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## **Management Systems for Gabion Construction and Installations**

The performance of gabion structures is dependant not only on the quality of the gabion materials, but also on the assembly and installation of the system.

To ensure the best construction techniques, the manufacturer's recommendations for assembly and installation should be adhered to.

In many instances the poor performance of structures is attributed to poor installation which may be as a result of one or more of the following: -

Failure to observe correct assembly and erection procedures.

Incorrect grading of rockfill.

Poor filling of units.

The following management system is designed to ensure the quality of construction and performance of gabion structures.

### **CONSTRUCTION INSPECTION**

Material delivery: - Ensure the correct gabion materials as specified are delivered to site.

Rockfill                      Check the rockfill is to the correct grading (normally 100-200mm) and that it is of a hard durable stone. It is normally acceptable to have 6% by weight of rockfill less than the 100mm minimum dimension. To improve filling of gabion units the maximum size grading of 200mm can be reduced to 150mm.

Assembly                      Gabions can be assembled by 1 of 3 methods.

Lacing - Units should be continually laced through every mesh opening of joints to form the box shape. The start and end of each length of lacing should be secured by 3 turns of wire with the cut end being turned into the unit. Lacing wire is to have the same corrosion protection as the mesh wire and to be a minimum of 2.0mm wire diameter.

Helicals: - The helical should extend to the full length of the joint with the free ends turned in to lock the spirals into place. Helicals are to be formed from wire having the same or better corrosion protection as the mesh wire and to be a minimum of 3.0mm wire diameter.

Ring System: - C Rings to be 3.0mm diameter to the same or better specification than the mesh wire. The rings are to be closed with a pneumatic closing tool such that the free ends overlap by a minimum of 10mm. Rings must be placed at 1 every other mesh opening, otherwise the joint strength is insufficient.

Gabions that have had mesh damaged in transportation or during storage on site should not be used.

#### Placement

The foundation to the gabion structure should be prepared to the correct grades and levels as required by design (poor foundation preparation will result in settlements and poor alignment both vertically and horizontally). Any soft areas of the foundation must be excavated and replaced with granular fill or rockfill on a geotextile separator.

Positioning of geotextile if required should take place with a minimum of 300mm overlaps on adjacent pieces.

Unless it is proposed to prefill and lift units into place, the empty units should be positioned to line and level as required by design and jointed together on all verticals and where the gabion is placed on an existing gabion or mattress it should be laced to the units below at the front and rear prior to filling. Where units are placed prefilled, the units must be jointed to the adjacent units as above.

#### Filling of units

The units must be filled in maximum 330mm lifts. Once placed into the gabion, the rockfill should be hand picked over to ensure that no large voids or arching of rock pieces occurs. Where required the facing should be hand placed to give a dry stone wall appearance. At each lift a windlass tie should be placed at mid width of each cell to maintain the face alignment.

The windlass should be tightened to the correct width of the unit, over tightening will cause bulging and under tightening will cause sagging of the units. Windlassing is required to all external faces of the gabion structure unless the units are to be prefilled and lifted, in which case they are required to all cells and in both directions. For each lift the above procedures should be observed.

At each stage of filling, a visual inspection of the face should be made to ensure no large voids are present and that rockfill of size less than the mesh opening are not present on the face.

When filled to the full height of the unit, the lid is closed such that it bears down on the rockfill. The lid must then be fixed down by one of the above techniques along all sides and across each diaphragm.

In no circumstances during the filling operations should there be a difference greater than 1 lift of rockfill between adjacent cells, unless the

cells are braced in both directions.

#### Backfilling

Backfill to the gabions should be carried out in layers and compacted. Positioning of geotextile, if required, should take place with a minimum of 300mm overlaps on adjacent pieces.

#### END OF CONSTRUCTION

On completion, a visual inspection should be made to check that ...

- 1) The overall line and level is acceptable and that there are no large voids present on the exposed faces.
- 2) All joints should be tight and correctly formed.
- 3) No damage has occurred to the mesh fabric or its coatings during the construction period. Any areas where mesh has been damaged must be patched by overlaying with a secondary mesh piece such that it can be wired to areas of adjacent sound mesh.

#### POST CONSTRUCTION

Periodic inspection should be carried out to ensure the performance of the structure and that no external damage has occurred to the mesh fabric which would affect the integrity of the structure.

If the wall is in a river, lake or coastal environment, the wall should be additionally inspected after severe weather or flood occurrences.

#### PROGRAM FOR INSPECTION

At 1 year intervals for the first 5 years Thereafter at 5 year intervals.

##### **Inspection requirements:-**

**Damage to the mesh fabric:** -If there has been a failure of one or more mesh wires, the area must be patched (see end of construction).

##### **Settlements: -**

Where settlements have occurred the cause should be investigated (it will usually be due to localised poor construction, foundation preparation or backfilling). In severe cases the affected area should be taken down and reconstructed, reinstating the foundation if that was the cause.

Where settlements are minor, these should be monitored on a six monthly basis to check if it is an initial settlement problem or a long-term problem. Initial settlements generally stabilise and do not cause further problems. Long term settlements must be investigated as to the cause and remedial action taken. Where mattress toe protection is used to prevent undermining, settlements can occur if the depth of scour is too great. Normally the apron length of the mattress is 1.5 to 2 times the anticipated depth of scour, however, in highly erodable soils this may be needed to increase.

It is therefore necessary where settlements have occurred on mattress apron protection schemes to check if the scour has exceeded the recommendations for the mattress length.

**Excessive bulging: -**

Excessive localised bulging of gabions is usually a result of poor internal windlass tie installation or failure of the internal windlass ties. Should the bulging be visually acceptable then no remedial measures are required, otherwise the affected units should be opened, emptied and repacked.

Where excessive bulging has occurred over a length, the causes are generally settlement or movement of the wall. This will require further investigation and more regular inspection to ascertain if it is an ongoing problem.

Where problems occur during or after construction, advice should be sought from the technical department of the manufacturer.