

**GABION AND  
MATTRESS  
CONSTRUCTION  
SPECIFICATION**

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## 1. **SCOPE OF WORK**

This specification covers the construction of gabions for the protection of earthworks against soil erosion. It covers gabion walls and aprons used as retaining walls, channel linings, weirs and other slope stability and erosion control structures.

Note: Also refer to SABS 1200DK specification for further details.

## 2. **DEFINITIONS**

For the purposes of this specification the definitions and abbreviations are given in the following:

### 2.1.1 **Box:**

A gabion generally of depth 0,5m, to 1,0m, and of width and length 1m to 4m.

### 2.1.2 **Diaphragm:**

An internal division of a gabion cage that is attached to the bottom, the sides, and, after the gabion cage is packed with stones, the lid of the cage.

### 2.1.3 **Gabion:**

A cage of galvanized steel wire mesh (with or without PVC coating) that is packed with stones and is used in material retaining structures and in various situations to counter erosion. (A gabion can be in the form of a box or a mattress, depending on its dimensions).

### 2.1.4 **Gabion cage:**

An unfilled gabion.

### 2.1.5 **Geomembrane:**

A sheet material that is highly impermeable to water and typically has an hydraulic conductivity of  $1 \times 10^{-14}$  m/s to  $1 \times 10^{-13}$  m/s.

### 2.1.6 **Geotextile:**

A material in the form of a sheet, a blanket or a net that is permeable to water and typically has an hydraulic conductivity of  $1 \times 10^{-5}$  m/s to 1 m/s.

### 2.1.7 **Mattress:**

A cage generally of depth up to 0,3 and width 1,0m or 2,0m and of length up to 6,0m.

### 2.1.8 **Selvedge/selvage:**

A boundary or edge for the panels of a gabion cage that is intended to strengthen and facilitate connections between panels.

## 3 **MATERIALS**

### 3.1 **Gabion Baskets and Mattresses**

#### 3.1.1 **Rock**

##### 3.1.1.1 **Quality**

Stone shall be clean, hard, unweathered, and free from fissures and flaking. It shall have a relative density of at least 2.40 and

- a) when the stone is subjected to the weathering test, the loss of mass shall not exceed 5%, and,
- b) in the case of dolerites, when the stone is subjected to the durability test, the number of stones broken near their middle shall not exceed 5%. Generally angular or rounded river stone should be used and not flat stone.

### 3.1.1.2 Size

No stone shall be of such a size that it will pass through a ring of diameter 10% greater than the cross-dimension of the mesh being used for the gabion (dimension b in table 1).

No stone shall be of a size exceeding the maximum size given in column 5 of table 1, and at least 85% of the stones shall be of a size equal to or exceeding the minimum size given in column 4, appropriate (in each case) to the nominal depth of the gabion and, when relevant, to the nominal mesh size.

**Table 1 – Size of stones for gabions**

1	2	3	4	5
Nominal depth of gabion cage m		Nominal size of mesh (nominal cross-dimension b as in SABS 1580) mm	Stone size (largest dimension) Mm	
Over	Up to and Including		Min.	Max.
0,15	0,17	50	60	100
0,17	0,23	80	100	120
0,23	0,3	80	100	150
0,3	0,5	80	100	200
0,5	1,0	80	100	250

### 3.1.2 Gabion Cages

Gabion boxes and mattresses shall comply with the requirements of SABS 1580. They shall be to the dimensions shown on the drawings, specified in the project specification, or scheduled. The wire shall be polyvinyl-chloride (PVC) coated if so specified in the project specification or scheduled.

### 3.1.3 Geotextile

A geotextile blanket shall be made of fibres consisting of at least 85% (by mass) of polypropylene, polyethylene, a polyester, a polyamide, or a co-polymer of vinyl chloride and vinylidene-chloride, or any combination of these polymers, and the polymer(s) shall contain such additives as are necessary to render the filaments resistant to the effects of ultraviolet radiation and heat.

The amount of water absorbed by a geotextile after it has been soaked in water at 20 °C for 24h shall be less than 1 % (by mass) and its equivalent open size (EOS), strength and other properties shall be as specified in the project specification.

The Engineer's approval of the make and the grade of geotextile shall be obtained by the Contractor before the Contractor orders or uses any geotextile in the Works.

### **3.1.4 Geomembrane (Impermeable membrane)**

A geomembrane shall be either

- a) A waterproof sheet of polyethylene, that, except that the nominal thickness shall be at least 500um, complies with the relevant requirements of SABS 952 for type C sheet and bears the SABS certification mark; or
- b) A material made from a woven or non-woven fabric that has been heat bonded or impregnated with bitumen or with a plastics material. The Engineer's approval of the make and grade of the geomembrane shall be obtained by the Contractor before the Contractor orders or uses any geomembrane in the Works.

### **3.1.5 Concrete**

Where required in terms of 4.2.1, concrete shall comply with the relevant requirements of SABS 1200 G or SABS 1200 GA, as applicable.

## **4. CONSTRUCTION**

### **4.1 Gabion cages**

#### **4.1.1 Binding and connecting wire**

Sufficient lacing (binding) and connecting wire shall be supplied with the gabion cages to complete all the wiring operations that are necessary for the construction of all gabion wall and aprons as specified in 4.2.

#### **4.1.2 Lacing of cages**

Using adequate quantities of connecting and lacing (binding) wire, the Contractor shall complete the wiring in accordance with the manufacturer's instructions. The lacing together of the edges of adjoining boxes /mattresses and of diaphragms to side panels, and the lacing of lids shall be so carried out that, when the laced attachments are tested in accordance with 7.5, the force required to separate the edges, the diaphragms and the lids is at least 1,5 kN/m.

### **4.2 Gabion walls and aprons**

#### **4.2.1 Preparation of the foundation and surface for bedding**

The bed on which gabion cages are to be laid before they are filled with rock shall be so levelled as to present an even surface at the depth shown on the drawings or as directed. If necessary, cavities between rock protrusions shall be filled with suitably sized material of a type similar to that specified in filling the gabions and well compacted or, if so scheduled and ordered, such cavities shall be filled with well-punned grade 15 concrete. A foundation trench that runs along the toe of a revetment and in which gabions are to be laid, shall be excavated to the dimensions shown on the drawings or as directed.

#### **4.2.2 Geotextile or geomembrane**

Where and as scheduled, geotextile or geomembrane that complies as already stated, as applicable, shall be placed in the positions shown on the drawings, on the top of the prepared bottom or on the sides, or on both, of each excavation before the gabion cages are placed. A geotextile shall be placed either

- a) with an overlap of at least 300mm that is securely fastened to prevent any movement or slipping during the placing of gabion cages and rock fill, or
- b) provided that it is sewn or bonded in an approved manner, with an overlap of at least 75mm. A geomembrane shall be joined by means of a welding process or an adhesive that has been approved and is used in accordance with the manufacturer's instructions.

### **4.2.3 Assembly**

During erection and before the start of rock placing, each gabion cage shall be stretched, aligned, and wired to the adjacent cage. Wire braces in sufficient number to prevent the deformation of a cage as it is being filled with rock shall be connected between the vertical sides of each of the outer cells of each gabion cage. The lower braces shall be tensioned when the gabion cage is not more than one-third full and the upper braces when it is not more than two-thirds full. Where gabions of depth 0,5m or more are to be used immediately downstream of weirs or where water could fall direct onto the gabions or where a neat upper face is required, similar vertical braces shall be used at half the height. The corners or adjacent gabion cages, shall be securely wired together to provide a uniform surface. Where practical, consecutive courses of gabion cages shall be staggered to avoid the coincidence of vertical joints. Subject to prior approval, certain cages may be filled with rock before they are placed in situations of difficult access, such as under water.

### **4.2.4 Rockfilling**

#### **4.2.4.1 Gabion boxes in retaining walls**

Particular care shall be exercised in filling against the faces of gabion boxes that will be exposed to view in the finished structure. Selected rock particles of adequate size shall be so packed as to obtain a fair-faced finish. Successive gabion boxes shall be filled in stages, to prevent deformation and bulging. They shall be filled to just below the level of the wire braces (as above) and the braces shall then be twisted, windlass-style, to provide tension, after which the filling shall be completed, the boxes being slightly overfilled to provide for settlement. Care shall be taken to ensure that the lids of each course of gabion boxes are closed and laced before the next successive course of gabion boxes is placed, and that each box is filled evenly to a level surface ready to receive the next course of boxes.

#### **4.2.4.2 Mattresses used in revetments and aprons**

Gabion mattresses used to form aprons and revetments shall be filled by spreading random rock particles in at least two layers and, where so required in terms of the project specification, by so using selected rock particles for the top layer as to present the appearance of a dry stone pitched surface.

### **4.2.5 Final wiring**

The closing and wiring-down of lids shall proceed as soon as is practical after the filling operations. Lids shall be stretched tightly over the filling, and wired down securely through each mesh along all edges, ends and diaphragms. The ends of all tying and bracing wires shall be turned into the gabion box or mattress on completion of the lacing operations.

### **4.2.6 Cutting and folding mesh**

Only where shown on the drawings or where directed for the purpose of forming metre joints, angles, curves or slopes that are not possible to obtain in structures with standard rectangular gabions, shall a gabion mesh be cut, folded and wired together. Such mesh shall be neatly cut, and the surplus mesh shall be completely removed, or folded back, or folded and tightly wired to an adjacent gabion face. The cut edges of the mesh shall be securely laced together with binding wire in the manner already specified. The assembly, filling and final wiring of re-shaped gabions shall otherwise be carried out as specified in previously.

#### 4.2.7 Special finish

Where a special finish is ordered and scheduled, the outer face of the gabions shall be carefully packed by hand with selected stone of size 100 mm to 250mm or as ordered, to provide a neat, flat appearance.

#### 4.3 Instillation

Note: - Land Rehabilitation Systems offer the following training tools:

1. Gabion Instillation Videos
2. On Site Training
3. Instillation Instructions – Visual Guides (Gabions & mattresses)

#### 5. TOLERANCES

The materials and the finish of the work shall be to Degree of Accuracy II and the permissible deviations (PD) shall be within the limits given below for Degree of Accuracy II

1	2	3	4
ITEM	Permissible deviation		
	Degree of accuracy		
	III	II	I
	mm	mm	mm
a) Gabion walls and revetments			
1) Position of top edge of terrace PD from designated position of any point, measured from nearest grid line.	±450	±300	±150
2) Alignment of top edge of terrace PD from a line joining any two points 30m apart on top exposed edge of each course of gabion boxes or mattresses	±200	±100	± 50
3) Finished levels PD from designated levels	±150	± 50	± 50
4) Slopes to top surfaces PD from direction of slope	nil	nil	nil
	%	%	%
PD from rate of fall:			
1 in 100 to 1 in 300	20	20	5
1 in 400 and flatter	10	5	2
	mm	mm	mm

#### 6. TESTS

##### 6.1 Taking and testing of samples

The Contractor shall carry out sufficient tests to satisfy himself as to the consistency of materials used for and placed in gabion cages.

##### 6.2 Material or standard of finish not to specification

The Engineer may carry out such check tests as he deems necessary, at any depth or on any layer, and the results of such tests will be made available to the Contractor. Where the Engineer's tests reveal that the material used does not comply with the applicable requirements of the specifications, or that the specified standard of finish has not been attained, the Contractor shall so rectify the work that the material complies with the said requirements and the specified standard of finish is attained.

**6.3 Weathering and Durability tests**  
As specified in SABS 1200 DK

**7 MEASUREMENT AND PAYMENT**

**7.1 Principles**

The principles and computation of quantities set out as relevant, shall apply to excavations.

**7.2 Scheduled items**

**7.2.1 Surface preparation for bedding of gabions**

- a) Cavities filled with approved excavated material or rock .....Unit: m<sup>2</sup>
- b) Cavities filled with grade 15 concrete (provisional) ..... Unit: m<sup>2</sup>

The area measured for payment will be calculated from the neat dimensions shown on the drawings of wall foundations, revetments or aprons, as applicable.

The rates for (a) and (b) above shall cover the cost of material, plant and labour for levelling, filling of cavities, if any, with rock or concrete, as applicable (see 4.2.1) and compacting the founding surface ready to receive gabion cages for retaining walls, aprons and revetments.

**7.2.2 Gabions and Mattresses.....Unit:m<sup>3</sup>**

Separate items will be scheduled for gabions of galvanized wire and for gabions of PVC-coated galvanized wire and for each size of box or mattress, each mesh size, and each diaphragm spacing. The volume will be calculated from the dimensions of the gabions as shown on the drawings or as ordered, irrespective of any deformation or bulging of gabions as constructed. The rate shall cover the cost of the supply of stones, wire mesh cages, binders and connectors, and the cost of loading, transporting, offloading, assembly and filling of the cages, and completion of the construction of the gabions.

**7.2.3 Extra-over 7.2.2 for packing selected stone for exposed face (Degree of accuracy on finished faces and edges stated) .....Unit: m<sup>2</sup>**

Where packing selected stone for an exposed face is scheduled or ordered, the area measured will be that specified as having the special appearance.

The rate shall cover the additional cost of selecting and placing selected stone in the manner specified in the project specification.

**7.2.4 Geotextile (or geomembrane) .....Unit: m<sup>2</sup>**

The area measured will be that of the gabion face scheduled or ordered to be backed with geotextile (or geomembrane).

The rate shall cover the cost of supplying geotextile (or geomembrane), cutting, waste, placing, joining, overlapping and fastening the geotextile (or geomembrane) in position.