TERRAMESH® SYSTEM
GALVANIZED & PVC COATED

FORWARD

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NOTES:

The following items have been changed or updated from previous versions. The current date of this specification is August 2008.

The following ASTM standards and specifications have been added or updated:

ASTM A313/A 313M-98	Standard Specification for Stainless Steel Spring Wire
ASTM A370-97a	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A641/A 641M-03	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM B117-97	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D1242-95a	Standard Test Methods for Resistance of Plastic Materials to Abrasion
ASTM D1499-99	Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics
ASTM D4420-95	Standard Test Method for Rubber Property—Durometer Hardness
ASTM D412-98a	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D746-04	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D792-00	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM G152-00	Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Non-metallic Materials
UL 746B	Polymeric Materials-Long Term Property Evaluation

Terramesh® System
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1.0 Description

This work shall consist of furnishing, assembling, and filling woven wire mesh soil reinforcement units used in Mechanical Stabilized Earth (MSE) 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 Terramesh® System manufactured by Maccaferri, Inc.

2.0 Materials

2.1 Woven Mesh

2.1.1 Wire (Zinc Coated):

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

- *Tensile strength*: the wire used for the manufacturing of Terramesh® System and the lacing wire shall have a maximum tensile strength of 75,000psi (515 MPa), in accordance with ASTM A641/A641M-03.
- *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 A370-97a.
- *Zinc coating*: minimum quantities of zinc according to ASTM A641/A641M-03, 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-03.

2.1.2 PVC (Polyvinyl Chloride) Coating

- *Specific density*: 81-84 pcf (1.30-1.35 kg/dm^3) in accordance with ASTM D792-00;
- *Hardness*: between 50 and 60 Shore D, according to ASTM D2240-95;
- *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, *t*he PVC polymer coating shall have a projected durability life of 69 years when tested in accordance with UL 746B.

The accelerated aging tests are:

- *Salt spray test*: test period 3,000 hours, test method ASTM B117-97;
- *Exposure to UV rays*: test period 3,000 hours at 145°F (63°C), test method ASTM D1499-99 and ASTM G152-00;
- *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).

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 – 0.106 in (2.70 mm) internal, 0.146 in (3.70 mm) external
- *Selvedge Wire*: 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 Galvanized and PVC coated lacing wire and internal connecting wires.

(Connecting wires are used in Terramesh® System on exterior of structure):

- *PVC coating thickness:* Nominal – 0.02 in (0.5 mm), Minimum – 0.015 in (0.38 mm)
- *Lacing wire*: Diameter – 0.087 in (2.20 mm) internal, 0.127 in (3.20 mm) external
- *Cross Tie/Stiffener wire*: Diameter - 0.087 in (2.20 mm) internal, 0.127 in (3.20 mm) external
- *Preformed Stiffener*: Diameter – 0.134 in (3.4 mm) internal, 0.174 in (4.4 mm) external

2.1.5 Steel Mesh Properties

- *Mesh Tensile Strength* shall have a minimum strength of 2900 lb/ft (42.3 kN/m) when tested in accordance with ASTM A975 section 13.1.1
- *Punch Test Resistance* shall have a minimum resistance of 5300 lb (23.6 kN) when tested in accordance with ASTM A975 section 13.1.4
- *Connection to selvedges* shall have a minimum resistance of 1200 lb/ft (17.5 kN/m) when tested in accordance with ASTM A975.

2.1.6 Spenax Fasteners (Overlapping Fasteners):

Overlapping stainless steel fasteners may be used in lieu of, or to complement, lacing wire for basket assembly and installation. The spacing of the fasteners during all phases of assembly and installation shall be in accordance with spacing based on 1,200 lb/ft (17.5 kN/m), pull apart resistance for PVC coated mesh tested in accordance with ASTM A975 section 13.1.2 and with a nominal spacing of 4 in (100 mm), and not to exceed 6 in (150 mm).

- *Stainless steel fasteners*: diameter: 0.120 in (3.05 mm), according to ASTM A313/A313M-98, Type 302, Class I.
- *Tensile strength:* 222,000 to 253,000 psi (1530-1744 MPa) in accordance with ASTM A313/A313M-98.
- *Proper installation of rings:* A properly formed Spenax fastener shall have a nominal overlap of 1 in after closure (Fig. 2).

2.2 Tolerances

Wire: Zinc coating, in accordance with ASTM A641/A641M-03, Class III soft temper coating.
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):

Fig. 1

Mesh Type	Nominal Dimension D
8 x 10	3.25 in (83 mm)

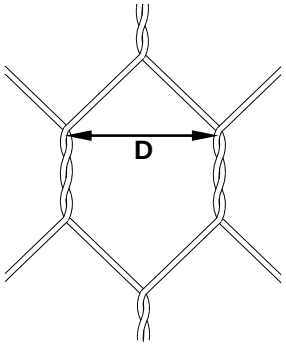
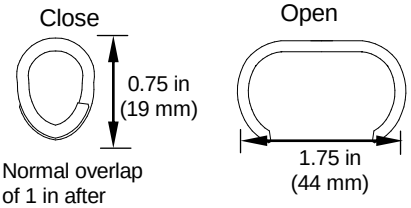


Fig. 2



2.3 Standard Unit Size

Table of sizes for Terramesh® System		
L=Length ft (m)	**W=Width ft (m)**	**H=Height ft (m)**
9 (2.7)	8 (2.40)	2.5 (0.76)
12 (3.7)	8 (2.40)	2.5 (0.76)
15 (4.6)	8 (2.40)	2.5 (0.76)
18 (5.5)	8 (2.40)	2.5 (0.76)

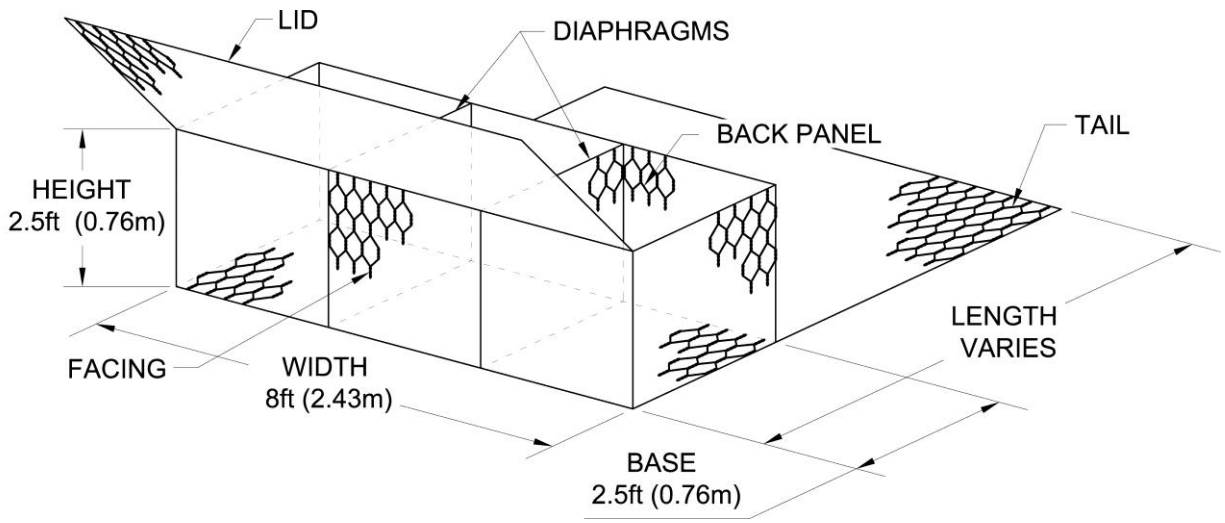
* Additional Sizes May Be Available Upon Request

2.4 Fabrication

Terramesh® System shall be manufactured with all components mechanically connected at the production facility. The external face, reinforcing panel, and lid of the Terramesh® shall be woven into a single unit. The ends, back, and diaphragm shall be factory connected to the base. All perimeter edges of the mesh forming the basket shall be selvedged with wire having a larger diameter.

The facing element of a Terramesh® unit is divided into three cells by means of the diaphragms positioned at approximately 2.6-ft (0.8 m) centers. The diaphragm shall be secured in position to the base so that no additional lacing is necessary at the job-site.

Fig. 3



2.5 Rock

Rock for the facing section of a Terramesh® unit shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. The rocks shall range between 4 in (100 mm) and 8 in (200 mm). Each range of sizes may allow for a variation of 5% oversize rock by number of particles, or 5% undersize rock by number of particles, or both. The size of any oversize rock shall allow for the placement of minimum of three layers of rock must be achieved when filling the 2.5 feet (0.76 m) high Terramesh® units.

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 0.00072 in (0.02 mm) to 0.75 in (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

Terramesh® System units are supplied folded flat and packed in bundles. The facing section of the units are assembled individually by erecting the sides, back, ends, and diaphragm, ensuring that all panels are in the correct position, and the tops of all sides are aligned. The four corners of the basket shall be connected first, followed by the internal diaphragm to the outside walls. All connections shall be made using lacing wire or ring fasteners as previously described in Section 2.1.4 and Section 2.1.6.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting to secure 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 ring fasteners shall be in accordance with the manufacturer's recommendations as specified in Section 2.1.6.

Following assembly of the facing section the reinforcing panel shall be unfolded to the required length and the shipping folds removed. Folds can be removed by placing the fold over a 2 in x 4 in (50 mm x 100 mm) board and walking along the sides.

3.2 Installation

Prior to installing the assembled units, the foundation on which the 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.

The Terramesh® units are carried to their final position and connected with the adjoining empty units along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described in Section 3.1. Whenever a structure requires more than one layer of units, the upper layer shall be connected to the top of the lower layer along the front and back edges of the contact surface using the same connecting procedure(s) described in Section 3.1.

3.3 Filling of the Facing Section

The facing section shall be filled with rock as specified in Section 2.4. During the filling operation some manual stone placement is required to minimize voids. For vertical or near vertical structures the exterior of the basket may be carefully hand placed to give a neat, flat, and compact appearance. Care shall be taken when placing fill material to ensure that the sheathing on the PVC coated baskets is not damaged.

The cells shall be filled in stages so that local deformation may be avoided. That is, at no time shall any cell be filled to a depth exceeding 1-ft (0.30 m) higher than the adjoining cell. It is also recommended to slightly overfill the baskets by 1 to 2 in (25 to 50 mm) to allow for settlement of the rock.

3.4 Internal Connecting Wires

Mac Tie preformed stiffeners or lacing wire can be used as internal connecting wires when a structure requires more than one layer of Terramesh® to be stacked on top of each other. Internal Connecting Wires with lacing wire shall connect the exposed face of a cell to the opposite side of the cell. Internal Connecting performed stiffeners shall connect the exposed face of a cell to the adjacent side of the cell. Preformed stiffeners are installed at 45° to the face (side of the unit), extending an equal distance along each side to be braced (approximately1 ft (300 mm)). An exposed face is any side of Terramesh® that will be exposed or unsupported after the structure is completed.

3.4.1 2.5 Feet (0.76 m) High Terramesh® System

2.5 ft (0.76 m) high Terramesh® System shall be filled in three layers, 11 in (280 mm) at a time. Connecting wires shall be installed after the placement of each layer, that is, at 11 in (280 mm) high and 22 in (560 mm) high.
1.5 ft (0.46 m) high Terramesh® System shall be filled in two layers, 9 in (225 mm) at a time. Connecting wires shall be installed after the placement of the first layer, that is, at 9 in (225 mm) high.

3.5 Placement of the Structural Backfill

The anchor mesh panel should be unfolded, the shipping folds flattened out, and pulled tight to minimize further creepage. Prior to starting this operation, a geotextile filter shall be placed at the facing section and backfill interface. The characteristics of the geotextile shall be as specified by the engineer. The geotextile should have a 12 in (300 mm) return at both top and bottom.
The granular backfill specified by the engineer shall be installed in lifts of approximately 8 in (200 mm), and dumped in the middle section of the anchor mesh panel. Compacting is to precede parallel to the wall, ensuring that the compacting machine does not come in contact with the mesh panel or within 3 ft (1 m) of the rear of the face section. The homogeneity of the backfill and the level of compaction required shall be verified.

3.6 Lid Closing

Once the baskets are completely full, the lids shall be pulled tight until the lid meets the perimeter edges of the basket. A tool like a lid closer can be used. The lid must then be tightly laced and/or fastened along all edges, ends, and tops of diaphragm(s) in the same manner as described in Section 3.1.

3.7 Mesh Cutting and Folding

Where shown on the drawings or otherwise directed by the engineer, the Terramesh® System may 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 Terramesh® System shall be assembled, installed, filled and closed as specified in the previous sections.

4.0 Method of Measurement

4.1 The excavation pay limits for a Terramesh® structure shall be determined by the exterior of the facing baskets 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.

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

4.3 This bid price shall include the installed in place cost of all materials, equipment, and labor, including Terramesh® System, rock, and backfill material.

5.0 Basis of Payment

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