GABION
GALVANIZED & PVC COATED

Gabion – Galvanized & PVC Coated

1.0 Description

This work shall consist of furnishing, assembling, and filling woven wire mesh gabions with rock as specified in the contract to 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 gabions as manufactured by Maccaferri Inc or equivalent.

2.0 Materials

2.1 Woven Mesh Gabions

2.1.1 Wire (Zinc Coated):

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

- *Tensile strength*: both the wire used for the manufacture of gabions and the lacing wire, shall have a maximum tensile strength of 75,000 psi (515 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 gravity*: 81-84 pcf (1.30-1.35 kg/dm^{3,}) in accordance with ASTM D792, Table 1;
- *Hardness*: between 50 and 60 Shore D, according to ASTM D 2240;
- *Tensile strength*: not less than 2,985 psi (20.6 MPa), according to ASTM D412;
- *Modulus of elasticity*: not less than 2,700 psi (18.6 MPa), according to ASTM D412;
- *Abrasion resistance*: the percentage of the weight loss shall be less than 12%, according to ASTM D1242.
- *Heat Aging Test*: prior to UV and abrasion degradation, the PVC polymer coating shall have a projected durability life of 69 years when tested in accordance with UL 746B.

Note: The standard stock color for Maccaferri PVC coating is gray.

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.

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 gabions (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 stiffeners:

- *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/m) 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):

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 and PVC coated wire 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 A313 Table 5.
- *Proper installation of rings:* A properly formed Spenax fastener shall have a nominal overlap of one (1) in. after closure (Fig. 2).

2.2 Tolerances

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

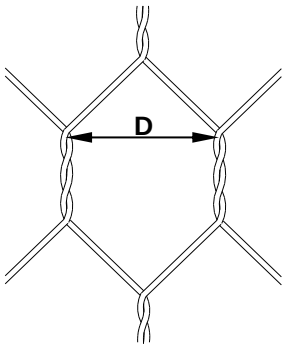
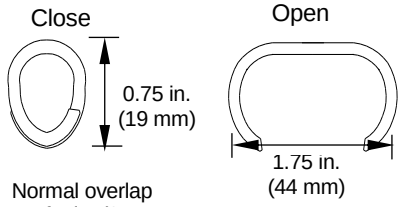


Fig. 2



Normal overlap of 1 in. (25 mm) after closure

2.3 Standard Unit Size

Table of sizes for gabions			
L=Length ft (m)	W=Width ft (m)	H=Height ft (m)	# of cells
6 (1.8)	3 (0.9)	3 (0.9)	2
9 (2.7)	3 (0.9)	3 (0.9)	3
12 (3.6)	3 (0.9)	3 (0.9)	4
6 (1.8)	3 (0.9)	1.5 (0.45)	2
9 (2.7)	3 (0.9)	1.5 (0.45)	3
12 (3.6)	3 (0.9)	1.5 (0.45)	4
6 (1.8)	3 (0.9)	1 (0.3)	2
9 (2.7)	3 (0.9)	1 (0.3)	3
12 (3.6)	3 (0.9)	1 (0.3)	4
4.5 (1.4)	3 (0.9)	3 (0.9)	1

All sizes and dimensions are nominal. Tolerances of ± 5% of the width, and length height, of the gabions shall be permitted.

2.4 Fabrication

Gabions shall be manufactured and shipped with all components mechanically connected at the production facility. The front, base, back and lid of the gabions shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base. All perimeter edges of the mesh forming the basket and top, or lid, shall be selvedged with wire having a larger diameter.

The gabion is divided into cells by means of diaphragms positioned at approximately 3 ft (1 m) centers. The diaphragms shall be secured in position to the base so that no additional lacing is necessary at the jobsite. See Figure 3.

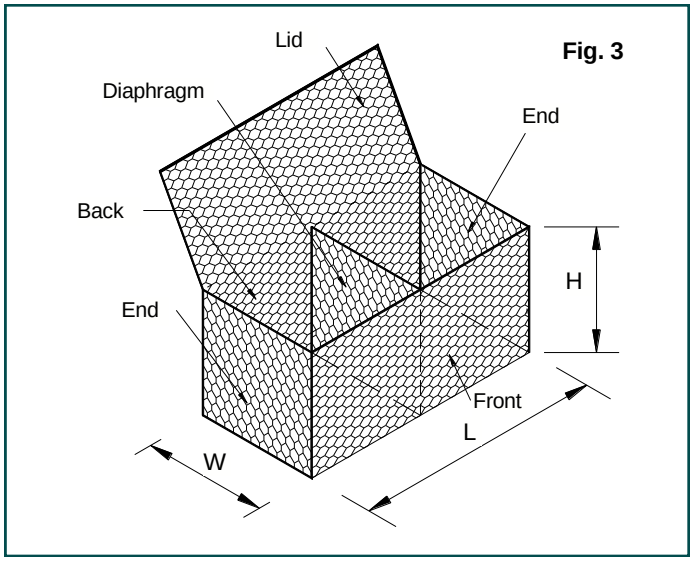


Fig. 3

2.5 Rock

The rock for gabions 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. Gabion rocks shall range between 4 in. (0.10 m) and 8 in. (0.20 m). The range in sizes shall allow for a variation of 5% oversize and/or 5% undersize rock, provided it is not placed on the gabion exposed surface. The size shall be such that a minimum of three layers of rock must be achieved when filling the gabions.

3.0 Construction Requirements

3.1 Assembly

Gabions are supplied folded flat and packed in bundles. The units are assembled individually by erecting the sides, ends, and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are aligned. The four corners shall be connected first, followed by the internal diaphragms to the outside walls. All connections should use lacing wire or 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 fasteners shall be in accordance with the manufacturer's recommendations as specified in Section 2.1.6.

3.2 Installation

After initial assembly, the gabions are carried to their final position and are securely joined together 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, the upper empty baskets shall also 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

Gabions shall be filled with rock as specified in Section 2.4. During the filling operation some manual stone placement is required to minimize voids. The exposed faces of vertical structures 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-foot (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. Behind gabion walls, compact the backfill material simultaneously to the same level as the filled gabions.

3.4 Internal Connecting Wires

MacTie preformed stiffeners or lacing wire can be used as internal connecting wires when a structure requires more than one layer of gabions 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 Preformed 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 (approximately 1 ft. (300 mm)). An exposed face is any side of a gabion cell that will be exposed or unsupported after the structure is completed.

3.4.1 3 Feet (1 m) High Gabions

3 feet (1 m) high gabions shall be filled in three layers, 1 foot (300 mm) at a time. Connecting wires/bracings shall be installed after the placement of each layer, that is, at 1 foot (300 mm) high and 2 feet (600 mm) high.

3.4.2 1.5 Feet (0.5 m) High Gabions

1.5 feet (0.5 m) high gabions do not require connecting wires/bracings unless the baskets are used to build vertical structures. In some cases, these units shall be filled in two layers, 9 in. (230 mm) at a time. Connecting wires shall be installed after the placement of the first layer, which is at 9 in. (230 mm) high.

3.5 Lid Closing

Once the gabion baskets are completely full, the lids will be pulled tight until the lid meets the perimeter edges of the basket. A tool such as 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.

3.6 Mesh cutting and folding

Where shown on the drawings or otherwise directed by the engineer, the gabions shall be cut, folded and fastened together to suit 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 gabions shall be assembled, installed, filled and closed as specified in the previous sections.

4.0 Method of Measurement

4.1 The payment quantities for excavation shall be determined by the outside limits of the gabion structure. Quantities will 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 gabions” shall be the number of cubic meters or cubic yards of gabions measured in their final position. Project conditions and material availability will determine the actual size of gabions to be used.

4.3 Excavated material beyond the limits of the gabions shall be backfilled with gravel, crushed rock or other material approved by the engineer.

4.4 This bid price shall include the installed in place cost of all materials, equipment, and labor, including gabions, rock, and backfill material.

5.0 Basis of Payment

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