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Roads & Bridges Agrément Certificate No 93/R075

Second issue*

Designated by Government
to issue
European Technical
Approvals

MACCAFERRI GABIONS

Ouvrages de soutènement
Befestigungsstrukturen

Product



• THIS CERTIFICATE RELATES TO MACCAFERRI HEXAGONAL MESH GABIONS FOR RETAINING WALLS.

- The system is based on box gabions formed from hexagonal mesh of PVC-coated galvanized or PVC-coated galfan wire.
- The gabions are marketed by Maccaferri Ltd and manufactured by the Maccaferri Group.
- Construction of the system is generally carried out by civil engineering contractors.

Department of the Environment, Transport and the Regions, Highways Agency Requirements

1 Requirements

- 1.1 The general requirements for gabions are contained in the Department of the Environment, Transport and the Regions, Highways Agency, (DETR, HA) Manual of Contract Documents for Highway Works (MCHW), Volume 1 *Specification for Highway Works (SHW)*, March 1998 Edition.
- 1.2 Additional site requirements may be included on particular projects.
- 1.3 The gabion system is for use on projects which fall within the scope of Departmental Standard HD22 (D.M.R.B. 4.1.2) *Ground Investigation and Earthworks — Procedure for Geotechnical Certification*. This assumes a design life of not less than 60 years.

Technical Specification

2 Description

2.1 Maccaferri Gabions are rectangular cages of hexagonal woven-steel wire mesh, laced together, and filled with selected granular material (stone) (see section 5.2). The nominal dimensions (m) of standard gabions are:

height	0.5 or 1.0
length	1.5, 2.0, 3.0 or 4.0
depth	1.0

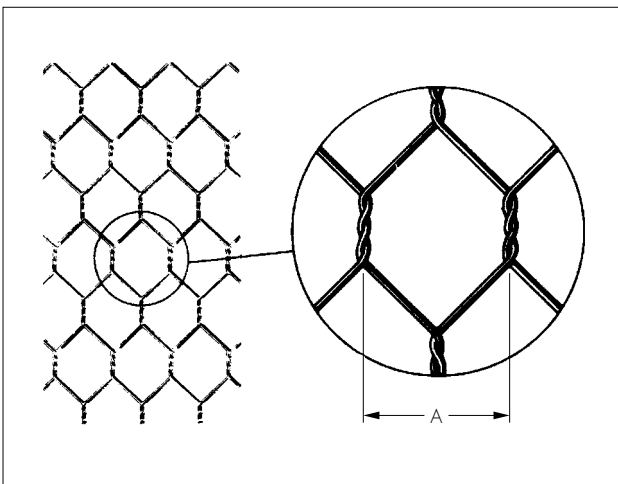
2.2 The double-twist mesh is available in the standard sizes given in Table 1 and detailed in Figure 1.

Table 1 General specification of wires⁽¹⁾ used in gabions

Manufacturer's reference	Mesh dimension A ⁽²⁾ (mm)	Mesh	Selvedge	Edge	Lacing
P8/2.7	80	3.7	4.9	4.4	3.2
P8/2.4	80	3.4	4.0	4.0	3.2

(1) diameter given in mm.
(2) see Figure 1.

Figure 1 Details of gabion mesh



2.3 The wire used to manufacture the mesh is generally to BS 1052 : 1980(1986) with a tensile strength of between 380 and 500 Nmm⁻² and with a minimum elongation at failure of 12%.

2.4 The wire is either galvanized in accordance with BS 443 : 1982(1990) or galfan⁽¹⁾ coated in accordance with ASTM A 856/A 856M — 97, prior to being PVC coated. The minimum zinc or galfan coating thickness for the various wire diameters is given in Table 2. Different wire specifications are used for the edge wire, selvedge wire, mesh and lacing coil (see Tables 1 and 2 and Figure 2).

(1) a 95% zinc 5% aluminium alloy.

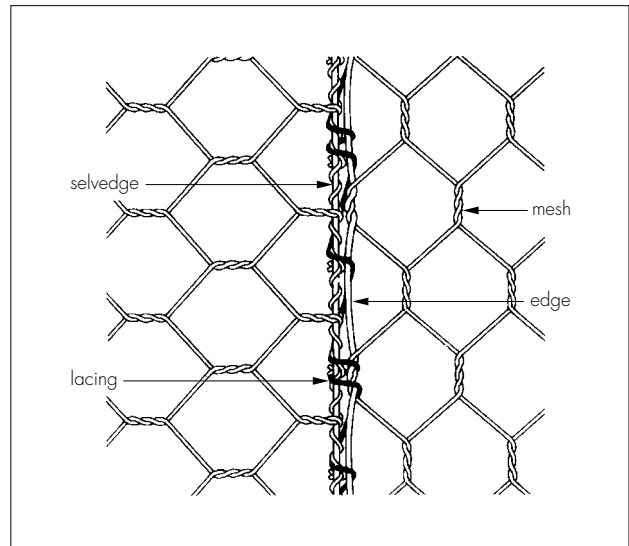
2.5 Steel lifting frames, with the appropriate number of slings attached, are available from

Maccaferri Ltd and are used to install pre-filled gabions (see section 11.14).

Table 2 Wire specification

Minimum overall diameter (mm)	Nominal core diameter (mm)	Tolerance (± mm)	Minimum zinc or galfan coating (gm ⁻²)
3.2	2.2	0.07	265
3.4	2.4	0.07	280
3.7	2.7	0.08	295
4.0	3.0	0.08	295
4.4	3.4	0.08	295
4.9	3.9	0.08	310

Figure 2 Details of gabion construction



3 Manufacture and quality control

3.1 PVC-U coated galvanized/galfan wire is manufactured by the Maccaferri Group or obtained from an approved supplier with mill certificates for the steel and a Certificate of Conformity to the Maccaferri Group's specification.

3.2 The wire is woven into a hexagonal pattern, with double-twist joints and larger diameter wire introduced along the edge. The mesh is cut to the required length, the selvedge wire positioned and the cut ends twisted into the panel. The end and diaphragm panels are fixed to the main panel and the gabion folded and packed ready for delivery.

3.3 Factory production control includes visual and dimensional checks on the incoming wire coil, checks on the quantity of the galvanized/galfan coating, thickness of the plastic coating, and dimensional checks on the woven mesh. Each batch of 20 to 80 gabions is weighed.

4 Delivery, storage and site handling

4.1 Maccaferri Gabions are delivered to site in bundles weighing from 600 kg to 900 kg.

4.2 The products should be stored away from site traffic to avoid the risk of accidental damage, and should remain packaged until required.

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

4.4 Bundles of gabions must be handled with due care to avoid damage to the PVC-U coating. Individual gabions can be manhandled.

Design Data

5 General

5.1 Maccaferri Gabions comply with the requirements of the DETR, HA MCHW, Volume 1 *Specification for Highway Works*, clause 626, and therefore are suitable for use in the manner described in section 1.3.

5.2 Selected granular material (as detailed in the DETR, HA MCHW, Volume 1 *Specification for Highway Works*, Series 600, Table 6/1, Class 6G) must be used to fill the gabions. The fill material should be of hard durable stone such as quarried or naturally occurring rounded stone (see BS 5390 : 1976, Section 3, paragraph 16). The maximum and minimum particle size must comply with DETR, HA MCHW, Volume 1 *Specification for Highway Works*, clause 626.5.

5.3 The design of gabion structures should be based on the principle of mass earth retaining walls.

5.4 The density of filled gabions should be taken as 60% of the density of the solid material in accordance with the recommendations of BS 8002 : 1994.

5.5 Gabion walls can be constructed with a minimum radius of curvature of 25 metres without modification to the panels.

5.6 Placing the external layer of stone by hand can give a better appearance to the completed wall to be constructed without affecting the strength of the gabion structure.

6 Strength

6.1 The mesh has adequate strength to resist all loads associated with handling and positioning. Care must be taken when installing pre-filled gabions (see sections 11.12 to 11.14).

6.2 Correctly laced gabions will remain in position and adequately sustain the load associated with placing the stone infill.

6.3 Gabion walls are permeable and will not permit hydrostatic pressure to build up behind the wall. Gabion structures are not normally designed to withstand hydrostatic pressure.

6.4 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.

6.5 The lifting frames and slings have adequate strength when used in accordance with the manufacturer's instructions.

7 Practicability of installation

The gabions are installed easily under normal site conditions.

8 Maintenance and repair

Routine maintenance is not normally required; however, should the exposed gabion be vandalised or accidentally damaged, additional or replacement panels can be fixed readily to the structure.

9 Durability

9.1 The life of a gabion structure is dependent on the quality of the mesh, the durability of the stone and, in the longer term, the stability of the consolidated mass of the infill material.

9.2 The PVC-coated, galvanized/galfan steel wire will not be affected by the chemicals normally encountered in earth retaining structures.

9.3 Some local damage may occur to the PVC coating during installation and in exposed areas, and may lead to corrosion of the mesh. From site evidence and test data it is indicated that such damage will remain local and not cause sequential corrosion underneath the intact adjacent area of mesh. The design of the wire mesh and the fact that the strength of the mesh is not used in the design of the structure as a whole indicate that this local damage will not affect the integrity of the structure.

9.4 A gabion wall is a mass earth retaining structure and settlement may occur under the action of its self-weight. The movement associated with this will gradually increase the density of the structure and a reduction in the volume of voids. Additional settlement may occur when gabions are founded on weak soils.

9.5 A gabion wall will permit the growth of vegetation which will contribute to the integrity of the structure and to maintaining a natural appearance.

9.6 The design life of a gabion structure constructed in accordance with this Certificate, with suitable stone infill and adequate maintenance (see section 8), will be in excess of the 60 years required by DETR, HA.

Figure 3 Installation — in situ

10 General

Installation must be in accordance with this Certificate and the manufacturer's installation instructions.

11 Procedure

In-situ filled gabions

11.1 The gabion is opened and unfolded on a hard surface and any creases not required for forming the box pressed out.

11.2 The front and rear sides, ends and diaphragm are lifted into position to form a box shape (see Figure 3a).

11.3 The top corners are secured with the thick selvedge wire.

11.4 The edges are laced together, starting from the top corner, in a continuous operation using alternate single- and double-twists at spacings of between 100 mm and 150 mm (see Figure 3b). Individual ties of lacing wire must not be used.

11.5 The initial layer of gabions should be placed on a flat surface.

11.6 A number of empty gabions are placed in position and secured together with lacing wire using the method described in section 11.4.

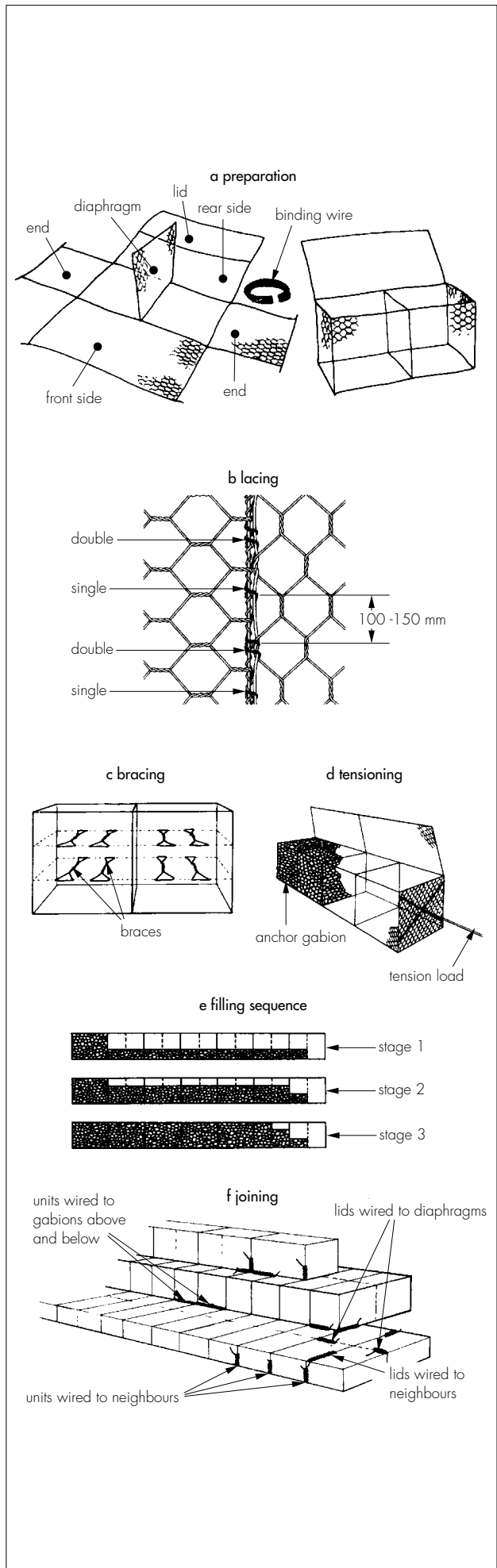
11.7 The end gabion is partly filled with suitable stone to form an end anchor and bracing wires are fixed at 500 mm spacing to prevent the front side from bulging (see Figure 3c). The gabions are tensioned by applying a load to the end remote from the anchor gabion, ensuring the load is distributed over the whole area of the last gabion (see Figure 3d).

11.8 One-metre high gabions should be filled to one-third height, braced, filled to two-thirds height and braced again. A half-metre high gabion requires only one row of bracing at 250 mm height. The gabion is overfilled by approximately 50 mm to 75 mm to allow for settlement of the infill (due to self weight).

11.9 The mesh lid is folded down, stretched into position and the lid laced to the front side and the top of the diaphragms.

11.10 The remaining row of gabions may then be filled sequentially as shown in Figure 3e.

11.11 It is essential that each gabion is properly laced and fixed to adjacent gabions, above, below and on each side (see Figure 3f).

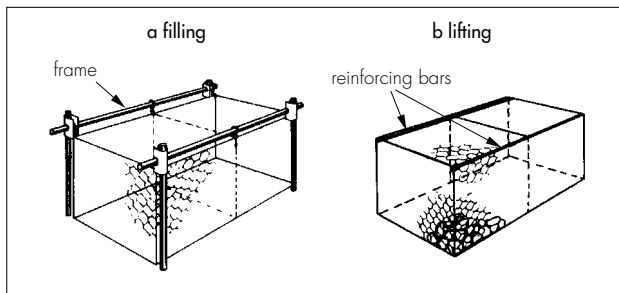


Pre-filled gabions

11.12 The gabion is constructed in the manner described in sections 11.1 to 11.4, 11.8 and 11.9. However, it is necessary to construct a slightly oversize frame of scaffolding or timber in which the empty unit is stretched taut (see Figure 4a).

11.13 The horizontal edges at the top should be stiffened with 20 mm diameter reinforcing bars to maintain the shape of the box during lifting. These bars should be removed after placement (see Figure 4b).

Figure 4 Installation — pre-filled



11.14 The purpose-made lifting frames and slings (see section 2.5) must be used for lifting the filled units. Filled gabions weigh up to a maximum of 1.8 tonnes per metre.

Technical Investigations

The following is a summary of the technical investigations carried out on Maccaferri Gabions.

12 Investigations

12.1 The manufacturing process was examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

12.2 An assessment of data was made to determine:

dimensional accuracy
tensile strength
quantity of galvanized coating
the effect of tolerances
strength of wire, mesh and filled gabions
quality of materials
quality of plastic coating
ease of assembly
compliance with clause 626 of DETR, HA specification (see sections 1.1 and 5.1)
design procedures
strength of the lifting frame
durability
effect of site damage
equivalent performance of galfan and galvanized coated wire.

12.3 Site visits were carried out to assess the practicability, ease of handling and installation under various site conditions.

Bibliography

BS 443 : 1982(1990) *Specification for testing zinc coatings on steel wire and for quality requirements*

BS 1052 : 1980(1986) *Specification for mild steel wire for general engineering purposes*

BS 5390 : 1976(1984) *Code of practice for stone masonry*

BS 8002 : 1994 *Code of practice for earth retaining structures*

ASTM A 856/A 856M — 97 *Standard specification for Zinc-5% Aluminium-Mischmetal Alloy-Coated Carbon Steel Wire*

Conditions of Certification

13 Conditions

13.1 This Certificate:

- (a) relates only to the product that is described, installed, used and maintained as set out in this Certificate;
- (b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- (c) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- (d) is copyright of the BBA.

13.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, shall be construed as references to such publication in the form in which it was current at the date of this Certificate.

13.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabricating process(es) thereof:

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;
- (b) continue to be checked by the BBA or its agents;

(c) are reviewed by the BBA as and when it considers appropriate; and

(d) remain in accordance with the requirements of the Department of the Environment, Transport and the Regions, Highways Agency.

13.4 In granting this Certificate, the BBA makes no representation as to:

- (a) the presence or absence of any patent or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the nature of individual installations of the product, including methods and workmanship.

13.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product



In the opinion of the British Board of Agrément, Maccaferri Gabions are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 93/R075 is accordingly awarded to Maccaferri Ltd.

On behalf of the British Board of Agrément

A handwritten signature in black ink, appearing to read 'P. Q. Newson', is written over a light grey background.

Date of Second issue: 10th December 1998

Director

**Original Certificate issued 23rd June 1993. This amended version includes a change of company name and address, reference to DETR, HA (replacing DOT) and revised Conditions of Certification.*