1. MATERIALS AND REQUIREMENTS BEFORE STARTING

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 determined by the engineer.

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

The correct size and type of units should be delivered to the site. Ensure that the correct sizes are selected for the different structures. For easy identification, bundles are coded with coloured stripes, in different positions and orientations, to identify the sizes. For a detailed colour chart contact your local Maccaferri Southern Africa office.

1.2 Bracing and lacing wire and stiffeners for binding operations:
Lacing wire is used to assemble and interconnect empty units, to close and secure stone filled units and for internal stiffeners. Sufficient lacing wire is supplied in coils with each unit to enable assembly but addition wire will be required to interconnect gabions. All lacing wire is Class A zinc coated. For PVC coated gabions, PVC coated lacing wire is used. Ensure that the correct type of lacing wire is available for use with the required structure. To support the facing and to connect the front panel to the back panel of a gabion 3.4mm pre-formed bracing wires may alternatively be used to the lacing wire. They are available from Maccaferri Southern Africa.

1.3 Geotextiles:
An MacTex N geotextile must be placed at each soil-gabion interface for separation/filtration purposes. Ensure that the correct type, grade and quantity is delivered to the site.

The MacTex N range of geotextiles has been developed specifically for gabion related applications and is available in various grades for different applications.

1.4 Rock:
Ensure that the correct quality, grading and quantity of rock is available for the completion of the works. Rock used should be clean, sufficiently durable and should be obtained from a commercial crushing source or as per engineer’s specification. For gabions, the rock should be well graded between 100mm and 200mm, and should have a minimum Specific Gravity of 2.3.

A well packed gabion ensures better performance of the gabion structure. Once filled, gabions typically have a void ratio (e) of 0.3.
1.5 Tools:
To aid the lacing and bracing operations, the use of pliers to create tight joints is recommended. Care shall 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 PVC and zinc coating. Care shall be taken when using crowbars for closing the lids as this also damages the coating.

1.6 Gabion Construction Frame:
For ease of alignment of the structure, both horizontally and vertically, and to obtain the correct lines and levels, the use of a gabion construction frame is recommended. The frame further assists in minimising bulging during filling and ensures that the finished structure is aesthetically pleasing. Detailed drawings and dimensions of the recommended construction frame are available from Maccaferri Southern Africa.

1.7 Greening gabion structures:
Experience has shown that greening is most successful if integrated early on in the design stage. Greening should not be undertaken as a post-construction activity as certain products such as BioMac™ are incorporated during the construction phase.

For more information on how to successfully incorporate greening techniques, please contact your local Maccaferri Southern Africa office for copies of our Soil Bioengineering Training Manual available on CD or download from our website, www.maccaferri.co.za.

2. FOUNDATION PREPARATION
The foundation on which 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 smooth, and free from surface irregularities, loose material, and vegetation, in accordance with the project specifications. To facilitate the construction of battered walls the founding surface should be sloped at a maximum of 6 degrees.

The foundation should be compacted to the engineer’s specification to ensure uniform bearing capacity and minimise differential settlements. When founding on rock, a concrete levelling pad and dowel anchors are recommended.

3. FLATTENING THE UNIT
The folded units shall be taken out from the bundle and placed on a hard, flat surface. Gabions shall be opened, unfolded and pressed out to their original shape.
4. ASSEMBLING AND LACING THE INDIVIDUAL UNITS

Front, back and end panels shall be lifted to a vertical position to form an open box shape. Panels shall be fastened together with the projecting heavier wire by firmly wrapping the selvedge wire around the selvedge or edge of the intersecting panel, or back panel. Inner diaphragms shall be lifted into vertical position and secured in the same manner. **NOTE: It is essential that the top corners meet.**

Secure the lacing wire at the top corners of the panels to be joined and laced from the top down. Lace the edges using the double and single loop technique along the wire mesh openings. Allow for 100mm between loops.

Cut off a piece of wire approximately 1.5 times the length of the edges to be tied. The maximum length of the edge to be tied at one time shall not exceed 1m. Longer edges shall be joined by several lengths of wire. All diaphragms are pre-attached to the base with a spiral.

5. PLACING GEOTEXTILE

Geotextiles prevent the loss of fines from the soil behind the gabion structure through the rock fill and simultaneously negate the build up of any water pressure behind the wall. The omission of the geotextile is detrimental to the integrity of the structure as a whole.

Cut sufficient geotextile to line the structure along the soil-gabion interface. Place the geotextile on the prepared foundation, with the remaining geotextile temporarily draped along the backfill.

Place the gabion on the geotextile lined foundation. Ensure that the geotextile is not torn or ripped during the placing and filling of the basket, or the placing and compacting of the backfill.

During construction, ensure contact between the geotextile and the back face of the gabion structure. If required, tie the geotextile to the top of the gabion structure to facilitate construction.

When overlapping geotextiles, ensure a minimum overlap of 300mm. In hydraulic applications, ensure that the upstream section of geotextile overlaps the downstream section of geotextile as indicated in the sketch.
6. PLACING THE UNITS

Place a number of individually laced units side by side in the required position. Care must be taken not to damage the geotextile. Lace adjacent units together as described in Section 4 of this manual at every adjacent edge to form a monolithic cage structure.

Thereafter the units should be tensioned longitudinally using a fencing wire tensioner. The gabions should remain under tension during the filling operation to allow for good alignment and finish. All gabion structures should be aligned and constructed accurately using standard engineering methods and procedures e.g. fish lines, dumpy levels or formwork (Section 1.6). Alignment should be done BEFORE the units are filled, as the units are almost impossible to move afterwards.

NOTE: All Gabion units to be laced to each other on all contact surfaces. Each layer of Gabion must be securely laced to the Gabion layer below.

7. FILLING AND BRACING THE GABIONS

Only stone as specified in Section 1.4 of this document can be used for filling of gabions unless otherwise stipulated by the project engineer.

Fill each gabion cell in 1/3 layers between which bracing wires are installed. A minimum of four bracing wires per square metre of gabion front face is recommended. These should be fixed at one third and two thirds the total depth of a 1m deep gabion as shown in the sketch. For 0,5m high gabions, bracing wires should be fixed at a height of 0,25m.

Two complete turns from the coil of binding wire supplied (approximately 2,3 - 2,7m), is sufficient for each brace for a 1m wide gabion unit and approximately 3,3 - 3,7m for a 1,5m gabion unit.

Thread the wire around two mesh openings on the front and rear faces of the basket and twist the ends together at the middle and tension the brace. This procedure should be repeated across all exposed faces of the gabion structure.

Fill each row of gabions in stages when placing a number of gabion units next to each other. Fill the entire row, except the last cell to a third. Brace the entire row at 1/3 level before filling and proceed with filling the row up to the one third mark. Again brace the entire row at the two third mark and then fill the remainder of the cells to the top. At no time should the difference in height of gabion rock between adjacent cells be more than a third of a metre. This is done so as to prevent bulging of the diaphragms. If more gabions are to be added to a row, the last cell in each row should be left empty to facilitate wiring. To ensure a good finished appearance, all visible faces should be hand-packed carefully.

Alternatively prefabricated bracing wires are available to expedite construction. (See Section 1.2).

Gabions should be overfilled by 25mm to allow for natural settlement of the rock fill whilst keeping the top edge of the diaphragm visible so as to lace it to the lid.
8. BACKFILLING
Compaction of the backfill must be done simultaneously with every row of gabions laid. Care must be taken not to damage the geotextile when placing and compacting the backfill. Heavy compaction equipment must not come within 2.0m of the gabion basket. Small hand held compaction equipment may be used adjacent to the gabion basket.

9. CLOSING
Fold the lid down, stretch into position with the aid of a suitable tool (see Section 1.5), lace the lid to the front, the ends and the top of the diaphragm as per Section 4.