

SECTION 715 - GABIONS AND ROCK MATTRESSES

~~##This section cross references Sections 173, 175, 204, 210, 702, 801 and 812.
If any of the above sections are relevant, they should be included in the specification.
If any of the above sections are not included in the specification, all references to those sections should be struck out, ensuring that the remaining text is still coherent:~~

715.01 DESCRIPTION

This section covers the requirements for the supply of materials, assembly, installation and filling of rock filled gabions and rock mattresses.

This section also covers specific requirements for gabion retaining structures, and specific requirements for the use of gabions and rock mattresses in waterways and coastal waters.

715.02 DEFINITIONS

Gabion

A container manufactured from hexagonal mesh wire netting or square welded mesh, partitioned into maximum 1 m³ cells, interconnected with other units and filled with rock. Gabions may be used for landscaping, erosion control, noise attenuation walls, facing panels for reinforced soil structures and retaining structures.

Gabion fill material and rock mattress fill material

Rock used to fill gabions and rock mattresses.

Gabion retaining structure

A mass retaining structure constructed from gabions, 1.5 m or greater in height and steeper than 0.66(H):1(V), or which would result in a traffic or pedestrian hazard or damage to neighbouring property upon failure.

Prefilled gabion

A gabion assembled and filled with gabion fill material, and then lifted and transported prior to installation.

Rock mattress

A container manufactured from hexagonal mesh wire netting, partitioned into maximum 2 m² cells with a maximum height of 300 mm and filled with rock, used for landscaping and erosion control.

715.03 GABIONS

(a) Hexagonal mesh wire netting shall have the following properties:

- (i) wire and selvedge wire shall have a minimum tensile strength of 380 MPa and a minimum diameter of 2.7 mm and 3.4 mm respectively
- (ii) wire and selvedge wire shall be coated with a minimum of 240 g/m² zinc/5% aluminium alloy and a minimum 0.5 mm of grey coloured extruded PVC, prior to netting manufacture
- (iii) netting shall be manufactured by winding two wires around each other through three 180° rotations to form a tight, helical twist with a nominal mesh size of 80 mm x 100 mm.

Gabions manufactured from hexagonal mesh wire netting shall be partitioned into maximum 1 m³ cells, and selvedge wires shall be provided on all edges.

- (b) Square welded mesh shall have the following properties:
- (i) wire shall have a minimum tensile strength of 380 MPa and a minimum diameter of 5.0 mm
 - (ii) welded mesh shall be manufactured with a minimum weld shear strength of 7.5 kN and a maximum mesh size of 75 mm x 75 mm
 - (iii) welded mesh shall be coated with a minimum of 240 g/m² zinc/5% aluminium alloy, after mesh manufacture.

Gabions manufactured from square welded mesh shall be partitioned into maximum 1 m³ cells, and shall not be used in noise attenuation walls, facing panels for reinforced soil structures and retaining structures.

- (c) Fasteners shall have the following properties:
- (i) wire shall have a minimum tensile strength of 1500 MPa and a minimum diameter of 3.0 mm
 - (ii) wire shall be stainless steel wire.

Fasteners shall be able to be folded around four selvedge wires with a minimum overlap of 25 mm.

- (d) Braces shall have the following properties:
- (i) wire shall have a minimum tensile strength of 380 MPa and a minimum diameter of 3.4 mm
 - (ii) wire shall be coated with a minimum of 240 g/m² zinc/5% aluminium alloy and a minimum 0.5 mm of grey coloured extruded PVC, prior to brace forming.

Braces shall be formed by folding one wire to form a U shape with strands of nominal length 1000 mm and a span of nominal length 200 mm; returns of nominal length 100 mm shall also be provided at the open end of the brace.

- (e) Certificate of compliance

HP Prior to the commencement of work, the Contractor shall supply a certificate of compliance from the manufacturer confirming that the gabions, fasteners and braces comply with this specification., for approval by the Superintendent.

715.04 ROCK MATTRESSES

- (a) Hexagonal mesh wire netting shall have the following properties:
- (i) wire and selvedge wire shall have a minimum tensile strength of 380 MPa and a minimum diameter of 2.0 mm and 2.4 mm respectively
 - (ii) wire and selvedge wire shall be coated with a minimum of 210 g/m² zinc/5% aluminium alloy and a minimum 0.5 mm of grey coloured extruded PVC, prior to netting manufacture
 - (iii) netting shall be manufactured by winding two wires around each other through three 180° rotations to form a tight, helical twist with a nominal mesh size of 60 mm x 80 mm.

Rock mattresses manufactured from hexagonal mesh wire netting shall be partitioned into maximum 2 m² cells, and selvedge wires shall be provided on all edges.

- (b) Fasteners shall have the following properties:
- (i) wire shall have a minimum tensile strength of 1500 MPa and a minimum diameter of 3.0 mm;
 - (ii) wire shall be stainless steel wire.

Fasteners shall be able to be folded around four selvedge wires with a minimum overlap of 25 mm.

- (c) Certificate of compliance

HP Prior to the commencement of work, the Contractor shall supply a certificate of compliance from the manufacturer confirming that the gabions and fasteners comply with this specification., for approval by the Superintendent.

715.05 GABION FILL MATERIAL AND ROCK MATTRESS FILL MATERIAL

(a) General

Gabion fill material and rock mattress fill material shall consist of rock with not less than two broken or angular faces. The rock shall be resistant to weathering action of air, wind and water and shall be free from staining, laminations, cracks and other structural defects which may reduce its mechanical strength.

All rock used for gabion fill material and rock mattress fill material shall comply with the material requirements for 'sound' rock as specified in Section 801 and the Los Angeles Value (LAV) requirements of Table 801.033. The rock shall have a minimum apparent particle density of 2.5 t/m³ when tested in accordance with AS 1141.6.1. In addition, the rock shall have a minimum wet strength of 100 kN and a wet/dry strength variation not exceeding 35% when tested in accordance with AS 1141.22.

Rock from a quarry or non-quarry site shall not be used until the source has been investigated and accredited in accordance with VicRoads Code of Practice for Source Rock Investigations as listed in Section 175.

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Prior to the commencement of work, the Contractor shall nominate the proposed source of rock and supply the specified test results. ~~for approval by the Superintendent.~~

(b) Dimensions

The dimensions of gabion fill material and rock mattress fill material shall comply with the relevant requirements of Table 715.051.

Table 715.051 Dimensions of Gabion Fill Material and Rock Mattress Fill Material

Material	Minimum Dimension (mm)	Maximum Dimension (mm)
Gabion fill material	100	250
Rock mattress fill material	75	Two-thirds the thickness of the rock mattress, or 200 mm, whichever is the lesser.

(c) Testing

The Contractor shall sample and test gabion fill material and rock mattress fill material at a frequency of at least one test per 100 tonnes or part thereof to ensure that the material consistently complies with the dimensions shown in Table 715.051. Samples shall be obtained from stockpiles in accordance with AS 1141.3.2. Tests shall be undertaken by passing the samples through rigid screens with round holes with a diameter of the relevant dimension.

715.06 GABION ASSEMBLY, INSTALLATION AND FILLING

(a) Foundation preparation

Areas upon which gabions are to be installed shall be prepared and test rolled as specified in Section 204 and Section 173. Any unstable areas detected by test rolling shall be rectified as specified in Section 204.

The Contractor shall request the ~~Superintendent~~ Council to be present during all test rolling.

(b) Assembly

Gabions shall be laid out on a hard, flat surface and stretched to remove all kinks and bends. Individual gabions shall be assembled by raising the sides and partitions and connecting selvedge wires at all abutting edges with fasteners at maximum 150 mm intervals. Gabions may be cut into two segments and spliced by a minimum length of 200 mm to form nonstandard dimensions. Fasteners shall be installed at both edges of the splice at maximum 150 mm horizontal and vertical intervals.

(c) Installation

Gabions shall be installed in the positions shown on the drawings and each gabion shall be connected to all adjacent gabions by connecting all abutting edges with fasteners at maximum 150 mm intervals. Temporary supports, permanent supports consisting of galvanized star pickets or galvanized steel structural sections, or tensioning shall be used as required to ensure the sides of the installed gabions do not vary by more than 50 mm from a 3 metre straight edge laid across the surface prior to, during and after filling with gabion fill material.

(d) Filling

Gabions shall be filled with gabion fill material by mechanical means aided by hand sorting to ensure that exposed surfaces are free from excessive bulges and depressions. Gabions shall be one third filled and braces installed at evenly distributed nominal 330 mm horizontal centres. Gabions shall then be two thirds filled and additional braces installed at evenly distributed nominal 330 mm horizontal centres. Gabions shall then be fully filled, the selvedge wires on the lids connected to selvedge wires at all abutting edges with fasteners at maximum 150 mm intervals, and any temporary supports or tensioning removed.

Where bulges and depressions greater than 50 mm are present after filling, the gabions shall be refilled. Square welded mesh that is buckled by impacts during filling shall be replaced.

(e) Prefilled gabions

HP The use of prefilled gabions is not permitted without the prior written approval of the Superintendent Council.

The Contractor shall submit a procedure for filling, lifting and transporting prefilled gabions for approval by ~~the Superintendent Council~~. The procedure shall demonstrate that the prefilled gabions will not vary by more than 75 mm from a 3 metre straight edge laid across the surface after installation. Where required by ~~the Superintendent Council~~, a test prefilled gabion shall be filled, lifted, transported and lifted again to confirm the suitability of the procedure.

Prefilled gabions shall be installed in the positions shown on the drawings and each prefilled gabion shall be connected to all adjacent prefilled gabions by connecting accessible abutting edges only with fasteners at maximum 150 mm intervals. The exposed sides of the prefilled gabions after installation shall not vary by more than 75 mm from a 3 metre straight edge laid across the surface after installation. Where bulges and depressions greater than 75 mm are present after installation, the prefilled gabions shall be replaced.

715.07 ROCK MATTRESS ASSEMBLY, INSTALLATION AND FILLING

(a) Foundation preparation

Areas upon which rock mattresses are to be installed shall be prepared and test rolled as specified in Section 204 and Section 173. Any unstable areas detected by test rolling shall be rectified as specified in Section 204.

The Contractor shall request ~~the Superintendent Council~~ to be present during all test rolling.

A separation/filtration geotextile layer shall be placed on the prepared surface. The geotextile shall comply with the requirements of Section 210, and shall have a classification of very robust, an overlap of 300 mm, and shall be a non-woven type geotextile. The geotextile shall be placed as specified in Section 210, and shall be buried to a depth of 300 mm at the edges of the areas upon which rock mattresses are to be installed.

(b) Assembly

Rock mattresses shall be laid out on a hard, flat surface and stretched to remove all kinks and bends. Individual rock mattresses shall be assembled by raising the sides, ends and partitions and connecting selvedge wires at all abutting edges with fasteners at maximum 150 mm intervals. Rock mattresses may be cut into two segments and spliced by a minimum length of 200 mm to form nonstandard dimensions. Fasteners shall be installed at both edges of the splice at maximum 150 mm horizontal and vertical intervals.

(c) Installation

Rock mattresses shall be installed in the positions shown on the drawings. Rock mattresses installed on slopes shall be arranged with the longest dimension of the rock mattress in the direction of the slope. Each rock mattress shall be connected to all adjacent rock mattresses by connecting selvedge wires at all abutting edges with fasteners at maximum 150 mm intervals. Permanent anchors consisting of galvanized star pickets shall be installed on a minimum 1 m by 1 m centre grid. The galvanized star pickets shall be driven into the foundation to a minimum depth of 500 mm and shall be connected to the base of the rock mattress with a fastener.

(d) Filling

Rock mattresses shall be filled with rock mattress fill material by mechanical means aided by hand sorting to ensure that exposed surfaces are free from excessive bulges and depressions. Rock mattresses shall be fully filled and the lids connected to all abutting edges with fasteners at maximum 150 mm intervals. The lids of the rock mattresses shall not vary by more than 50 mm from a 3 metre straight edge laid across the surface. Where bulges and depressions greater than 50 mm are present after filling, the rock mattresses shall be refilled.

715.08 GABION RETAINING STRUCTURES

(a) General

Gabions manufactured from square welded mesh and rock mattresses shall not be used in gabion retaining structures.

(b) Design

Gabion retaining structures shall be designed in accordance with AS 5100.3, and the following requirements:

- (i) the design life shall be 100 years
- (ii) the gabions shall lean backward into the retained material and the base of the gabions shall have a slope of 10(H):1(V)
- (iii) the gabion fill material design source rock unit weight shall be 24.5 kN/m³, unless demonstrated otherwise by nominating the source rock and supplying apparent particle density test results in accordance with Clause 715.05(a)
- (iv) the gabion fill material design porosity shall be 20% for design for bearing failure and global failure ultimate limit states, and shall be 40% for design for sliding, rotation and structural failure ultimate limit states, unless demonstrated otherwise by determining the porosity using a sacrificial test gabion
- (v) the Type A structural material, permeable fill material or no fines concrete design effective cohesion shall be 0 kPa, the design effective friction angle shall be 40°, and the design unit weight shall be 20 kN/m³.

~~##(strike through the remainder of this clause if not required):~~

In addition, for gabion retaining structures with a retained height of 6 m or more:

- (i) the gabion fill material design source rock unit weight shall be determined by nominating the source rock and supplying test results demonstrating the minimum apparent particle density
- (ii) the gabion fill design porosity shall be determined by preparing a sacrificial test gabion and measuring the mass of gabion fill material in the test gabion, in tonnes to the nearest 0.1 tonne, and the volume of the test gabion, in m³ to the nearest 0.1 m³. The gabion fill design porosity shall then be determined using:

$$1 - \frac{(\text{mass of gabion fill material in test gabion, t}) / (\text{apparent particle density, t/m}^3)}{\text{volume of test gabion, m}^3}$$

- (iii) the design shall be proof-engineered by a Proof Engineer who shall be prequalified at Level PE in accordance with the VicRoads prequalification scheme.

(c) Foundation preparation

In addition to the requirements of Clause 715.06(a), the prepared surface shall have a slope of 10(H):1(V).

(d) Installation

In addition to the requirements of Clause 715.06(c), temporary supports, permanent supports or tensioning shall be used as required to ensure the top of the first layer of gabions has a slope of 10(H):1(V) prior to filling with gabion fill material. For subsequent layers of gabions, the placement of a screed layer of gabion fill of nominal dimension 70 mm on the underlying layer may also be used as required to ensure the top of the gabions has a slope of 10(H):1(V) prior to filling with gabion fill material.

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In addition, for gabion retaining structures with a retained height of 6 m or more:

- (i) in addition to the requirements of Clause 715.06(d), internal braces shall be installed at evenly distributed nominal 250 mm horizontal centres
- (ii) gabions shall be installed in a stretcher bond pattern, so that the ends of the gabions are staggered vertically from the ends of the gabions in the layers above and below
- (iii) **the Contractor shall request the Superintendent Council to be present during the installation of gabions to ensure the top of the gabions have a slope of 10(H):1(V) prior to filling with gabion fill material.**

(e) Material placed behind gabion retaining structures

Prior to placing material behind gabion retaining structures:

- (i) a separation/filtration geotextile layer shall be placed on the rear of the gabion retaining structure. The geotextile shall comply with the requirements of Section 210, and shall have a classification of very robust, an overlap of 300 mm, and shall be a non-woven type geotextile
- (ii) a subsurface drainage pipe shall be placed at the base of the rear of the gabion retaining structure. The subsurface drainage pipe shall comply with the requirements of Section 702, and shall be a category 2 pipe, shall have a minimum diameter of 100 mm, shall have a perforation size of 2 mm and shall be fitted with a knitted seamless sleeve.

Material placed behind gabion retaining structures shall consist of:

- (i) Type A structural material, consisting of 20 mm Class 3 crushed rock which shall comply with the requirements of Section 812 and shall have a minimum permeability of 1×10^{-8} m/s. Type A structural material shall be placed and compacted as specified in Section 204 Clause 204.11, and testing and acceptance of compaction and moisture content shall be undertaken as specified in Section 204 Clause 204.13 Scale A compaction requirements, Section 204 Clause 204.14(c) and Section 173
- (ii) permeable fill material, consisting of Grade A4, A5, A6, B1, B2, B3 or B4 granular filter material which shall comply with the requirements of Section 702. Permeable fill material shall be placed and compacted as specified in Section 204 Clause 204.11;
- (iii) no fines concrete, which shall comply with the requirements of Section 702. Permeable fill material shall be placed as specified in Section 204 Clause 204.11.

715.09 GABIONS AND ROCK MATTRESSES IN WATERWAYS

HP Gabions and rock mattresses shall not be installed below the 1:50 annual recurrence interval flood level of waterways with a permanent flow of water without the prior approval of the Superintendent Council or the relevant Catchment Management Authority.

The Contractor shall submit a proposal for protecting gabions and rock mattresses from damage from debris impact, and written consent from the relevant Catchment Management Authority, for approval by ~~the Superintendent Council~~.

715.10 GABIONS AND ROCK MATTRESSES IN COASTAL WATERS

Gabions and rock mattresses shall not be installed below the highest astronomical tide level of tidal waterways or coastal waters, or within the splash zone of coastal waters.