ultimate)	ASTM D4595	kN/m (lbs/in)	78.8 (450)	109.4 (625)
Wide Width Tensile Elongation	ASTM D4595	%	20 (max.)	20 (max.)
Factory Seam Strength	ASTM D4884	kN/m (lbs/in)	70 (400)	
CBR Puncture Strength	ASTM D6241	N (lbs)	8900 (2000)	
Apparent Opening Size (AOS)	ASTM D4751	mm (U.S. Sieve)	0.43 (40)	
Water Flow Rate	ASTM D4491	l/min/m^2 (gpm/ft^2)	813 (20)	
UV Resistance (% strength retained after 500 hrs)	ASTM D4355	%	80	

Filtration Properties	Test Method	Unit	Typical Value
Pore Size Distribution (O_{50})	ASTM D6767	Micron	80
Pore Size Distribution (O_{95})	ASTM D6767	Micron	195

Physical Properties	Test Method	Unit	Typical Value
Mass/Unit Area	ASTM D5261	g/m^2 (oz/yd^2)	585 (17.3)
Thickness	ASTM D5199	mm (mils)	1.8 (70)

PRODUCT AND MANUFACTURER

Geotube® containers provided by:

TenCate™
3680 Mount Olive Road
Commerce, GA 30529
Phone: (706) 693-1897
Fax: (706) 693-1896

Or: Engineer Approved Equal

PART 3 - PLAN OF CONSTRUCTION AND EXECUTION

Prior to performing any work, the contractor shall submit a "Plan of Construction" describing the sequences of operations for the installation of the Geotube® container. The plan shall address site preparation, deployment, chemical/polymer selection, mixing, injection, and filling of the Geotube® containers. Anchoring or securing Geotube® containers using the white handling straps attached to container are not to be used during filling. Equipment used for these operations shall also be outlined.

3.1 Site Preparation

A. Areas in which Geotube® containers are to be placed shall be constructed according to the lines and grades shown on the Drawings. Where such areas are below the allowable grades, they shall be brought to grade. All obstructions that could damage the Geotube® containers, such as roots and projecting stones, shall be removed. The site surface is best if it can be designed with a level grade 0° slope across the width of the Geotube® container and a maximum slope positioning it on a prepared surface that is level across the width of the Geotube® container with a maximum slope of 0.5% in the overall length direction of the Geotube® container. This will require a drainage system such as an aggregate system on a sloped cover that drains to a sump or lower outlet, or a three-dimensional filtration fabric with a ditch system around the parameter that allows the filtrate to flow unobstructed. It is preferred that the perimeter of the dewatering cell be complete with a 2 ft. high containment berm with 1:1 side slopes.

B. The site must have an impervious surface or membrane placed on the prepared surface to underlay the entire Geotube® dewatering site and to cover the perimeter containment berms.

C. A drainage medium shall be required on top of the impervious membrane and under the Geotube® containers, as described in paragraph A. Acceptable materials would be Geotube® Filtration Fabric (GFF) or sufficient washed crush stone to create voided area for drainage. If used, the three-dimensional, GFF shall be installed prior to placement of the Geotube® container and may be installed in between each layer. The GFF provides drainage beneath the Geotube® containers for each layer especially when stacking.

D. The impervious membrane shall have a thickness of at least 17 mils.

E. The GFF must meet the specification shown in Table 2.

F. Immediately prior to placing the Geotube® containers, the ENGINEER shall inspect the prepared area, and no containers shall be placed thereon until the area has been favorably reviewed and approved by the engineer.

Table 2:
GFF - Geotube® Filtration Fabric

Mechanical Properties	Test Method	Unit	Typical Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.891 (425)	1.558 (350)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.935 (210)	0.690 (155)
Puncture Strength	ASTM D 4833	kN (lbs)	0.734 (165)	
Mullen Burst Strength	ASTM D 3786	kPa (psi)	5511.112 (800)	
Air Flow	ASTM D 737	cfm	1300	
Thickness	ASTM D 5199	mm (mils)	4.826 (190)	

Physical Properties	Test Method	Unit	Typical Value
Weight	ASTM D 5261	g/m² (oz/y²)	342.390 (10.1)
Fiber Content			100% PP
Construction		EPI x PPI	26 x 18

GFF is Provided by:

TenCate
3680 Mount Olive Road
Commerce, GA 30529
Phone: (706) 693-1897
Fax: (706) 693-1896

Or: Engineer Approved Equal

3.2 Testing

Rapid Dewatering Test (RDT) or Geotube® Dewatering Test (GDT) should be conducted to help determine proper drainage, volume reduction, and type and dosage of conditioners and or polymers. The RDT or GDT can assist in determining filtration rates that can be compared to full-scale material flow rates. Conditioner and/or polymer are generally used to achieve the desired rate of dewatering and the clarity and quality of the effluent water. The Project Engineer must approve the chemical program.

3.3 Placement of Geotube® Container

A. Place Geotube® containers within the limits shown on the plans or drawings.

B. The unrolled Geotube® container should be placed on top of the drainage media and be unrolled down the length direction of the dewatering site, then unfolded if required.

C. Fill ports should be located along the top, centerline of the unrolled Geotube® container. The dimensions of the feed pipe and the opening of the ports should be measured prior to connecting the flanges.

3.4 Filling Process

A. Following the tube placement, filling with materials from the source shall be accomplished in accordance with the approved Plan of Construction. The discharge line of the dredge or pump shall be fitted with a valve or manifold system to allow for control of the rate of filling or which Geotube® container will be filled. The manifold system shall be fitted with an internal mechanism such as a pinch valve to allow the contractor to regulate the filling rate and pressure into the Geotube® container. The manifold must also be fitted with a sampling port installed close to the first point of connection to the first Geotube® container to enable the contractor to sample the material being pumped to insure the proper flocculation if conditioner and or polymer are being used. Any excess discharge shall be directed away from the tubes into a designated area. Before filling, the fill ports not being used for filling shall be closed according to the manufacturer's recommendations to prevent loss of material during filling of the Geotube® containers.

B. The dredge or pump discharge pipe shall be free of protrusions that could tear the Geotube® surface. The dredge or pump discharge pipe shall be supported in a manner which reduces stress on the PVC fill port. Excessive movement of the dredge or pump discharge pipe during filling can result in damage to the Geotube® container or to the PVC fill port. The Connection Detail supplied by the manufacturer should be followed for the best method to affix the dredge or pump discharge pipe to the fill port. The dredge or pump discharge flow rate shall not change abruptly causing hydraulic pulse action in the tube that would temporarily exceed fabric maximum tensile force design.

C. The Geotube® containers shall be filled as evenly as possible until the design height has been achieved. Effluent water shall be allowed to adequately drain away from the Geotube® container.

D. After the initial filling cycle, allow Geotube® containers to dewater, then the Geotube® containers may be filled again to the recommended height. This process can be repeated until the Geotube® dewatering process is completed. Upon completion of filling the Geotube® container, the Fill Port sleeves shall be closed by rolling the sleeve down to the top of the port flange and closing with a clamp.

E. Geotube® container recommended filling heights will be supplied by the manufacturer.

F. Overall compliance with the manufacturer's installation instructions is required.

3.5 Manufacturer's Representative

A manufacturer's representative shall be present for the installation of the first Geotube® containers unless the contractor can prove adequate, successful experience with this technology.

3.6 Terminology

A. **Geotube® Container** — A large tube [greater than 7.5 ft. (2.3 m) in circumference] fabricated from high strength engineered textiles in lengths greater than 20 ft. (6.1 m). Geotube® containers are used for containment and dewatering of high moisture content sludge and other fine grain material. Also, Geotube® containers are used for coastal and riverine erosion control, and cores for marine structures such as sand dunes and levees. The tubes can also be filled by a combination mechanical and hydraulic method.

B. **The Filling Port,** also know as "Injection Port", are PVC flanges which the inner port body and outer port body each comprise one or more cellular surfaces capable of distributing a force caused by the clamping of the two bodies together. Once bolted to the top of the Geotube® container, the dredge or pump discharge line can be attached. Ports are typically 4 to 12 inches in diameter with a 3 to 5 feet long flexible sleeve attached. Ports are spaced along the top of the tube to provide access by the contractor. Spacing is usually between 50 and 100 ft. Additional ports may be added to accommodate high sand content slurry in dredged or pumped materials.

C. **"Specially Engineered Dewatering Textile"** - A woven synthetic textile used to construct the Geotube® container.

D. **Polymers** - Polyacrylamide polymers can be non-ionic, anionic, or cationic.

E. **Polymer Systems** - The components of the dry or emulsion system shall include as a minimum: polymer storage, metering pump, static mixer, calibration cylinder, flow control valve, and piping as required.

F. **Flow, Percent Solids, and Density Measurement** - A flow meter and a density meter are required in order to pace the polymer with the pumping rate and the solids in the line. Ideally they should be paced electronically with the polymer system.

G. **Bench-Scale** - Geotube® Rapid Dewatering Test (RDT) is a fast and easy test to determine how well a sludge dewaters through the GT500 textile. The test is designed to: evaluate the efficiency of the polymer, measure the volume of effluent filtered from the sludge, record the time of filtration, and analyze the quality of the effluent water. Contact your local Geotube® representative for assistance in conduction this test.

H. **Geotube® Dewatering Test (GDT) -** is a demonstration of the methodology of the sludge dewatering by means of a Geotube® container. The purpose of the test is to: visualize the dewatering methodology, evaluate the efficiency of the selected polymer, analyze the clarity and quality of the effluent, and indicate achievable percent solids. Contact your local Geotube® representative for assistance in conducting this test.