Product

- This Detail Sheet relates to MacCaferrri Hexagonal Mesh Gabions and Reno Mattresses for Earth Retention, Soil Reinforcement Systems, River Training and Erosion Control Purposes.
- The system is based on box gabions or Reno Mattresses formed from hexagonal mesh of galvanized wire or PVC coated galvanized wire and is for use in both temporary and long-term installation.
- Construction of the system is usually carried out by civil engineering or building contractors.

This Detail Sheet must be read in conjunction with the Front Sheets, which give the product's position regarding the Building Regulations, the hexagonal mesh details, and the Conditions of Certification.

1 Description

1.1 MacCaferrri Gabions and Reno Mattresses are cages formed from hexagonal galvanized wire mesh with or without a PVC-U coating.

1.2 The gabions and mattresses are available in a large range of standard sizes as defined in Tables 1 and 2. Non-standard sizes are available to special order for specific design requirements.

1.3 Details of the wire used for the range of standard mesh/wire combinations and the associated lacing wire required for on-site fabrication are given in the Front Sheets. Other sizes and mesh/wire combinations may be manufactured to order.

1.4 The MacCaferrri Gun reference SC-50 is a mechanical device for crimping stainless steel or galvanized steel Flex-C rings to the PVC-U coated or galvanized steel mesh, respectively. The stainless steel rings reference 11SS40 are manufactured from 3.05 mm diameter stainless steel to ASTM A313 type 302 class I. Galvanized steel rings reference 11GS40 are manufactured from 3.05 mm diameter high tensile wire coated with 280 gm⁻² of zinc to ASTM A90 and A76E class II.

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Table 1  Standard sizes of gabions

<table>
<thead>
<tr>
<th>Size (metres)</th>
<th>Z8/2.4(1)</th>
<th>Z8/2.7(1)</th>
<th>Z8/3.0</th>
<th>P8/2.4(1)</th>
<th>P8/2.7(1)</th>
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<td>1.5 x 1.0 x 1.0</td>
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<td>2.0 x 1.0 x 1.0</td>
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<tr>
<td>3.0 x 1.0 x 0.5</td>
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<tr>
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</tbody>
</table>

(1) Mesh available in 25 metres x 2 metres rolls for these codes.
(2) Available in UK. Other sizes to special order.

Table 2  Standard sizes of Reno Mattresses and jumbo gabions

<table>
<thead>
<tr>
<th>Size (metres)</th>
<th>Z6/2.0(1)</th>
<th>Z6/3.0</th>
<th>P6/2.0(1)</th>
<th>P8/2.4(1)</th>
<th>P8/2.7(1)</th>
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<tr>
<td>6.0 x 2.0 x 0.3</td>
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<td>6.0 x 2.0 x 0.17</td>
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</tr>
</tbody>
</table>

(1) Mesh available in 25 metres x 2 metres rolls for these codes.
(2) Available in UK. Other sizes to special order.

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Readers are advised to check the validity of this Detail Sheet by either referring to the Index of Current BBA Publications or contacting the BBA direct (Telephone Hotline 01923 662900).
2 Manufacture and quality control
2.1 Detail relevant to the manufacture of the hexagonal mesh is given in the Front Sheets.

2.2 During fabrication cut ends are mechanically selvedged with a wire of greater diameter than that used for the mesh wires (see Figure 1).

Figure 1 Selvedge detail

2.3 Box gabion end panels and diaphragms are selvedged along their upper edges in a similar manner to that described in section 2.2.

2.4 Reno Mattresses consist of a separate base and a lid. The lid is formed either by a panel of mesh for each base or by a roll of mesh used to cover several adjacent mattresses.

2.5 Reno Mattress bases are fabricated from a single panel of mesh having sides, ends and diaphragms formed by folding during manufacture (see Figure 8). The mattresses are folded and packed for delivery. Mattresses constructed from mesh to code P8/2.7 are manufactured with separate diaphragms.

3 Delivery, storage and site handling
3.1 The gabions and mattresses are delivered to site in bundles weighing up to 800 kg depending on unit size and mesh specification.

3.2 The products may be stored in the open, but away from site traffic to avoid the risk of accidental damage, and should remain packaged until required.

3.3 A label, bearing the BBA Certificate number, manufacturer’s name, batch number and product code, is attached to each bundle.

3.4 All bundles must be handled with care to avoid damage to coatings. Individual units may be manhandled.

4 Maccaberri Gabions — general
4.1 The design of gabion structures should be based on the principle of mass earth retaining walls. Additional allowances may be made to account for the effect of the wire mesh.

4.2 The density of filled gabions should be generally taken as 60% of the density of the solid material. A higher value may be appropriate in certain circumstances but this will be the responsibility of the consulting engineer who must ensure that the design value is achieved on site.

4.3 The stone infill to the gabions is normally sized between 100 mm and 200 mm and is of hard, durable stone as quarried or naturally occurring rounded stone [see BS 5390 : 1976(1984), Section 3, paragraph 16].

4.4 Gabion walls can be constructed with a minimum radius of curvature of 25 metres without modification of the gabion structure.

5 Maccaberri Reno Mattresses — general
5.1 The design of the Reno Mattress structures should be based on the principles of hydraulic engineering and, where applicable, mass earth retaining structures.

5.2 The density of filled Reno Mattresses should be taken as 60% of the density of the solid material. A higher value may be appropriate in certain circumstances but this will be the responsibility of the consulting engineer, who must ensure that the design value is achieved on site.

5.3 The stone infill to the Reno Mattresses is normally sized between 75 mm and 150 mm. The size will depend on the use of the product and the mesh size. In hydraulic structures the nominal size of the stone should be 1.5 times the mesh size. To ensure adequate protection to the underlying soil, the stone size and grading should be chosen to ensure more than one layer within the mattress depth. The fill must be of hard, durable stone as quarried or naturally occurring rounded stone [see BS 5390 : 1976(1984), Section 3, paragraph 16].

5.4 Reno Mattresses can be constructed to form curved sections by either cutting and folding units or by overlapping adjacent mattresses.

6 Design of Maccaberri Gabion and Reno Mattress structures
6.1 The design of gabion and Reno Mattress structures should be carried out by a suitably qualified engineer.

6.2 The magnitude and distribution of the earth pressures and earth resistance should be calculated in accordance with current design philosophy.
6.3 As in other earth retaining structures it is necessary to determine a suitable factor of safety against the principal modes of failure for the following parameters:
overall stability
overturning
shearing pressure
sliding
internal stability.

6.4 Watercourse linings, weirs and other hydraulic structures may require special consideration in regard to scour, uplift, wave action, seepage, etc.

6.5 The mesh specification should be chosen to achieve the required design life (see section 10).  

7 Strength of Maccalferrì Gabions and Reno Mattresses

7.1 If installed in accordance with this Certificate the mesh has adequate strength to resist all loads associated with handling, positioning and filling.

7.2 Gabions and mattresses are permeable and, in general, will not permit hydrostatic pressure to build up. Gabion earth retaining structures are not normally designed to withstand hydrostatic pressure.

7.3 Where cohesive materials, eg clay, etc., are retained, water movement may cause it to exude into the gabion structure and block the passage of water. To reduce the risk of a build-up of hydrostatic pressure in these conditions it may be necessary to provide additional granular layers behind the gabion structure to allow water to drain away.

7.4 Maccalferrì Gabions and Reno Mattresses have adequate strength to permit pre-filling and placing by crane when carried out in accordance with the manufacturer’s instructions.

8 Practicability of installation
The gabions and mattresses are installed easily under normal site conditions.

9 Maintenance and repair
Routine maintenance is not normally required; however, damaged exposed mesh can be repaired by securing additional or replacement mesh as required.

10 Durability
10.1 The specification for a particular installation must be chosen to achieve the required design life.
10.2 The life of a gabion structure is dependent on the specification of the mesh, the durability of the stone and in the longer term, the stability of the consolidated mass of the infill material and in the conditions of exposure encountered during its design life.
10.3 PVC-U coated, galvanized steel wire will not be affected by the chemicals normally encountered in earth retaining structures.
10.4 Some local damage may occur to the PVC-U coating during installation and in exposed areas. Evidence from installations up to 40 years old indicates that such damage will remain local and not spread, affecting the integrity of the structure. Therefore, when used in dry land retaining walls, the PVC-U coated mesh may be considered to have a life expectancy of 120 years.
10.5 When used in sea water, aggressive conditions, eg polluted environments, or where the anticipated exposure conditions are uncertain, PVC-U coated mesh should be used to ensure an optimum design life.
10.6 The life expectancy of the non-coated galvanized wire products may be estimated from the data given in the Front Sheets.
10.7 The life expectancy of products used in river erosion and coastal protection schemes will also be affected by the scouring effects of fast flowing water. Maccalferrì Ltd can advise on the design of such installation to optimise the performance of the system.
11 General
Installation must be in accordance with this Certificate and the manufacturer’s installation instructions.

12 Procedure
In-situ filled gabions (see Figures 2 to 6)
12.1 Gabions are opened and folded on a hard surface, pressing out any unwanted creases.
12.2 Front and rear sides, ends and diaphragms are lifted into position to form a box shape.
12.3 Top corners are secured with the thick selvedge wire. Edges are joined together, using the appropriate lacing wire, starting from the top course, either in a continuous operation using alternate single and double twists or with rings applied using the Maccaferri Gun reference SC-50.
12.4 A number of empty gabions may be placed in position on a flat surface and secured together as described in section 12.3.
12.5 The gabions are filled with suitable stone to a level approximately 50 mm to 75 mm overfull to allow for settlement of the infill due to self-weight.
12.6 When considered necessary for aesthetic or other considerations the gabion may be filled whilst under tension. Gabions are tensioned by applying a load, distributed over the full end panel of a row of gabions, to the first cell which has been anchored in position.
12.7 Gabions forming the exposed face of a structure should be filled to one-third height, braced from front to rear, filled to two-thirds height and again braced. Filling may then be completed.
12.8 The mesh lid is folded down, stretched into position and secured to the front, sides and diaphragms.
12.9 It is essential that each gabion is properly secured to adjacent gabions above, below and on each side, using the lacing wire as described in section 12.3.

Pre-filled gabions
12.10 Gabions are constructed as described in sections 12.1 to 12.3, 12.5, 12.7 and 12.8, but with double loops throughout. However, it is advantageous to construct a slightly oversize frame within which the empty unit can be stretched taut.
12.11 After filling the horizontal top edges are stiffened, if required, using reinforcing bars, typically 20 mm diameter, to maintain shape during lifting. Bars should be removed after placement.
12.12 Purpose-made lifting frames and slings must be used for lifting filled units which weigh up to 1.8 tonnes per cubic metre.
12.20 After filling, the unit must be properly secured using the method described in section 12.3.  
12.21 Purpose-made lifting frames are available with suitable attachments to enable the filled mattresses to be safely placed in position.

In-situ filled mattresses (see Figures 7 to 9)
12.13 Mattresses are opened and folded on a hard surface, pressing out any unwanted creases.
12.14 Ends, side panels and diaphragms are lifted into position and the ends and diaphragms are secured to the side panels using the method indicated in section 12.3.
12.15 The unit is placed in its final position and secured to adjacent mattresses, ensuring that diaphragms, ends and sides are taut.
12.16 Fill is placed into each compartment, working from the base of the slope upwards, until each cell is filled completely.
12.17 The lid is secured along each edge and diaphragm using lacing wire or rings as specified.

Pre-filled mattresses
12.18 The mattress is assembled as described in section 12.14 but using double loops throughout.
12.19 Additional support should be provided under the lid using steel bars, typically 20 mm diameter.
The following is a summary of the technical investigations carried out in relation to Maccaferri Gabions and Reno Mattresses.

13 Investigations
13.1 The manufacturing process of the Maccaferri Gabions and Reno Mattresses was examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.
13.2 An assessment of data was made to determine:
- dimensional accuracy
- tensile strength for Flex-C rings
- quality of galvanized coating
- the effect of tolerances
- strength of wire, mesh and filled gabions
- quality of materials
- quality of plastic coating
- ease of assembly
- durability.

13.3 Site visits were carried out to assess the practicability, ease of handling and installation under various site conditions.
13.4 An assessment was made of data pertaining to site case studies where the product has been in use for a number of years.

Bibliography


On behalf of the British Board of Agrément

Date of Second issue: 30th June 1995

Director

*The original Detail Sheet was issued on 22nd May 1995. This amended version includes the change of name of the Certificate holder.