ROCK MATTRESSES DESIGNED TO RESIST MOVEMENT IN HIGH-FLOW CONDITIONS

GEOFABRICS GEOMATTRESS ROCK MATTRESS

INSTALLATION GUIDE

Geofabrics® Geomattress™ is manufactured from a double-twisted steel wire mesh which is interconnected with similar units to form flexible, permeable, monolithic structures such as riverbank protection and channel linings for erosion control projects.

IMPORTANT INFORMATION

RESPONSIBILITIES

The Contractor is fully responsible for carrying out the works in accordance with the construction design documents, technical specifications, and contract documents (which are not provided to Geofabrics). To support the contractor, Geofabrics has included recommendations in this guide; however, these do not absolve the contractor from adhering to all applicable safety regulations and procedures.

Geofabrics accepts no liability for any inaccuracies or omissions in the execution of the works, nor for any resulting consequences.

It is the responsibility of both the contractor and the client to ensure that all site personnel involved in the work have access to this guide and are familiar with its contents.

MATERIALS REQUIREMENTS BEFORE STARTING

This work consists of furnishing, assembling and filling woven wire mesh mattresses with rock as specified in the contract to the dimensions, lines and grades shown on the plans, or determined by the engineer.

GEOMATTRESS

Geomattresses are manufactured with all components mechanically connected at the production facility. Units are delivered to site folded and compressed in bundles weighing approximately 800 kg and measuring approximately 2 x 1 m in plan and 0.5 m in height; type and size determine the number of units per bundle.

LACING WIRE

Lacing wire is supplied in coils and is used to assemble and interconnect the units, and for facing support. Refer to Table 1 for the correct lacing wire to match the Geomattress coating.

GABION	LACING WIRE
Zn-Al Geomattress	Zn-Al lacing wire
Zn-Al/PVC Geomattress	Zn-Al/PVC lacing wire

Table 1 - Lacing wire type

RING FASTENERS

To increase the installation productivity, steel ring fasteners are used to connect units and to close and secure filled gabions (Fig 1).

Fig. 1 - Fastening Rings

The rings comply with EN 10223-3 and are supplied in box (1600 rings/box); these rings are available Zn/Al coated for use with the corresponding type of material, or stainless steel for use with polymer coated mesh. The indicative quantity of rings depends on the size of the Geomattresses units (Table 2).

Geomattresses	RINGS
H = 0.17 – 0.23m	15 - 18 /m²
H = 0.3 m	18 - 20 /m²

Table 2 - Suggested number of rings

GEOMATTRESS ROCK

Rocks should be hard, angular to round, durable and of such quality that they do not lose their integrity on exposure to water or weathering during the life of the structure. Rocks range between 75 mm and 150 mm for 6 x 8 wire mesh Geomattresses. The range in sizes may allow for a variation of 5% oversize and/or 5% undersize rock, provided it is not placed on the exposed surface.

GEOTEXTILE

Bidim non-woven geotextile to be placed at the soil-gabion interface for separation and filtration purposes. Ensure that the correct type, grade and quantity is delivered to the site.

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TOOLS

To aid the lacing and bracing operations, the use of pliers to achieve tight joints is recommended. Care needs to be taken to avoid damaging to the wire coating. The teeth of the pliers should be ground to a smooth finish. Do not use fencing pliers as they damage the polymer coating.

Pneumatic lacing tool shown in Fig 2 is suitable for lacing with Zn-Al or stainless-steel rings. Pneumatic lacing tool is to be connected to an air compressor using an air pipe (max 10 mm and max length 30 m).

The air compressor regulator should be set at 100 to 105 psi (690 to 720 kPa). Never operate above 115 psi (795 kPa). A 15 CFM air compressor is capable of a minimum delivery of 10 CFM with an air tank capacity of at least 48 litres.

Fig. 2 – Pneumatic lacing tool

REQUIRED MACHINERY FOR INSTALLATION

Individual units can be transported by a minimum of two workers. Unloading from trucks must be carried out with mechanical equipment (telehandler etc.) The rock filling of the Geomattress is to be carried out with the help of mechanical excavator of a mass and arm length to suit the construction site configuration.

INSTALLATION

FOUNDATION PREPARATION

The foundation on which Geomattresses are to be placed should be level and graded to the elevations as shown on the project construction drawings (Fig 3).

The foundation for Geomattresses must be smooth, and free from surface irregularities, loose material and vegetation, in accordance with the project specifications.

Fig. 3 – Prepared foundation

Appropriate measures is to be taken for filtering and drainage of the foundation, as per the project specifications. Normally a Bidim nonwoven geotextile shall be installed first, behind or underneath rock mattress structures, to comply with the requirements for subsurface drainage applications (Fig 4).

Fig. 4 – Prepared foundation

SETTING OUT

Points marked should be start of the lining, end of lining and any internal/ external angle changes or steps.

MATERIAL DELIVERY

All Geomattresses are supplied in a collapsed form, folded and bundled. Geomattress bases and lids are packed in separate bundles. Lacing wire is shipped in coils. Ring fasteners are shipped in boxes.

FLATTENING THE UNITS

Workers should ensure to have a safe open and level area adequate for opening the units. Each individual unit will be removed from the bundle; unfold the Geomattresses flat on the ground and press down on the unit to remove all factory folds. A timber board is helpful to remove the folds and to help form the sides and ends (Fig 5).

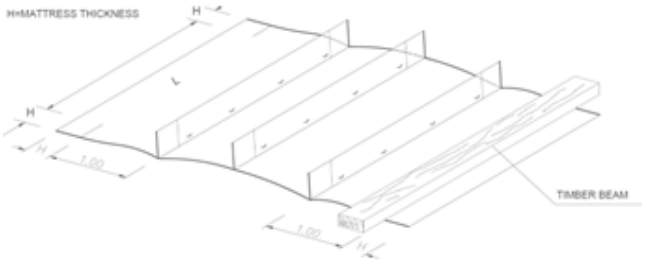

Fig. 5 – Flattening Geomattresses

ASSEMBLY

Front, back and end panels should be lifted to a vertical position to form an open box shape. End flaps are to be folded and/or overlapped, as appropriate. All edges of the diaphragms and end panels shall be tied or fastened to the front and back of the mattress.

The mattresses should be assembled individually, by erecting the sides, ends and diaphragms, ensuring that all creases are in the correct position and the tops of all sides are level.

FASTENING PROCEDURE

Connect the edges of the mattress by using either lacing wire or ring fasteners. When steel ring fasteners are used, the use of a pneumatic fastening tool is required (Fig 6).

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 150 mm pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting (Fig 7). The use of pliers is normally recommended to aid assembly and wiring of the units using the binding wire supplied with the Geomattresses.

Higher installation productivity rates can be achieved when fastening with steel rings. Spacing of the rings must not exceed 200 mm (Fig 7). Rings are installed at the top and the bottom connections of the end and centre diaphragms and along all edges. Care should be taken to ensure the steel ring fastener is completely closed after installation (Fig 7). When this is not possible, fixing rings must be complemented or replaced with lacing wire.

Fig. 6 – Pneumatic lacing tool

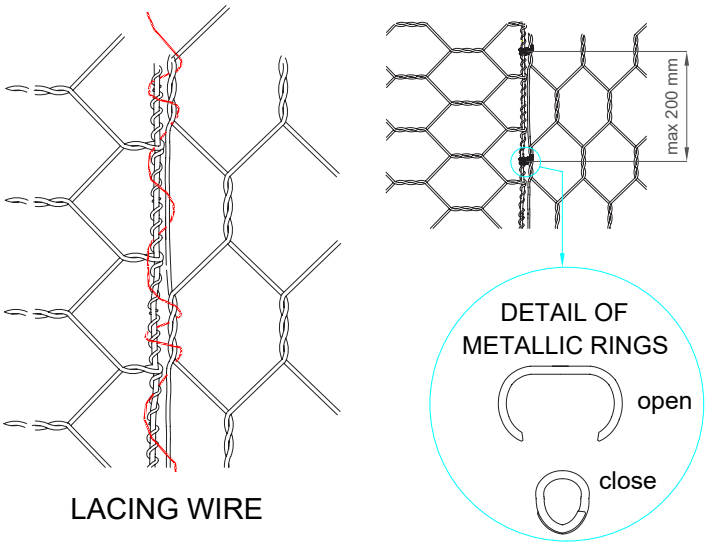

Fig. 7 – Lacing methodology

PLACING THE UNITS

After assembly, the mattresses are placed in their proper location and securely attached to adjacent units. For structural integrity, all adjoining empty units should be connected by means of lacing wire or ring fasteners along all the edges of their contact surfaces, in order to form a monolithic structure. On slopes, the mattress should be laid with the width perpendicular to the slope, except for very small ditches. Mattresses should be placed and securely attached while empty. Where mattresses are to be placed on steep slopes, the unit should be secured by hardwood or steel pegs driven into the ground just below the upper end panel, at 2 m centres or as specified in the project requirements (Fig 8).

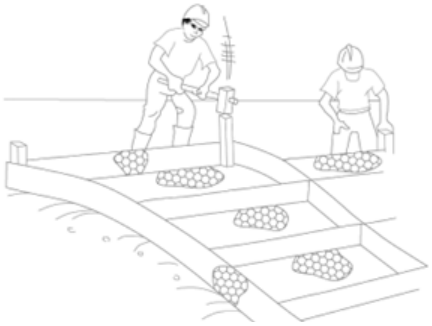

Fig. 8 – Securing Geomattress on a slope

Mattresses can conform to bends up to a radius of 18-21 m without alteration and placed to the required curvature for filling. Mattresses may be cut to form curves or bevels (Fig 9).

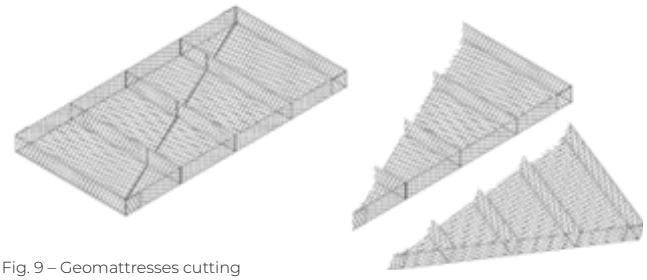

Fig. 9 – Geomattresses cutting

FILLING

Rocks for mattresses may be produced by any suitable quarrying method and using any device that yields the required sizes within the gradation limits chosen.

Rocks should be hard, angular to round, durable and of such quality that they do not disintegrate on exposure to water or weathering during the life of the structure.

Rock mattress rocks range between 75-150 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 mattress exposed surface. In all cases, any oversize rock for mattresses must allow for a placement of a minimum two layers of mixed rock sizes, dependent upon the height/thickness of the mattress.

When using PVC coated rock mattresses, care should be taken when placing the stone to ensure that the PVC coating on the mattress will not be damaged. Some hand placing is necessary to ensure the void ratio is kept to a minimum. If installing on a slope, start at the bottom of the slope. (Fig 10). Filling should be done unit by unit, but several units should be ready for filling at any one time. Ensure that the diaphragm tops are accessible for lacing to the mattress lids when required.

Fig. 10 – Filling from bottom cells

CLOSING

To allow for settlement, level off the fill 25 mm above the top of the mesh. In aprons downstream of weirs and similar places where water will fall directly onto the rock mattresses, install additional supporting wires vertically between the lid and bottom mesh. Make sure the top edges of the diaphragms are exposed.

Lay the lid down, pull the edges of the panels to be connected together where necessary using an appropriate tool as a lid closer. The lids must be tightly laced along all edges, ends and diaphragms in the same manner as described for assembling. Adjacent lids may be securely attached simultaneously. Securely attach the lids to the ends of the mattresses and then securely attach them to the sides, and diaphragms, using alternate double and single loops, or steel wire ring fasteners. Adjacent lids can securely be attached in one operation (Fig 11).

In cases where a number of adjacent bases are to be covered at one time, rolls of mesh can be used in place of individual unit size lids (Fig 12).

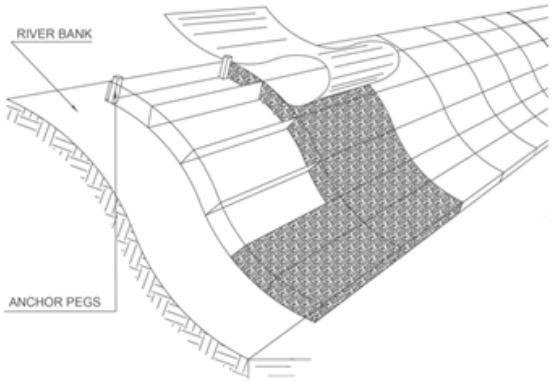

Fig. 11 – Closing with lids

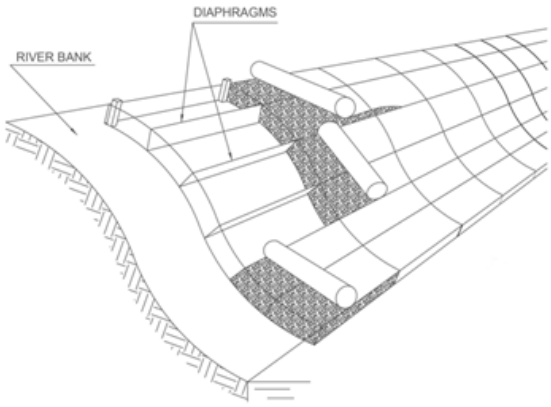

Fig. 12 – Closing with rolls

STEEP SLOPES

It is suggested to use anchors when installing mattresses on slopes steeper than 1.5H:1V to satisfy stability. A gabion anchor trench at the top of the slope is a common approach for securing mattresses on steep slopes (Fig 13).

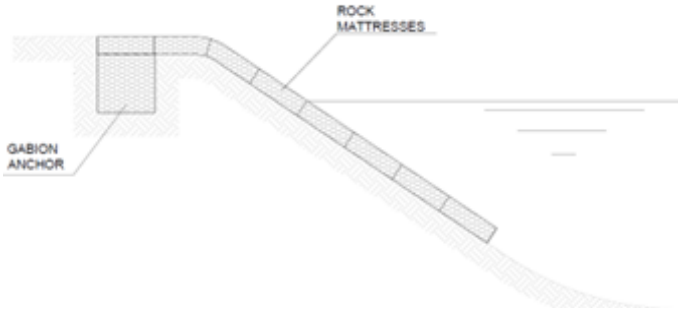

Fig. 13 – Gabion anchorage

INSTALLATION PRODUCTIVITY

The installation productivity is dependent on volume, geometry and access to working area.

A typical 5 men working team (1 foreman, 1 backhoe loader operator, 3 workers) operating 8 hours a day, the following rates can be assumed for Geomattresses with only 1 side facing (including the stone filling):

GEOMATTRESS HEIGHT (m)	UNIT	CREW	AVERAGE PRODUCTIVITY PER CREW	
			MINIMUM UNIT DAY CREW	MAXIMUM UNIT DAY CREW
0.17 – 0.30	M2	5	100	250