MACCAFERRI

PRODUCT INSTALLATION GUIDE

Rev: 01, Issue Date 04.01.2005

GABION

Material Delivery

Gabions are manufactured with all components mechanically connected at the production facility, as per ASTM A975-97. All gabions are supplied in the collapsed form, either folded and bundled or rolled. The bundles are compressed and strapped together at the factory for easy shipping and handling. Lacing wire is shipped in coils. Fasteners are shipped in boxes. Preformed corner stiffeners are shipped in boxes.

Assembly

Open and unfold each gabion on a flat, hard surface and remove any shipping fold if necessary. This can be done by placing the fold over a 2" x 4" board and walking along the sides. Lift up the sides, ends and diaphragms into a vertical position to form an open box shape (Fig. 1).

Connect the back and the front panels of the gabion to the end panels and center diaphragms. The top corner of the end panels and center diaphragms have the selvedge wire extending out approximately 4 in. (102 mm) from these panel edges. Raise the end panels and the diaphragms to a vertical position and wrap the selvedge wire around the edge wire of the top and back panels.

Connect the edges of the gabion and diaphragms by using either lacing wire or ring fasteners (Fig. 2). Ring fasteners shall not be spaced more than 6 in. (150 mm) apart. The procedure for using lacing wire consists of cutting a sufficient length of wire, 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 pliers to aid assembly and tying of the units using the lacing wire supplied with the gabions is normally recommended.

Erect the diaphragms into the vertical position, and tie them to the side panels in the same manner.

Fastening Procedure

When using lacing wire, cut off a piece of wire approximately 1.5 times the length of the edge to be tied. Longer edges shall be joined by several lengths of wire. Tie wires shall be secured around the selvedge wire or heavier edge wire, where present, by looping and twisting the lacing wire around itself. Proceed tying with alternate double and single loops. Double loops shall be made at intervals not greater than 6 in. (150 mm). The baskets should be pulled tightly together during the tying operation. The other end of the tie wire shall be secured by again looping and twisting the wire around itself. When using lacing wire to assemble the units, pliers may be used to create tight joints. Care should be taken to avoid damaging the wire coating.

When steel ring fasteners are used, the use of either a mechanical or a pneumatic fastening tool is required. Spacing of the rings shall be in accordance with ASTM A975-97 Table 2, Panel to Panel connection, Pull-Apart Resistance. In any case, ring fasteners spacing shall not exceed 6 in. (150 mm). Rings shall be installed at the end and center diaphragms and along all edges. Care should be taken to ensure the steel ring fastener is completely closed after installation. When this is not possible, connection must be complemented with lacing wire.

Foundation Preparation

The foundation on which the gabions are to be placed shall be level, and graded to the elevations as shown on the project construction drawings. The foundation for gabions shall be level, smooth, and free of surface irregularities, loose material, and vegetation in accordance with the project specifications. Appropriate measures shall be taken for filtering and drainage of the foundation, as per the project specifications (filter cloth, drain works, etc.). Geotextiles required to be installed behind gabion structures shall comply with the requirements for subsurface drainage applications.

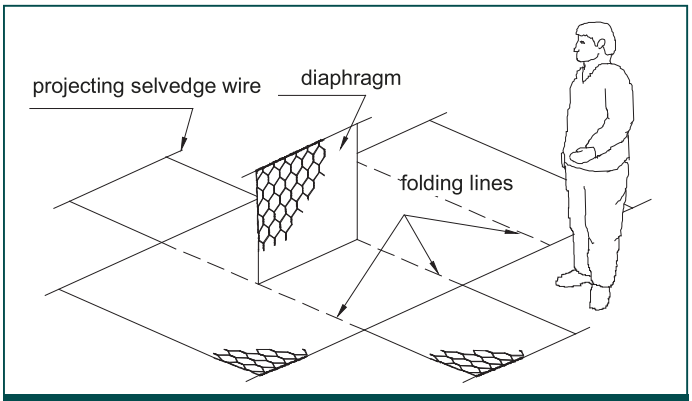

Figure 1

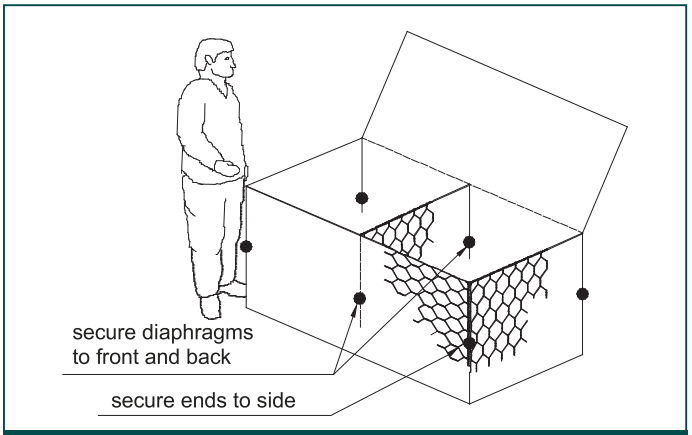

Figure 2

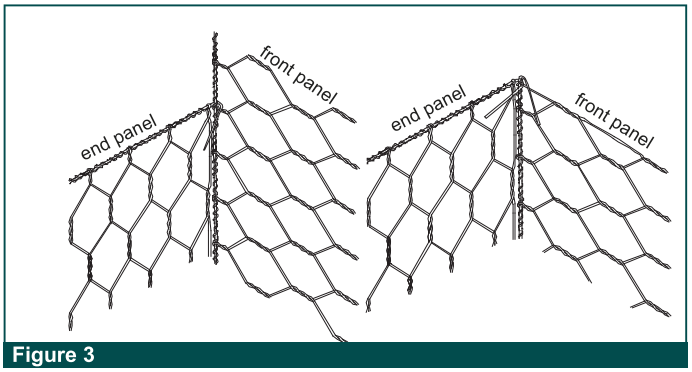

Figure 3

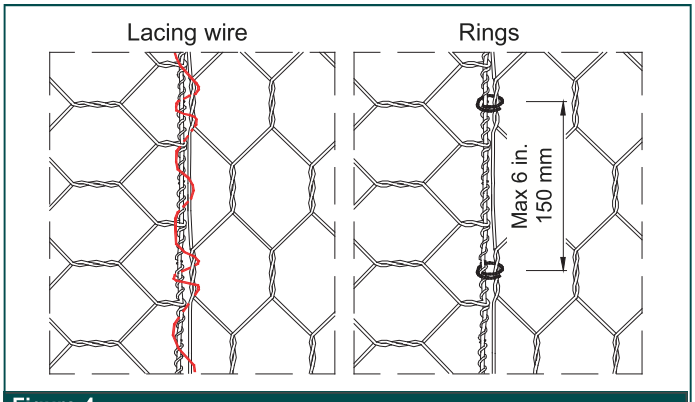

Figure 4

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Maccaferri reserves the right to amend product specifications without notice and specifiers are requested to check as to the validity of the specifications they are using.

Installation and Filling

After the foundation has been prepared, the pre-assembled gabions are placed in the desired location to form the structure. Gabions shall be connected together and aligned before filling the baskets with rock. All connections (panel-to-panel and basket-to-basket) shall be already carried out as described in the assembly operations.

Rocks for gabions may be produced by any suitable quarrying method, and by the use of any device that yields the required sizes within the gradation limits chosen. Rocks 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 4-8 in. (100-200 mm). The range in sizes may allow for a variation of 5% oversize and/or 5% undersize rock, provided it is not placed on the gabion's exposed surface. In all cases, the oversize rock shall not be larger than 10 in. (250 mm), and the undersize rock shall not be smaller than 2 in. (50 mm).

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. 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 (300 mm) higher than the adjoining cell (Fig. 7). When using PVC gabions, care should be taken when placing the stone to assure that the PVC coating on gabions will not be damaged.

Stiffeners or crossties shall be installed as indicated (Fig. 6), fixed at 1/3 and 2/3 of the height for 3 ft or 1 m gabions as the cell is being filled. In 1.5 ft (500 mm) high units stiffeners may be fixed at the half height level, if required. Preformed corner stiffeners are installed at 45° to the face/side of the unit, extending an equal distance along each side being braced (approximately 1 ft [300 mm]). Minimize the number of voids by using a well-graded stone and avoid large stones in order to achieve a dense, compact stone fill. All corners should be securely connected to the neighboring gabions of the same layer before filling the units.

When more than one layer of gabions is required, in order for the individual units to become incorporated into one continuous structure, the next layer of gabions must be connected to the layer underneath after this layer has been securely closed (Fig. 8).

Gabion placement should be front to front and back to back, so that pairs of facing lids can be wired down in one process.

Secure the end from which the work is to start, by partially filling the end unit with rock.

Closing

To allow for settlement, level off the fill 1-1.5 in. (25-40 mm) above the top of the mesh. In slow protection aprons downstream of weirs and places where water will fall directly on the gabions, install bracing wires vertically between the top and bottom mesh. Be sure to keep the top edge of the diaphragm exposed. Fold the lid down and pull the edges of the panels to be connected using an appropriate tool such as a lid closer (Fig. 9). The lids shall be tightly laced along all edges, ends and diaphragms in the same manner as described for assembling units (Fig. 4). Adjacent lids may be securely attached simultaneously. All end wires should then be turned in to avoid protrusions.

Lid closer	Pneumatic Spenax tool	Manual tool

Figure 9

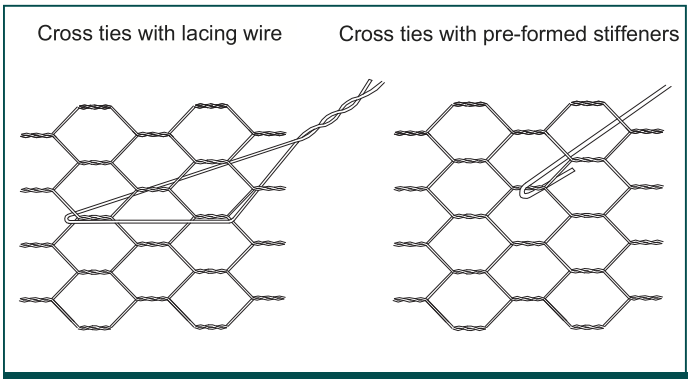

Figure 5

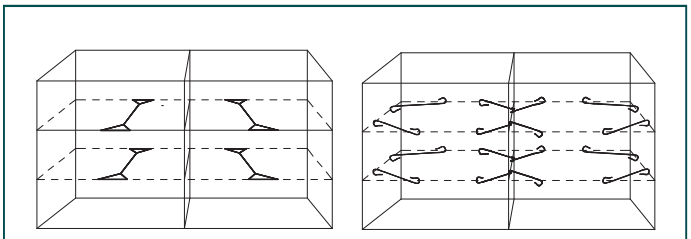

Figure 6

Figure 7

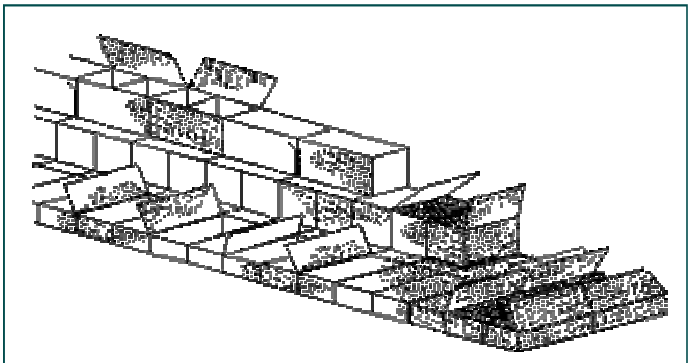

Figure 8

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TECHNICAL DATA SHEET

Rev: 01, Issue Date 03.01.2007

American Units

GABION

GALFAN® & PVC COATED

Product Description

Gabions are baskets manufactured from 8x10 double twisted hexagonal woven steel wire mesh, as per ASTM A975-97 (Figs. 1, 2). Gabions are filled with stones at the project site to form flexible, permeable, monolithic structures such as retaining walls, channel linings, and weirs for erosion control projects.

The steel wire used in the manufacture of the gabion is heavily Galfan® (zinc-5% aluminum-mischmetal [Zn-5 Al-MM] alloy) coated soft temper steel. A PVC coating is then applied to provide additional protection for use in polluted, contaminated or aggressive environments: in salt, fresh water, acid soil or wherever the risk of corrosion is present. The PVC coating has a nominal thickness of 0.02 in. (0.50 mm). The standard specifications of the mesh-wire are shown in Table 2.

The gabion is divided into cells by diaphragms positioned at approximately 3 ft (0.9 m) centers (Fig. 1).

To reinforce the structure, all mesh panel edges are selvedged with a wire having a greater diameter (Table 3). Dimensions and sizes of PVC coated gabions are shown in Table 1.

Gabions shall be manufactured and shipped with all components mechanically connected at the production facility.

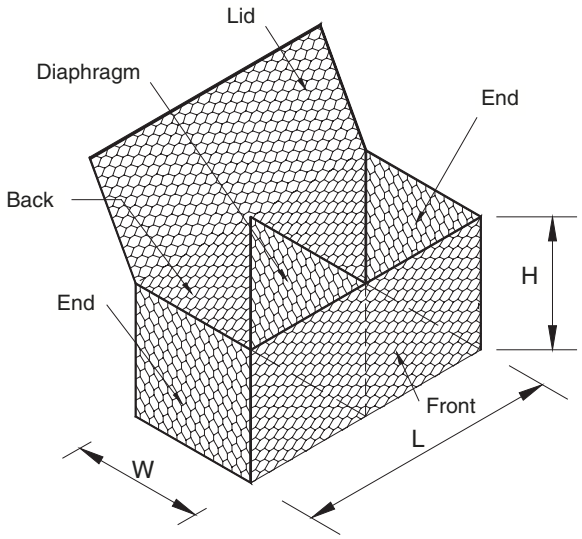

Figure 1

Wire

All tests on wire must be performed prior to manufacturing the mesh. All wire should comply with ASTM A975-97, style 3 coating, Galfan® and PVC coated steel wire. Wire used for the manufacture of gabions and the lacing wire, shall have a maximum tensile strength of 75 000 psi (515 MPa) as per ASTM A856-03, soft temper steel.

Woven Wire Mesh Type 8x10

The mesh and wire characteristics shall be in accordance with ASTM A975-97 Table 1, Mesh type 8x10 and PVC coated. The nominal mesh opening, D = 3.25 in. (83 mm) as per Fig. 2.

The minimum mesh properties for strength and flexibility should be in accordance with the following:

- *Mesh Tensile Strength* shall be a minimum of 2900 lb/ft (42.3 kN/m) when tested in accordance with ASTM A975-97 section 13.1.1.
- *Punch Test* resistance shall be a minimum of 5300 lb (23.6 kN) when tested in compliance with ASTM A975-97 section 13.1.4.
- *Connection to Selvedges* shall be 1200 lb/ft (17.5 kN/m) when tested in accordance with ASTM A975-97.
-

P.V.C. (Polyvinyl Chloride) Coating

The technical characteristics and the resistance of the PVC to aging should meet the relevant standards. The main values for the PVC material are as follows:

- The initial property of the PVC coating shall be in compliance with ASTM A975-97 section 8.2.
- Prior to UV and abrasion degradation, the PVC polymer coating shall have a projected minimum durability of 60 years when tested in accordance with *UL 746B Polymeric Material—Long Term Property Evaluation* for heat aging test .

The tolerance on the opening of mesh 'D' being the distance between the axis of two consecutive twists, is according to ASTM A975-97

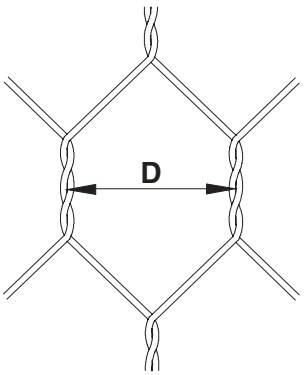

Figure 2

Lacing, Assembly and Installation

Gabion units are assembled and connected to one another using lacing wire specified in Table 3 and described in Fig. 3. 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.

Stainless steel ring fasteners can be used instead of, or to complement, the lacing wire (Fig. 4).

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Table 1—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.

Stainless steel rings for PVC coated gabions shall be in accordance with ASTM A975-97 section 6.3.
Spacing of the rings shall be in accordance with ASTM A975-97 Table 2, Panel to Panel connection, Pull-Apart Resistance. In any case, ring fasteners spacing shall not exceed 6 in. (150 mm) (Fig. 3).
The rings can be installed using pneumatic or manual tools (Fig. 5).
For full details, please see the Gabion Product Installation Guide.

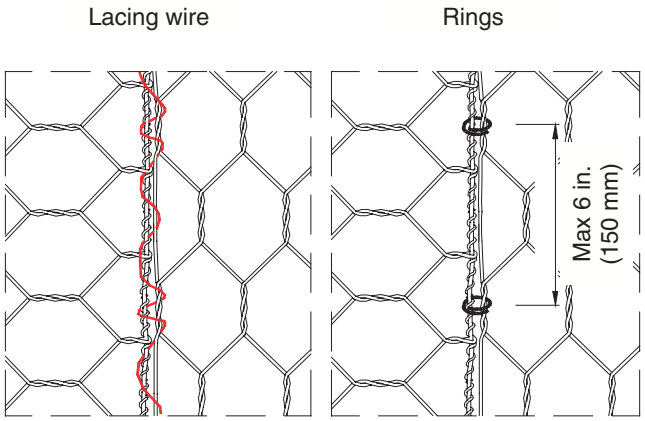


Figure 3

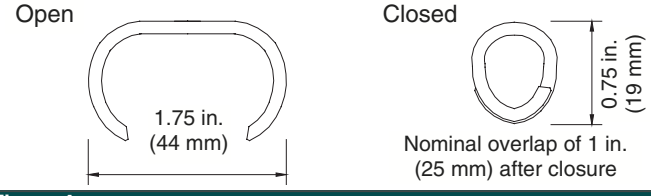


Figure 4

Table 2—Standard mesh-wire

Type	D in. (mm)	Tolerance	Internal Wire Dia in. (mm)	External Wire Dia in. (mm)
8x10/ Galfan®+ PVC	3.25 (83)	±10%	0.106 (2.70)	0.146 (3.70)

Table 3—Standard wire diameters

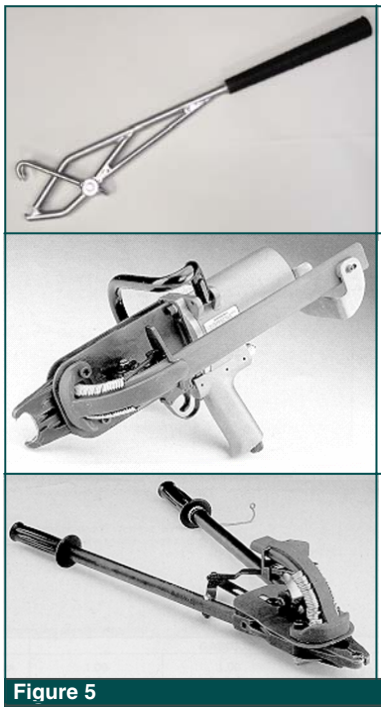
	Lacing Wire	Mesh Wire	Selvedge Wire / Preformed
PVC Mesh Diameter ø in. (mm)	0.087/0.127 (2.2/3.2)	0.106/0.146 (2.7/3.7)	0.134/0.174 (3.4/4.4)
Wire Tolerance (±) ø in. (mm)	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)
Minimum Quantity/Galfan® oz/ft² (g/m²)	0.70 (214)	0.80 (244)	0.85 (259)
Wire + PVC diameter in. (mm)	0.127 (3.20)	1.46 (3.70)	0.174 (4.40)

Quantity Request

When requesting a quotation, please specify:

- number of units,
- size of units (length x width x height, see Table 1),
- type of mesh,
- type of coating.

EXAMPLE: No. 100 gabions, 6x3x3, Mesh type 8x10, Wire diam. 0.106 in. (2.70 mm), Galfan® + PVC coated.



A Lid closer

B Pneumatic Spenax tool

C Manual tool

Figure 5

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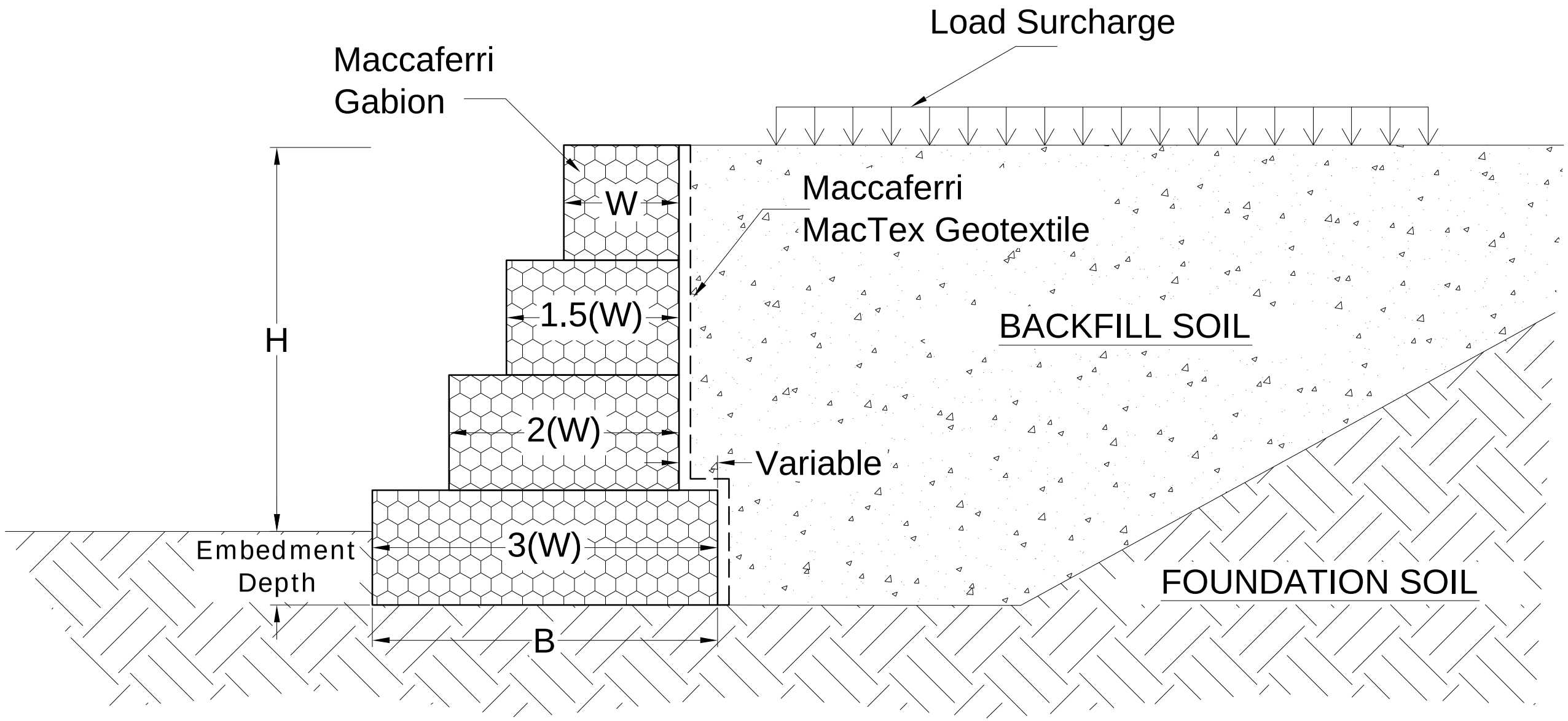

TYPICAL CROSS SECTION - GABION WALL

Maccaferri Inc. assumes no responsibility for the drawings and calculations it provides, as they must be intended as a general indication to suggest the proper use of its products.

Rev:	Issue / Revision:	Drawn:	App:	Date:

Project: Gabion Wall Cross Sections			
Project No: -	Client: -		
Drawing No: Gabion Wall_03	Scale: NTS	Rev: -	

Designed: -	Date: 03/01/07	Drawing Title: Stepped Faced Gabion Wall
Drawn: -	Date: -	
Checked: -	Date: -	NOT FOR CONSTRUCTION
Approved: -	Date: -	

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MACCAFERRI
Environmental Solutions

Update: December 2001

PRODUCT DESCRIPTION SHEET

Gabions

Gabions

Gabions, made with steel wire, are used for retaining walls and erosion control in civil works. Gabions are double–twisted wire mesh baskets of variable sizes, uniformly partitioned into internal cells, interconnected with other similar units (Figs. 1, 2, Table 1). They are filled with stone at the project site to form flexible, permeable, monolithic structures, such as retaining walls, sea walls, channel linings, revetments, and weirs for erosion control projects (Figs. 3, 4, 5, 6, 7, 8).

The wire mesh used for the gabions is fabricated from a soft tensile, heavily galvanized or Galmac coated steel, and woven into double-twisted hexagonal-shaped mesh. The Galmac coating consists of a Zinc–5% Aluminum Mischmetal Alloy and may be used in place of the conventional heavy galvanizing to provide a longer wire lifespan. The double-twist of the woven wire mesh provides integrity, strength and continuity to the structure by adding a non-raveling effect that prevents any accidental damage from spreading.

When gabions are to be placed in aggressive environments, an additional PolyVinyl Chloride (PVC) coating can be applied on the galvanized or Galmac coated wire by extrusion before the weaving of the mesh. The PVC coating will protect the wire and provide further resistance against chemical, biological, and corrosive agents.

With gabions, several unique mechanical characteristics are available to the project design. The most notable are their flexibility, permeability, strength, and versatility for their use in several applications and site conditions.

Gabion structures are able to develop and integrate with the surrounding environment, permitting the preservation or restoration of the natural environment. The filtering capability of the rock fill allows the soil, water, air, and plant life to interact naturally. Plant life can be developed even quicker by designing steps between each vertical layer creating planting terraces. Since gabions provide a completely natural look, they are often used by architects as decorative elements of the landscape.

Fig. 1

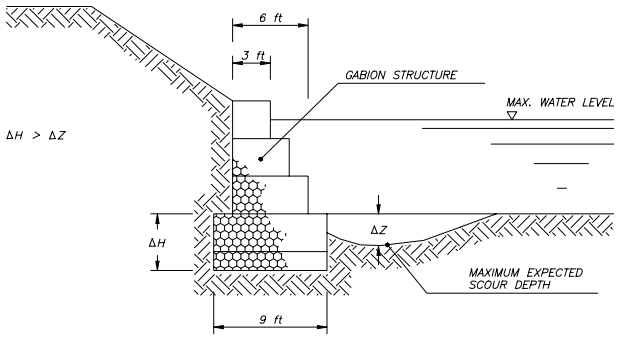


Fig. 2

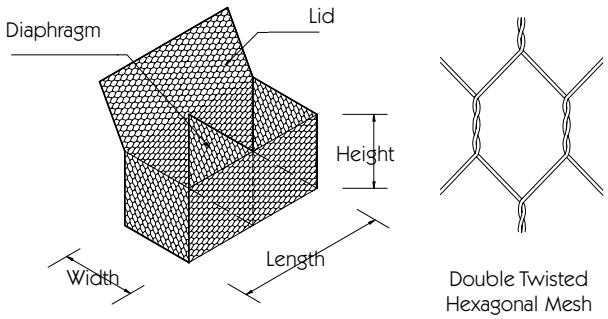


Table 1

Length (ft)	Width (ft)	Height (ft)	Tolerance
6	3	1 - 1.5 - 3	length +/- 5% width +/- 5% height +/- 5%
9	3	1 - 1.5 - 3	
12	3	1 - 1.5 - 3	
4.5	3	3	

Fig. 3

Fig. 4

Fig. 5

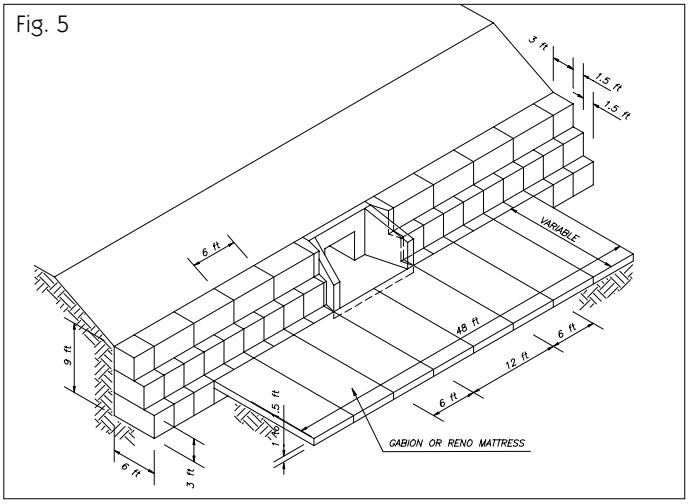


Fig. 6

Gabions are commonly used for a variety of applications that include: retaining wall structures for roads and railways (for both embankments above and below the roadway); protection of culverts; parking structures; land development projects; and landscaping.

Gabions also have very good hydraulic characteristics and are commonly used as weirs and bank protections along rivers and streams. PVC coated gabions are also applied to marine and sea or lake shoreline protection works, etc.

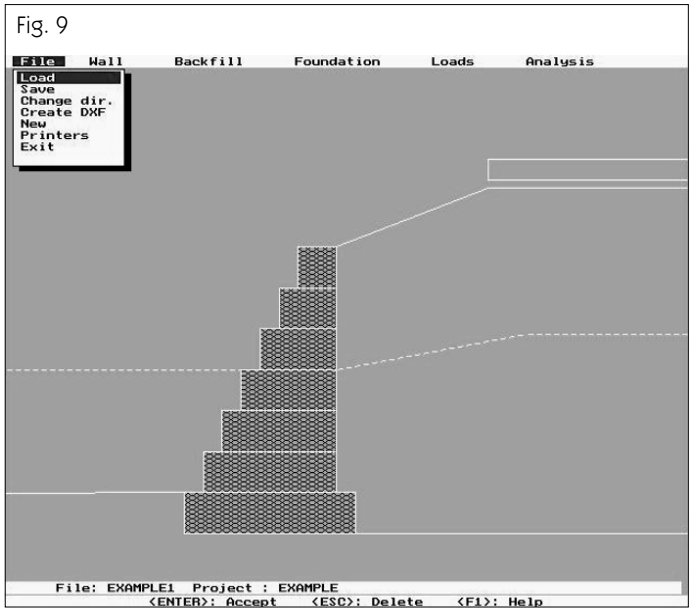
For more information about gabions, technical specifications, and installations procedures, please refer to the *Product Technical Data Sheet* and the *Product Installation Guide*.

Maccaferri provides a complete set of computer software and technical support to assist in the design of gabion structures. Pictured in Fig. 9 is the GAWAC program used to perform stability checks of mass gravity of gabion retaining walls against sliding, overturning, bearing capacity, internal stresses, and overall stability.

Fig. 7

Fig. 8

Fig. 9



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