

PRODUCT STANDARD SPECIFICATIONS

Rev: 01, Issue Date 04.1.2012

GREEN TERRAMESH[®] SYSTEM GALVANIZED & PVC COATED

Green Terramesh System[®]

1.0 Description

This work shall consist of furnishing, assembling, and back filling woven wire mesh soil reinforcement units used in Reinforced Soil Slope (RSS) structures, as specified in the contract documents in conformity with the dimensions, lines and grades shown on the plans, or as determined by the engineer. These specifications are in accordance with ASTM A975 and include Green Terramesh[®] manufactured by Maccaferri Inc. or equivalent.

2.0 Materials

2.1 Woven Mesh

2.1.1 Wire (Zinc Coated):

All tests on the mesh and lacing wire must be performed prior to manufacturing the mesh.

- *Tensile strength*: both the wire used for the manufacture of Green Terramesh[®] and the lacing wire, shall have a maximum tensile strength of 75,000 psi (517 MPa), in accordance with ASTM A641/A641M.
- *Elongation*: the test must be carried out on a sample at least 12 in. (30 cm) long. Elongation shall not be less than 12%, in accordance with ASTM A370.
- *Zinc coating*: minimum quantities of zinc according to ASTM A641/A641M, Class III soft temper coating.
- *Adhesion of zinc coating*: the adhesion of the zinc coating to the wire shall be such that, when the wire is wrapped six turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers, in accordance with ASTM A641/A641M.

2.1.2 PVC (Polyvinyl Chloride) Coating

- *Specific density*: 81-84 pcf (1.30–1.35 kg/dm³) in accordance with ASTM D792-00;
- *Hardness*: between 50 and 60 Shore D, according to ASTM D2240-04;
- *Tensile strength*: not less than 2,985 psi (20.6 MPa), according to ASTM D412-98a;
- *Modulus of elasticity*: not less than 2,700 psi (18.6 MPa), according to ASTM D412-98a;
- *Abrasion resistance*: the percentage of the weight loss shall be less than 12%, according to ASTM D1242-95a;
- *Heat aging test*: prior to UV and Abrasion degradation, the PVC polymer coating shall have a projected durability life of 60 years when tested in accordance with UL 746B.

The accelerated aging tests are:

- *Salt spray test*: test period 3,000 hours, test method ASTM B117;
- *Exposure to UV rays*: test period 3,000 hours at 145°F (63°C), test method ASTM D1499 and ASTM G152;
- *Brittleness temperature*: no higher than 15°F (- 9°C), or lower temperature when specified by the purchaser, when tested in accordance with ASTM D746-04.

The properties after aging tests shall be as follows:

- *Appearance of coated mesh*: no cracking, stripping or air bubbles, and no appreciable variation in color;
 - *Specific gravity*: variations shall not exceed 6%;
 - *Hardness*: variations shall not exceed 10%;
 - *Tensile strength*: variations shall not exceed 25%;
 - *Modulus of elasticity*: variations shall not exceed 25%;
 - *Abrasion resistance*: variations shall not exceed 10%;
 - *Brittleness temperature*: shall not exceed + 64°F (+18°C).
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2.1.3 Galvanized and PVC coated wire mesh (8 x 10 mesh type):

- *PVC coating thickness:* Nominal – 0.02 in (0.5 mm), Minimum – 0.015 in (0.38 mm);
- *Mesh wire Diameter:*
 - *Green Terramesh* – 0.106 in (2.70 mm) internal, 0.146 in (3.70 mm) external;
 - *Green Terramesh Light*– 0.087 in (2.20 mm) internal, 0.127 in (3.20 mm) external;
- *Selvedge Diameter* – 0.134 in (3.40 mm) internal, 0.174 in (4.40 mm) external.
- *Mesh opening:* Nominal Dimension D = 3.25 in. (83 mm), as per Fig. 1.

2.1.4 Steel Wire for Welded Back Panel:

- *Wire diameter:* Nominal 0.309 in (7.85 mm) Size W8 in accordance with ASTM A82;
- *Mesh openings:* 6.61 in. x 6.39 in. (168 x 162.5 mm);
- *Tensile strength:* 75 ksi (515 MPa) in accordance with ASTM A82 Table 2;
- *Bending:* in accordance with ASTM A82-97a Table 3;
- *Welding:* minimum of 2625 lbs (11 660 N) in accordance with ASTM A185.

2.1.5 Reinforcing Steel Brackets and Triangles:

- *Wire diameter:* Nominal 0.309 in. (7.85 mm) Size W8 in accordance with ASTM A82;
- *Tensile strength:* 80 ksi (550 MPa) in accordance with ASTM A82 Table 1.

2.1.6 Galvanized and PVC coated lacing wire:

Lacing wire: Diameter – 0.087 in (2.20 mm) internal, 0.127 in (3.20 mm) external

2.1.7 Spenax Fasteners (Overlapping Fasteners):

Stainless Steel overlapping fasteners may be used in lieu of, or to complement, lacing wire for basket assembly and installation.

- *High tensile fasteners shall have a nominal spacing of 4 in. (100 mm) not to exceed 6 in (150 mm) for all assembly and installation. This is based on a 1,200 lb/ft (17.5 kN/m) pull apart resistance for galvanized mesh with this spacing (ASTM A975 section 13.1.2).*
- *Fasteners used for assembly and installation of the units on the field shall be tested for compliance with the ASTM A975 section 13.1.2.2 Pull-Apart Resistance. Producer or supplier of the wire mesh shall provide certification no later than 15 days prior of starting construction.*
- *When tested in accordance with section 13.1.2.1, the average maximum resistance of the fasteners from the field shall not be lower than 90% of the resistance provided in the certification.*
- *Stainless Steel Fasteners:* Diameter = 0.120 in. (3.05 mm), according to ASTM A313/A313M, Type 302, Class I.
- *Tensile strength:* 222,000 to 253,000 psi (1530-1744 MPA) in accordance with ASTM A764(2001).
- *Proper installation of rings:* A properly formed Spenax fastener shall have a nominal overlap of one (1) in. after closure (Fig. 2).

2.1.8 Erosion Control Blanket:

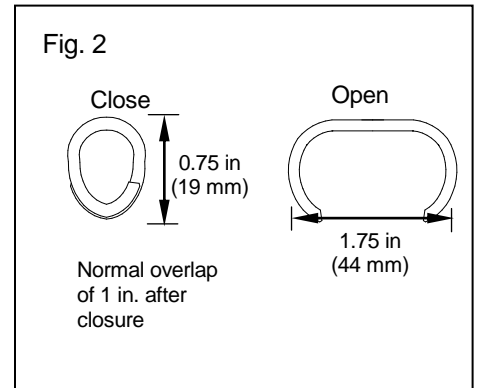
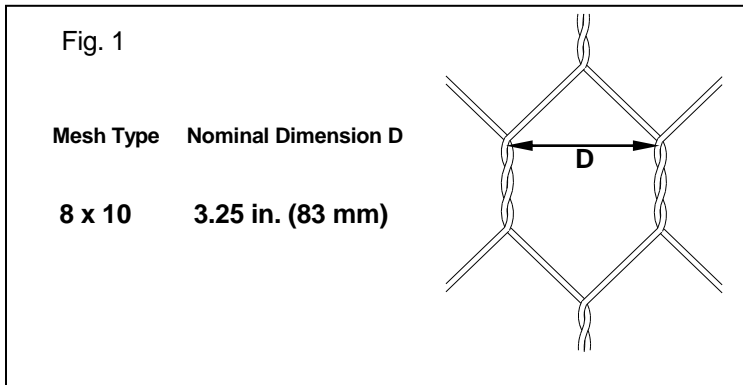
A Geosynthetic or biodegradable Erosion Control Blanket (ECB) is factory attached in the inside facing for faster installation.

2.2 Tolerances

Wire: Zinc coating, in accordance with ASTM A641/A641M, Class III soft temper coating.

Green Terramesh unit: ± 5 % on the length, width, and height.

Mesh opening: Tolerances on the hexagonal, double twisted wire mesh opening shall not exceed ± 10% on the nominal dimension D values (see Fig.1).

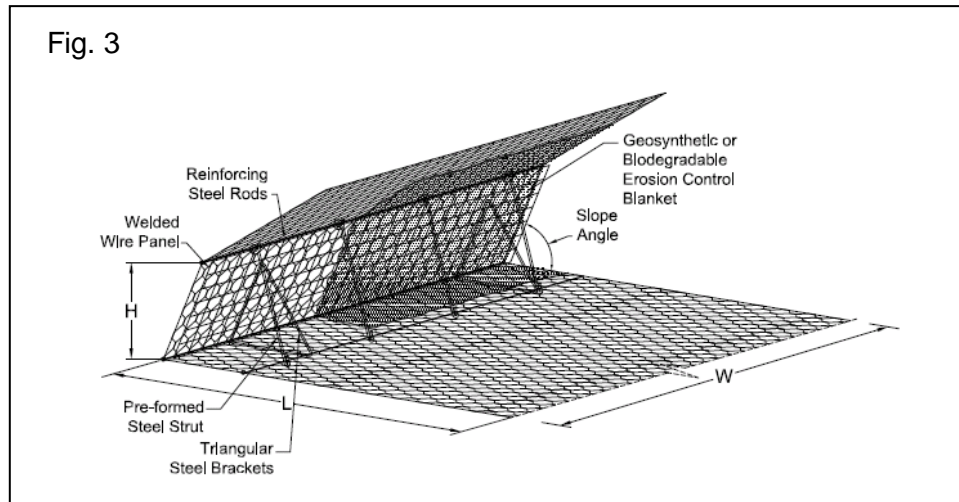


2.3 Standard Unit Size

Table 1 - Sizes for Green Terramesh®			
L=Length m(ft)		W=Width m(ft)	H=Height m(ft) / (Slope Angle)
Green Terramesh®	Green Terramesh® Light		
-	2 (6.5)	3 (9.8)	0.7 (2.3) / (60°)
-	2.5 (8.2)		
3 (9.8)	3 (9.8)		
4 (13.1)	-		
5 (16.4)	-		

2.4 Fabrication

Green Terramesh® shall be manufactured and shipped preassembled at the production facility. The external face, reinforcing panel, and top return shall be woven into a single unit. The welded wire panel with either Geosynthetic or Biodegradable Erosion control blanket as per project specifications shall be factory connected to the base unit. Additionally two preformed steel brackets shall also be factory connected to base unit for easy and faster installation. Reinforcing steel brackets shall be furnished unattached within the packaged units. See Figure 3.



2.5 Topsoil

Topsoil should be sandy clay or clay like sand, with 3% to 20% of organic material. The soil should be fertile and friable and should come from 8 in. to 12 in. (200 mm to 300 mm) depths in the field. Topsoil should be free from wood and stones larger than 2 in. (50 mm) in maximum dimension. Placement is made to the specified thickness and profile into the face of the unit prior to the placement of the structural backfill.

2.6 Structural Backfill

Mechanically stabilized earth structures shall be made of a good quality, free draining, granular and/or selected fill. The recommended soil gradation is in the range of 0.001 in. to 0.75 in. (0.02 mm to 19 mm), or as indicated by AASHTO T-27 and FHWA Demo 82. Soils outside of this range may be suitable, providing approval is given by a geotechnical engineer.

3.0 Construction Requirements

3.1 Assembly

Green Terramesh® units are pre-assembled during manufacturing and are supplied folded flat and packed in bundles. Each bundle is labeled with a tag reporting the sizes of the units. When the units are unfolded, they will have one or two shipping folds, which must be removed. This can be achieved by placing the fold over a 2 in. x 4 in. (50 mm x 100 mm) board and walking along the sides.

The procedure for using lacing wire consists of cutting a sufficient length of wire (+/- 3 ft) (+/- 1 m), and first looping and/or twisting the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening approximately every 6 in. (150 mm), pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting.

The use of fasteners shall be in accordance with the manufacturer's recommendations as specified in Section 2.1.7.

3.2 Installation

Prior to installing the assembled units, the foundation on which the Green Terramesh® units are to be placed shall be cut or filled and graded to the lines and grades shown on the construction drawings. Surface irregularities, loose material, and vegetation shall be removed during the preparation of the foundation.

Units are carried to and placed in their final position and the facing units shall be raised. Factory attached triangles insures correct facia angle and speed up the construction. Adjoining units must be securely joined together using the procedure(s) described in Sections 2.1.6 and 2.1.7, along the vertical facing and top edges of their contact surfaces. Adjacent units should be connected along the reinforcing panel every 3 ft (1 m) to avoid movement during backfilling. Whenever a structure requires more than one layer of units, the upper unit shall also be connected to the top of the lower layer via the welded panels using the procedure(s) described in Sections 2.1.6 and 2.1.7.

Connect the reinforcing steel brackets to the top of the welded wire panel and the reinforcing steel wire in the anchor panel. (Make a small cut to the ECB if necessary.) The bottom hook of the reinforcing steel bracket can be closed with an overlapping fastener. This ensures that the hook does not come unfastened. **The units placed on the last row**

(uppermost course) at the top of the structure should have a return of minimum 6.56 ft (2 m) long. This can be achieved on field by connecting extra mesh panel.

3.3 Vegetative Soil Placement

Prior to placing vegetative soil, ensure that the blanket overlap is located correctly. Vegetative soil shall be placed on the back of the facing element; 18-24 in. (457-610 mm) thickness minimum is required. The soil should be lightly compacted by foot or small machine compactor.

3.4 Placement of the Structural Backfill

The arches mesh panel should be unfolded; the shipping folds flattened out, and pulled tight to minimize future creepage. The granular backfill specified by the engineer shall be installed in maximum lifts of approximately 0.8in (200mm). Placement and compaction of backfill shall be parallel to the slope face, ensuring that construction equipment does not come into contact with the mesh panel or within 3 ft (1 m) from front face of Green Terramesh unit. The homogeneity of the backfill and the level of compaction required shall be verified.

3.5 Mesh Cutting and Folding

Where shown on the drawings or otherwise directed by the engineer, the Green Terramesh® shall be cut, folded and fastened together to suit existing site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners in the manner described in Section 3.1. Any reshaped Green Terramesh® shall be subject to all the aforementioned specifications in the previous sections.

4.0 Vegetation

To assist in vegetation establishment on the facing, various bioengineering techniques may be used during or after installation. Successful techniques include live branches, live staking and/or planting. Hydroseeding can be used on specific projects. It is recommended to consult a local specialist to select the appropriate vegetation techniques related to the project.

4.1 Hydroseeding

It is recommended to perform hydroseeding during the local growing season. After seeding and mulching, the Green Terramesh® slope should be watered a minimum of twice a week for 30 days after seeding. The watering equipment must not damage the plants, the grass and/or any other material on site. When herbaceous vegetation is used, an irrigation system and maintenance program maybe required to insure the growth of the vegetation. It is recommended to water the slope before seeding. Seeding and mulching operations shall be performed during the local growing season. Please consult a local specialist for the local growing season.

4.2 Live Staking

Live stake planting involves the insertion and tamping of live, vegetative cuttings into the ground in a manner that allows the stake to take root and grow. Use site reconnaissance to identify willow species, growth form, soil and site conditions on adjacent sites and compares their condition to the construction site. Planting will be more successful if soil, site and species selected match stable, vegetated nearby sites. The dimensions of the cuttings should be approximately ¾ in.-2 in. (19-50 mm) in diameter and 15 in.-40 in. (0.4-1 m) in length.

4.2.1 Installation

Stakes must be planted with butt-ends into the ground. Leaf bud scars or emerging buds should always point up.

- Stakes must not be allowed to dry out. All cuttings should be soaked in water for a minimum of 24 hours. Soaking significantly increases the survival rate of the cuttings, however they may be planted the same day they are harvested.
- Plant stakes 1 to 3 ft (0.3-1 m) apart. Use an iron stake or bar to make a pilot hole in firm soil.
- Set the stake as deep as possible into the soil, preferably with 80 percent of its length into the soil and in contact with mid-summer water table.
- It is essential to have good contact between the stake and soil for roots to sprout. Tamp the soil around the cutting.
- Do not damage the buds, strip the bark or split the stake during installation.
- Split or damaged stakes should be cut or removed and replaced.

5.0 Method of Measurement

5.1 The excavation pay limits for a Green Terramesh® structure shall be determined by the exterior of the slope face and a line coincident with the back of the reinforcement panel. Quantities shall be determined from cross sections and the linear distance, and paid for under the appropriate excavation bid items.

5.2 The quantity to be paid for “In place Green Terramesh® structure” shall be the number of square yards or square meters of Green Terramesh® measured in their final position. Project conditions and material availability will determine the actual size & type of units to be used.

5.3 The bid price shall include the in place cost of all materials, equipment, and labor including Green Terramesh® and backfill material.

6.0 Basis of Payment

Accepted Green Terramesh® will be paid for at the unit price for each pay item included in the contract.
