

Link Middle East Ltd

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**Agreement
Certificate
No 00/3682**

Designated by Government
to issue
European Technical
Approvals

**LINK MIDDLE EAST GABION BOXES,
MATTRESSES AND SAC GABIONS**

Ouvrages de soutènement
Befestigungsstrukturen

Product



• THIS DETAIL SHEET RELATES TO LINK MIDDLE EAST GABION BOXES, MATTRESSES AND SAC GABIONS FOR EARTH RETENTION, SOIL REINFORCEMENT SYSTEMS, RIVER TRAINING AND EROSION CONTROL PURPOSES.

• The system is based on Box Gabions, Mattresses and Sac Gabions formed from triple twist hexagonal mesh of galvanized wire or PVC-U coated galvanized wire and is for use in both temporary and long-term installation.

• The gabions are marketed in the UK by Intermesh Ltd, Harcourt Mews, Royal Crescent, Cheltenham, Glos GL50 3DA
Tel: 0870 333 4120,
Fax: 0870 333 4121
e-mail: info@phigroup.co.uk, and manufactured by Link Middle East Ltd, Dubai, UAE.

• Construction of the system is usually carried out by civil engineering or building contractors.

Building Regulations

1 The Building Regulations 1991 (as amended 1994) (England and Wales)



In the opinion of the BBA, Link Middle East Gabion Boxes, Mattresses and Sac Gabions are not subject to these Regulations.

2 The Building Standards (Scotland) Regulations 1990 (as amended)



In the opinion of the BBA, Link Middle East Gabion Boxes, Mattresses and Sac Gabions are not subject to these Regulations.

3 The Building Regulations (Northern Ireland) 1994



In the opinion of the BBA, Link Middle East Gabion Boxes, Mattresses and Sac Gabions are not subject to these Regulations.

Technical Specification

1 Description

1.1 Link Middle East Gabion Boxes, Mattresses and Sac Gabions are cages formed from triple twist hexagonal galvanized wire mesh with or without a PVC-U coating.

1.2 The products are available in a large range of standard sizes as defined in Tables 1 to 4. 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 Table 1.

Table 1 Standard mesh and wire sizes

Standard mesh dimensions X x Y ⁽¹⁾ (mm)	Mesh wire GI dia (mm)	Selvage wire GI dia (mm)	Lacing wire GI dia (mm)
60 x 80	2.0	2.7	2.2
80 x 100	2.2	3.0	
100 x 120	2.4 2.7 3.0 3.4	3.4 3.9 4.0 4.4	2.4

(1) See Figure 1.

Table 2 Standard sizes of gabions

Length (m)	Width (m)	Height (m)
1	1	0.5 or 1
1.5	1	0.5 or 1
2 ⁽¹⁾	1 or 2	0.5 or 1
3 ⁽¹⁾	1 or 2	0.5 or 1
4 ⁽¹⁾	1 or 2	0.5 or 1
5 ⁽¹⁾	2	0.5 or 1

(1) Diaphragm provided at every 1 m distance.

Table 3 Standard sizes of mattresses and jumbo gabions

Length (m)	Width (m)	Height (m)
3 ⁽¹⁾	2 or 3	0.17, 0.23 or 0.30
4 ⁽¹⁾	2 or 3	0.17, 0.23 or 0.30
5 ⁽¹⁾	2 or 3	0.17, 0.23 or 0.30
6 ⁽¹⁾	2 or 3	0.17, 0.23 or 0.30

(1) Diaphragm provided at every 1 m distance.

Table 4 Standard size of Sac Gabions

Length (m)	Width (m)	Height (m)
1-1.5	0.40 or 0.65	0.40 or 1.0
2	0.50 or 1.0	0.50 or 1.5
3	0.65 or 1.0	1.0 or 2.25

1.4 The wire used to manufacture the mesh is generally to BS 1052 : 1986 with a tensile

strength of between 380 Nmm⁻² and 550 Nmm⁻² and with a minimum elongation at failure of 12%.

1.5 The wire is galvanized in accordance with BS 443 : 1990 prior to being PVC-U-coated. The minimum zinc coating thickness for the various diameters is given in Table 4 of BS 443. Where necessary, the wire has an additional PVC-U coating (nominal thickness of 0.50 mm) applied by extrusion to the galvanized wires prior to weaving.

2 Manufacture and quality control

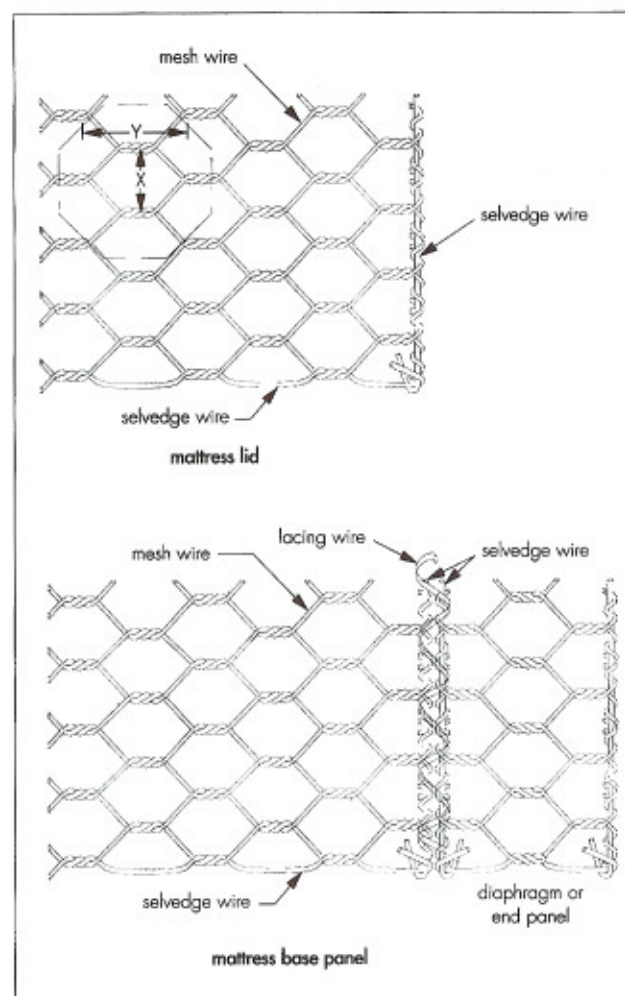
2.1 During fabrication, cut ends are mechanically selvaged with a wire of greater diameter than that used for the mesh wires (see Figure 1).

2.2 Box gabion end panels and diaphragms are selvaged along their upper edges in a similar manner to that described in section 2.1.

2.3 Mattresses above 3 m sizes consist of a separate base and a lid. The lid is formed by either a panel of mesh for each base or a roll of mesh used to cover several adjacent mattresses.

2.4 Mattress bases are fabricated from a single panel of mesh having sides formed by folding ends and diaphragms are formed by separate panels laced to base panels during the manufacture (see Figure 8). The mattresses are folded and packed for delivery.

Figure 1 Selvage detail



3 Delivery, storage and site handling

3.1 The products are delivered to site in bales of from five to seven bundles, with each bundle consisting of from 15 to 30 gabion boxes weighing from 500 kg to a maximum of 800 kg. The bundles of boxes are strapped together to form a bale, which has a maximum height of 2 m and maximum weight of from 2.5 tonnes to 3.5 tonnes.

3.2 The products should 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 Bundles must be handled with care to avoid damage to coatings. Individual units may be manhandled.

Design Data

4 General

Gabion boxes

4.1 The design of Link Middle East Gabion Box 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 gabion boxes 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 box walls can be constructed with a minimum radius of curvature of 25 m without modification of the gabion structure.

Mattresses

4.5 The design of the Link Middle East mattress structures should be based on the principles of hydraulic engineering and, where applicable, mass earth retaining structures.

4.6 The density of filled 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.

4.7 The stone infill to the 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.

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

Sac gabions

4.9 There are no design standards that relate directly to Link Middle East Sac Gabions. Each structure must be designed by a competent consulting engineer using the principles of mass earth retaining structures.

5 Design — Gabion box and mattress structures

5.1 The design of Link Middle East Gabion Box and Mattress structures should be carried out by a suitably qualified engineer.

5.2 The magnitude and distribution of the earth pressures and earth resistance should be calculated in accordance with current design philosophy.

5.3 As in other earth retaining structures, it is necessary to determine a suitable factor of safety against the principal modes of failure for parameters of:

- overall stability
- overturning
- shearing pressure
- sliding
- internal stability.

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

5.5 The mesh specification should be chosen to achieve the required design life (see section 9).

6 Strength — Gabion boxes, mattresses and sac gabions

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

6.2 Gabion boxes 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.

6.3 Where cohesive materials, such as clay, 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.

6.4 Link Middle East Gabion Boxes and Mattresses have adequate strength to permit pre-filling and placing by crane when carried out in accordance with the manufacturer's instructions.

7 Practicability of installation

The gabion boxes and mattresses are installed easily under normal site conditions.

8 Maintenance and repair

Routine maintenance is not normally required. However, damaged exposed mesh can be repaired by securing additional or replacement mesh as required.

9 Durability

9.1 The specification for a particular installation must be chosen to achieve the required design life.

9.2 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.

9.3 PVC-U coated, galvanized steel wire will not be affected by the chemicals normally encountered in earth retaining structures.

9.4 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.

9.5 When used in sea water, under 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.

9.6 The life expectancy of the non-PVC-U coated galvanized wire products may be estimated from the predicted loss of zinc coating based on exposure conditions.

9.7 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.

10 General

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

11 Procedure

In-situ filled gabion boxes (see Figures 2 to 6)

11.1 Gabion boxes are opened and folded on a hard surface, pressing out any unwanted creases.

11.2 Front and rear sides, ends and diaphragms are lifted into position to form a box shape.

11.3 Top corners are secured with the thick selvedge wire. Edges are joined together, using the appropriate lacing wire, starting from the top course in a continuous operation using alternate single and double twists.

11.4 A number of empty gabion boxes may be placed in position on a flat surface and secured together as described in section 11.3.

11.5 The gabion boxes 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.

11.6 When considered necessary for aesthetic or other considerations the gabion may be filled whilst under tension. Gabion boxes are tensioned by applying a load, distributed over the full end panel of a row of gabion boxes, to the first cell which has been anchored in position.

11.7 Gabion boxes 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.

11.8 The mesh lid is folded down, stretched into position and secured to the front, sides and diaphragms.

11.9 It is essential that each gabion box is properly secured to adjacent gabion boxes above, below and on each side, using the lacing wire as described in section 11.3.

Pre-filled gabion boxes

11.10 Gabion boxes are constructed as described in sections 11.1 to 11.3, 11.5, 11.7 and 11.8, but with double loops throughout. However, it is advantageous to construct a slightly oversize frame within which the empty unit can be stretched taut.

11.11 After filling the horizontal top edges are stiffened, if required, using reinforcing bars, typically 20 mm in diameter, to maintain shape during lifting. Bars should be removed after placement.

11.12 Purpose-made lifting frames and slings must be used for lifting filled units which weigh up to 1.8 tonnes per cubic metre.

Figure 2 Gabion box folding

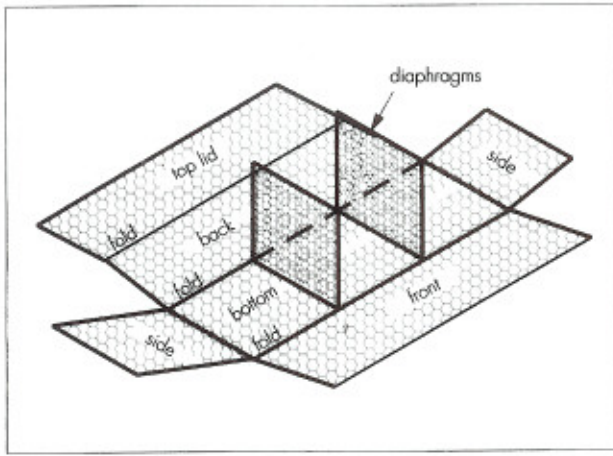


Figure 3 Gabion box panels lacing pattern

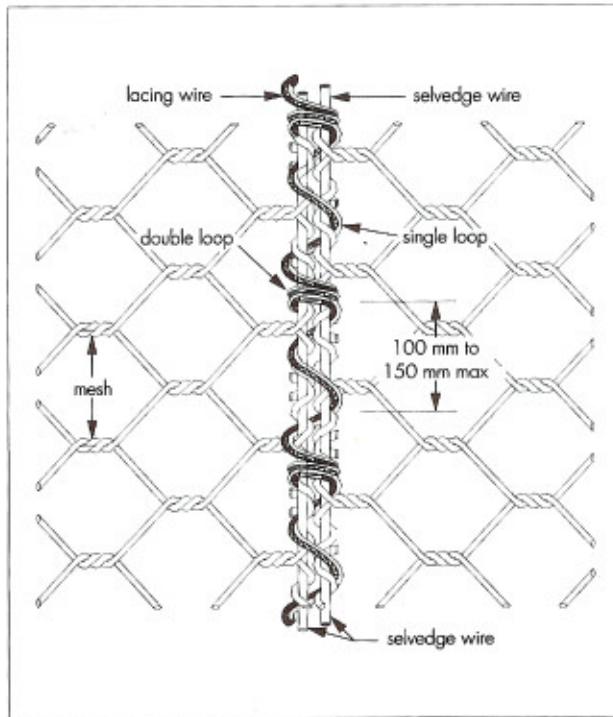


Figure 4 Gabion box forming

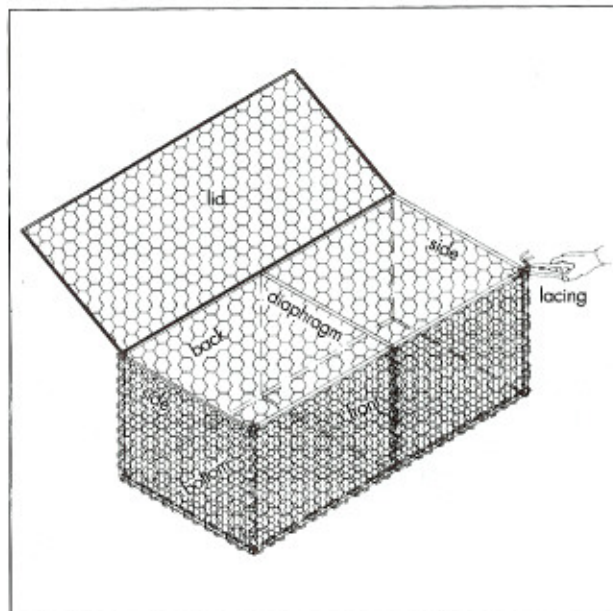


Figure 5 Bracings for gabion boxes

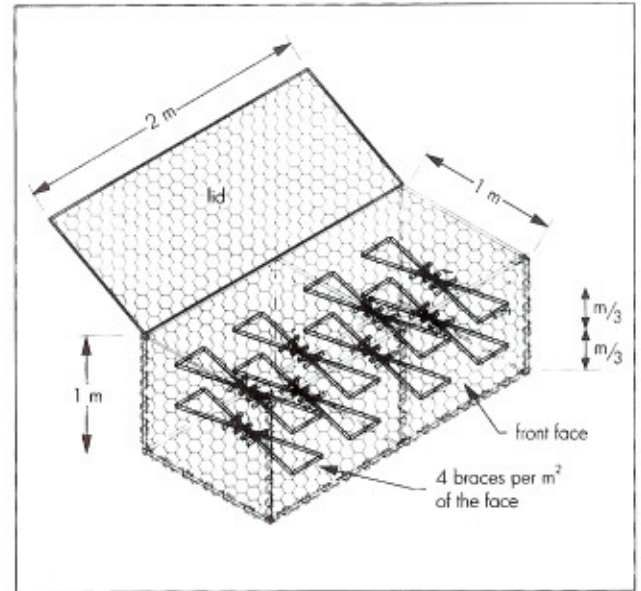
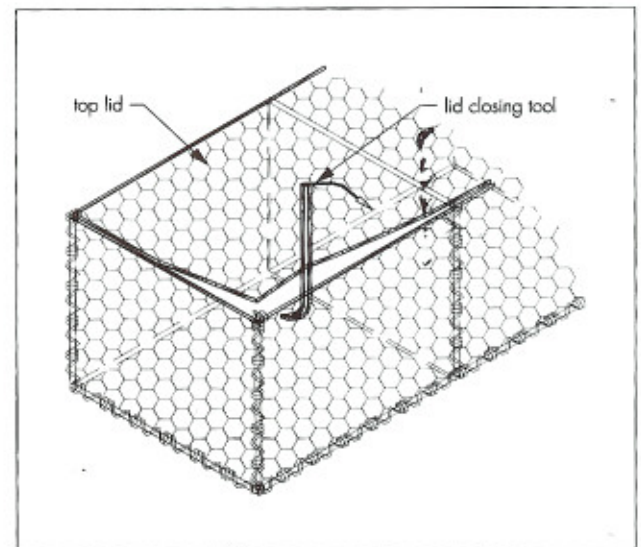


Figure 6 Lid closing for gabion boxes



In-situ filled mattresses (see Figures 7 to 9)

11.13 Mattresses are opened and folded on a hard surface, pressing out any unwanted creases.

11.14 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 11.3.

11.15 The unit is placed in its final position and secured to adjacent mattresses, ensuring that diaphragms, ends and sides are taut.

11.16 Fill is placed into each compartment, working from the base of the slope upwards, until each cell is filled completely.

11.17 The lid is secured along each edge and diaphragm using lacing wire as specified.

Pre-filled mattresses

11.18 The mattress is assembled as described in section 11.14, but using double loops throughout.

11.19 Additional support should be provided under the lid using steel bars, typically 20 mm in diameter.

11.20 After filling, the unit must be properly secured using the method described in section 11.3.

11.21 Purpose-made lifting frames are available with suitable attachments to enable the filled mattresses to be safely placed in position.

Figure 7 Preparation of mattresses

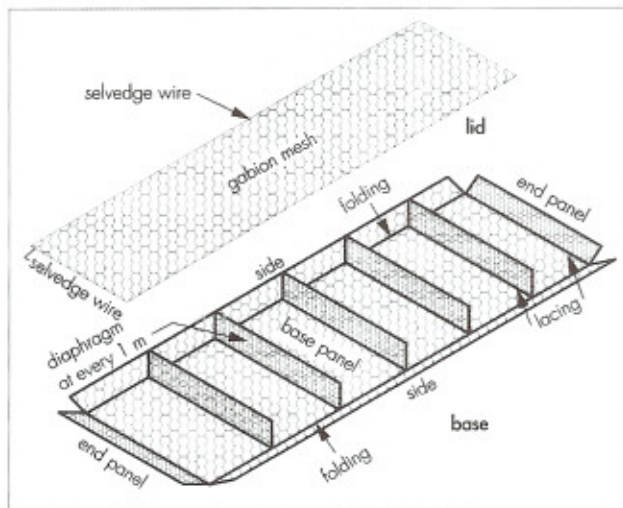


Figure 8 Gabion mattress panels joining detail

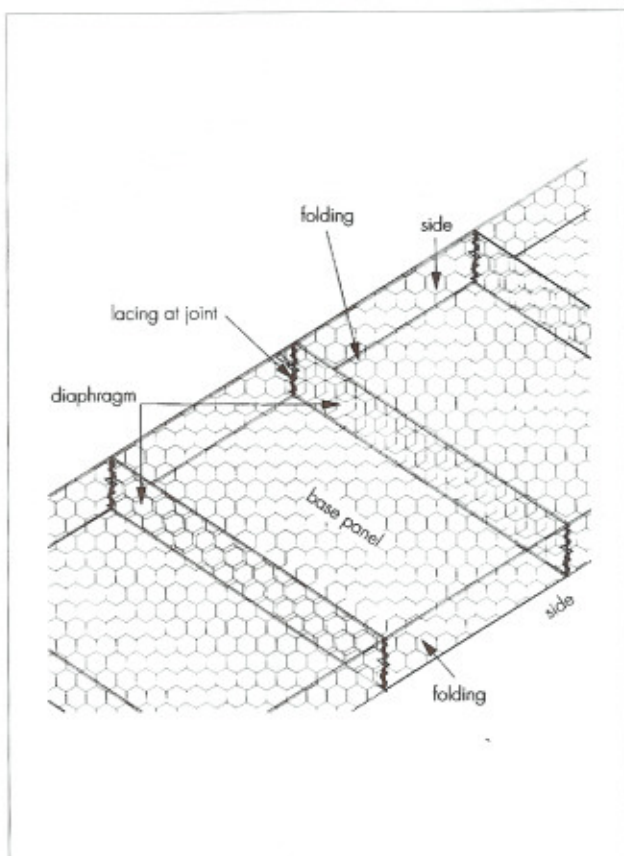
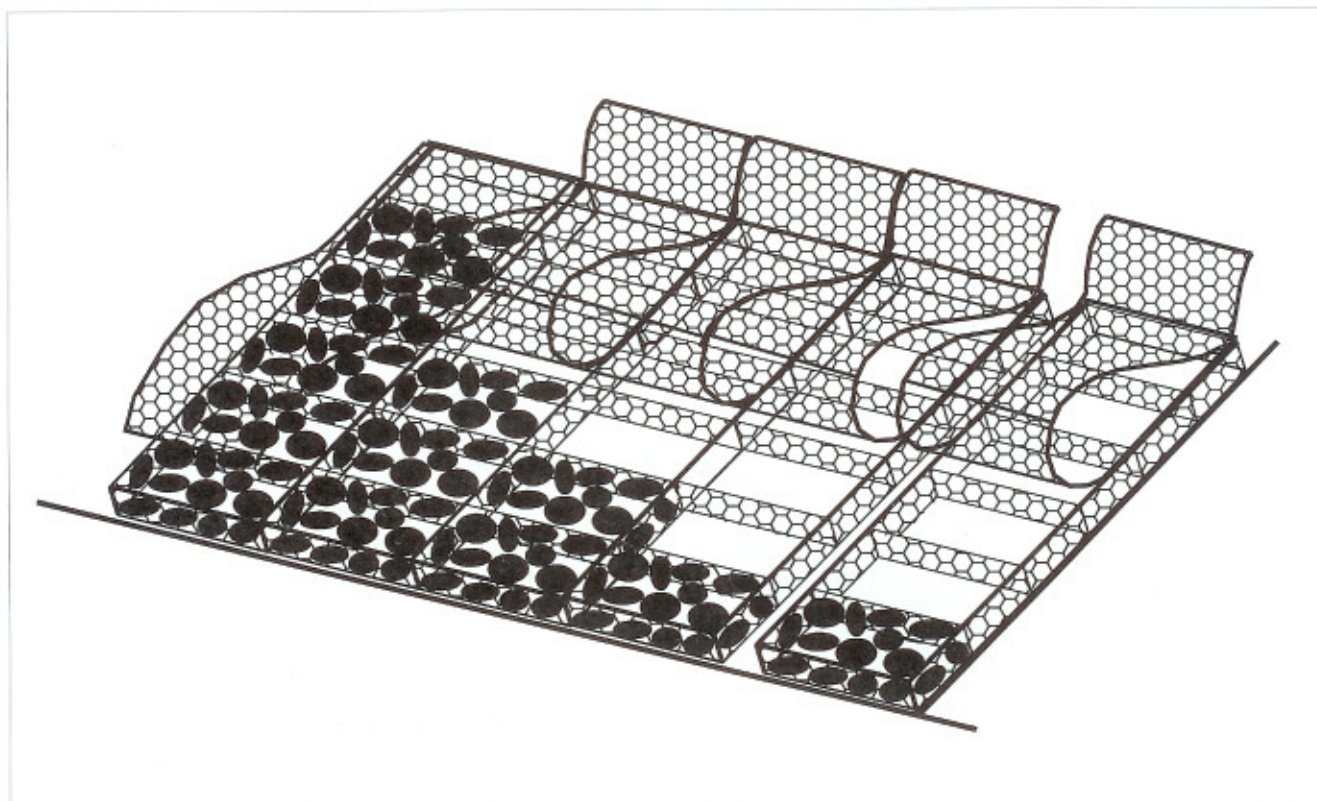


Figure 9 Gabion mattress placing and stone infilling details



Technical Investigations

The following is a summary of the technical investigations carried out on Link Middle East Gabion Boxes, Mattresses and Sac 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
- 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.

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*

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

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; and

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

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

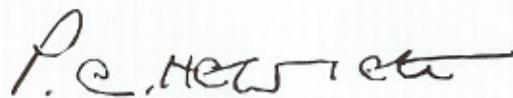
- (a) the presence or absence of any patent or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the nature of individual installations of the product, including methods and workmanship.

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 BBA, Link Middle East Gabion Boxes, Mattresses and Sac Gabions are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 00/3682 is accordingly awarded to Link Middle East Ltd.

On behalf of the British Board of Agrément


Chief Executive

Date of issue: 28th February 2000