



## EUROPEAN ASSESSMENT DOCUMENT

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# WELDMESH GABION BOXES AND MATTRESSES

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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## 1 SCOPE OF THE EAD

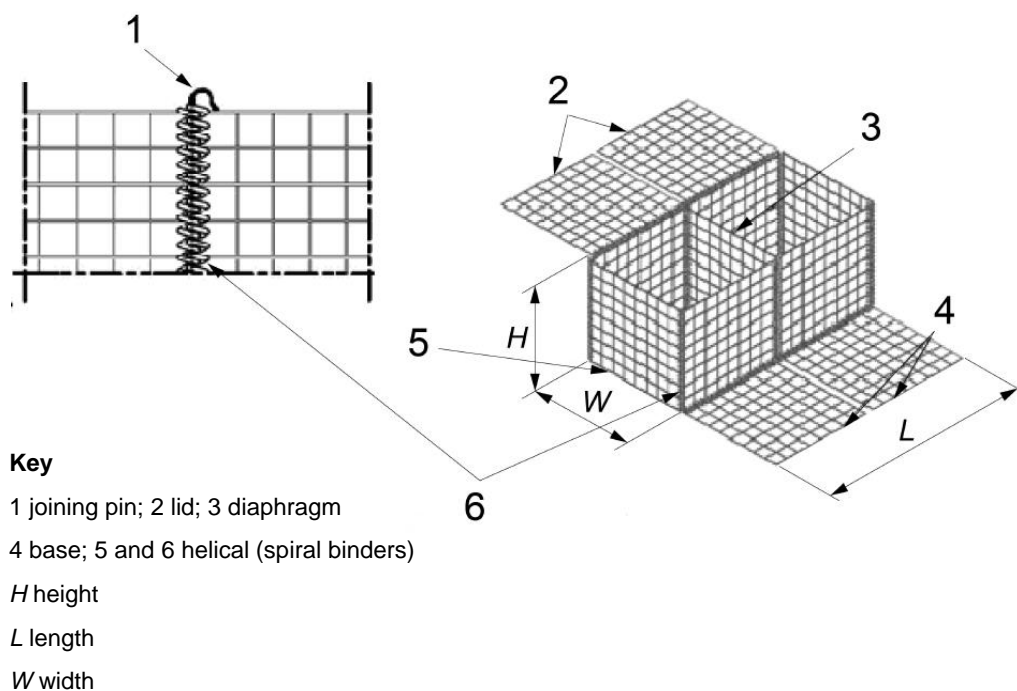
### 1.1 Description of the construction product

A gabion is a container made from welded wire panels (see Figure 1 and Figure 2) of variable sizes, uniformly partitioned into internal cells, interconnected with other similar units, and filled with stone at the project site to form flexible, permeable, monolithic structures used for earth retention, soil reinforcement, river training, erosion control, fascia systems, free-standing walls and rain screens.

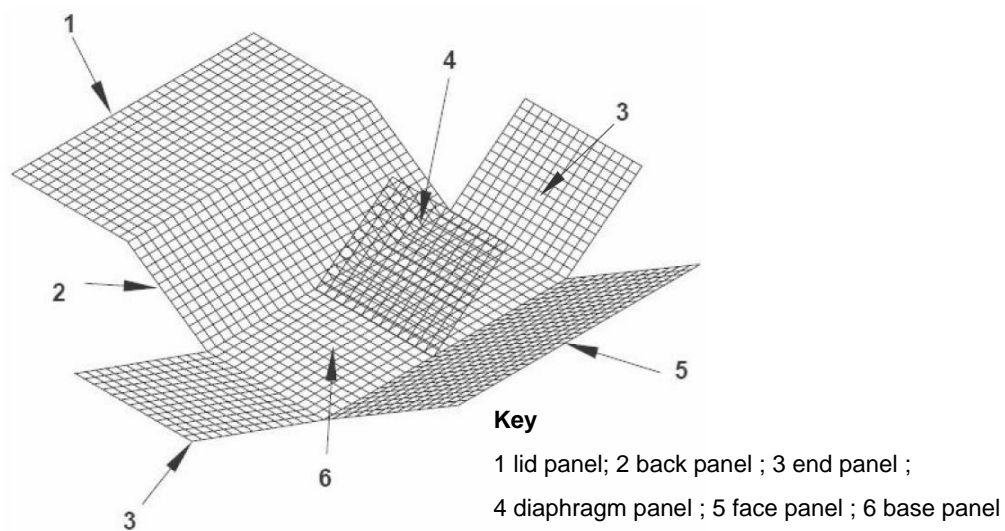
Mattress is welded steel wire mesh container uniformly partitioned into internal cells with relatively small height in relation to other dimensions.

Welded wire gabions can be manufactured as:

1. Welded wire panel, made from non-coated steel wire additionally hot-dip galvanized according to EN 10223-8 after panel production (welding, bending, etc.).
2. Welded wire panel made from wire which is Zn/Al alloy coated before welding into the fabric. Helical, lacing wire, locking pins, C-rings and bracing ties (stiffeners) also produced from Zn/Al alloy coated wire.
3. Welded wire panel and lacing wire produced from Zn/Al alloy coated wire and over coated with poly(vinyl chloride) (PVC). Helical, locking pins and bracing ties (stiffeners) produced from stainless steel wire or Zn/Al alloy coated wire and over coated with poly(vinyl chloride) (PVC).
4. Welded wire panel, helical, lacing wire, locking pins and brace ties produced from stainless steel wire.

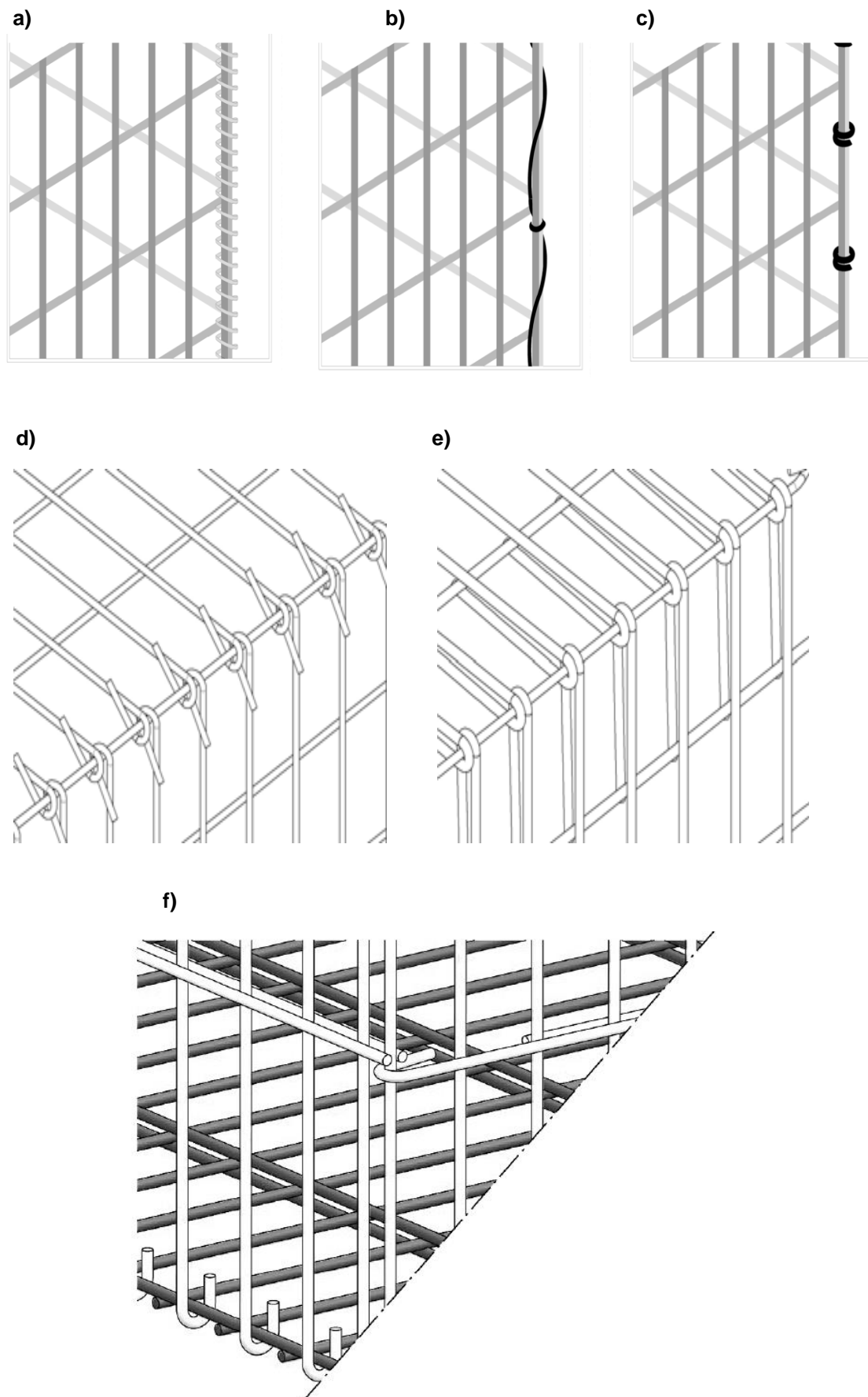


**Figure 1 – Components of welded gabions**

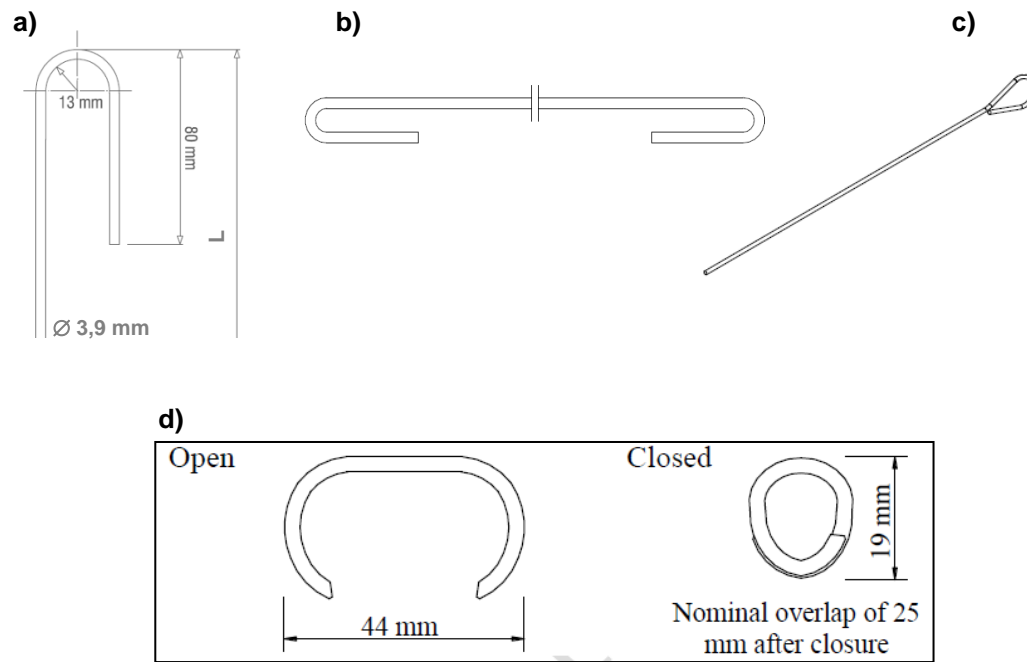


**Figure 2 – Welded wire mesh panels of welded gabions**

For connection of individual welded wire panels in works and/or for preassembling in manufacturing plant the options according to Figure 3 can be used. For structural application doubling of lids and side panels is necessary (for engineering solutions a different agreement can be done at the design stage).



**Figure 3 – Examples of connections : a) spiral binders (with joining pins, see Fig. 1.1), b) lacing wire, c) C-rings, d) eye with locking pins, e) and f) looped ends with locking pins**



**Figure 4 – Examples of gabion components: a) joining pin, b) stiffener, c) locking pin, d) C-ring**

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

## 1.2 Information on the intended use(s) of the construction product

### 1.2.1 Intended use(s)

Weldmesh gabion boxes and mattresses are intended to be used for:

- earth retention,
- river training,
- erosion control,
- fascia systems,
- architectural claddings,
- free-standing walls,
- sound barriers,
- noise mitigation works.

### 1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a:

- a) Working life of the welded mesh gabion boxes and mattresses made from Zn/Al coated and Zn/Al + organic coated wires for the intended use, in accordance with Annex A, EN 10223-8, in relation to different wire coating and corrosive categories (according to EN ISO 9223) of environment, when installed in the works and when durability tests are performed according to cl. 2.2.9.1, 2.2.9.2 and 2.2.9.3 in this EAD, moreover:

When tested according to 2.2.9.1:

Non – ferrous metallic coating Zn95/Al5 and Zn95/Al5+organic coating: the number of cycles is 28;

Non – ferrous advanced metallic coating: the number of cycles is 56;

Non – ferrous advanced metallic coating + organic coating: the number of cycles is 56;

When tested according to 2.2.9.2:

Non – ferrous metallic coating Zn95/Al5 and Zn95/Al5+organic coating: the number of hours in exposure is 1000;

Non – ferrous advanced metallic coating: the number of hours in exposure is 2000;

Non – ferrous metallic coating + organic coating: the number of hours in exposure is 2000;

When tested according to 2.2.9.3:

the change of retained tensile strength and elongation of organic coating material is not more than 25%.

- b) Working life of hot dip galvanized welded mesh gabion boxes and mattresses for the intended use, is in accordance with EN ISO 14713-1.

These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works<sup>1</sup>.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

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<sup>1</sup> The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.



## 1.3 Specific terms used in this EAD

### 1.3.1 Gabion/trapezoidal gabion/mattress

A welded wire container, partitioned, of variable size, and filled with stone or other suitable material at the site of use, or to be factory prefilled to form flexible, permeable, monolithic structures such as retaining walls, sea walls, channel linings, revetments, and weirs for erosion control. Trapezoidal gabion is a gabion of which the width of the lid is smaller than the width of the base.

Mattress is a gabion with a smaller height in relation to its width and length dimensions, generally used for river bank, slope protection or anti-scour erosion protection.

### 1.3.2 Mesh size of welded wire panel $M \times N$ (in mm)

Centre-to-centre distances between two consecutive wires in both orthogonal directions ( $M$  and  $N$ ).

### 1.3.3 Helical/spiral binder

For gabions and gabion mattresses; wire with coating that ensures equivalent corrosion protection as the gabion forming part used to assemble and interconnect empty units, to close and secure units filled with stone as a replacement for lacing wire or rings. The spiral binders shall pass through the openings.

### 1.3.4 Joining pin

Steel wire with J-shaped end used with spiral binder connection to prevent unravelling when load is applied (see Figure 4).

### 1.3.5 Locking pin/push-fastener

Wire with coating that ensures equivalent corrosion protection as the gabion forming part formed to pin, used to connect panels with looped ends and build a looped gabion container (see Figure 4).

### 1.3.6 Lacing wire

For gabions and gabion mattresses; wire with coating that ensures equivalent corrosion protection as the gabion forming part used to assemble and interconnect empty units, to close and secure units filled with stone as a replacement for spiral binders or rings and also used as bracing tie to prevent face deformation.

### 1.3.7 C-rings

Rings of C-shape (see Figure 4) made from high strength steel wire with coating that ensures equivalent corrosion protection as the gabion forming part, used to assemble and interconnect the empty gabions and to close and secure the units filled with stone.

### 1.3.8 Stiffener/bracing tie

Length of wire with coating that ensures equivalent corrosion protection as the gabion forming part used to support of facing by forming a diagonal brace across the corners of a gabion container (see Figure 4).

### 1.3.9 Diaphragm

Welded steel wire mesh panel connected to the walls and base panels to stabilize and ensure the position of walls of gabion/mattress.

## 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

### 2.1 Essential characteristics of the product

Table 1 shows how the performance of weldmesh gabion boxes and mattresses is assessed in relation to the essential characteristics.

**Table 1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics**

No	Essential characteristic	Assessment method	Type of expression of product performance <i>(level, class, description)</i>
<b>Basic Works Requirement 1: Mechanical resistance and stability</b>			
1	Wire diameter	2.2.1	$D_w$ (mm)
2	Wire tensile strength	2.2.2	$f_t$ (N/mm <sup>2</sup> )
3	Dimensions of product, mesh size and connection components	2.2.3	$H, L, W, M \times N$ (mm)
			Specific dimensions (mm)
4	Corrosion protection: non-ferrous metallic coating type class of coating mass mass of hot dip galvanized coating	2.2.4a	description
		2.2.4c	description g / m <sup>2</sup>
5	Additional corrosion protection: organic coating type coating thickness and wire diameter coating concentricity	2.2.5	description (mm) (mm) (%)
6	Weld shear strength	2.2.6	description
7	C-ring (or similar fastener) resistance to opening	2.2.7	$F_m$ (kN)
8	Tensile strength of gabion/mattress including connection	2.2.8	level (kN/m)
9	Durability in artificial atmospheres		
	Sulphur dioxide test with general condensation of moisture	2.2.9.1	Number of cycles with surface DBR $\leq$ 5% surface (Number)
	Neutral salt spray test	2.2.9.2	Exposure time with surface DBR $\leq$ 5% surface (hours)
	UV resistance of organic coating material	2.2.9.3	% of retained tensile strength and elongation (%)
<b>Basic Works Requirement 4: Safety and accessibility in use</b>			
10	Protection against injury	2.2.10	description
<b>Basic Works Requirement 5: Protection against noise</b>			
11	Airborne sound insulation	2.2.11	description
12	Sound absorption	2.2.12	description

## 2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

### 2.2.1 Wire diameter $D_w$ (in mm)

The diameter  $D_w$  (in mm) of mesh wire and wires of connection components as well, shall be verified according to cl. 4.1 in EN 10218-2. The verification shall be carried out by checking the inspection documents of incoming wire products and by additional checking according to the manufacturer's control plan.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 1 (tolerance class T1) in EN 10218-2 for non-ferrous metallic coated wires. The TAB shall also inform the manufacturer of outcomes of the comparison of test results with 7.4 in EN 10223-8.

### 2.2.2 Wire tensile strength $f_t$ (in N/mm<sup>2</sup>)

The tensile strength of mesh and connection components' wires shall be verified according to cl. 3, EN 10218-1. The verification shall be carried out by checking the inspection documents of incoming wire products and by additional checking according to the manufacturer's control plan.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with cl. 7.4 in EN 10223-8 for mesh wire and with cl. 7.7 in EN 10223-8 for connection component (C-ring, lacing, helical) wire.

### 2.2.3 Dimensions of product $H$ , $L$ , $W$ , mesh size $M \times N$ and dimensions of connection components (specific dimensions) (in mm)

The product dimensions (for dimensions  $H$ ,  $L$ ,  $W$ , see Figure 1, for  $M \times N$ , see 1.3.2) and connection components' dimensions *specific dimensions*<sup>1)</sup> (in mm) shall be measured at least on three samples for each type of product. The welded panel dimensions shall be measured according to Annex A in this EAD.

Note 1 – Specific dimensions are for example: dimensions of C-rings according to Figure 4, length of locking pins, outer diameter of spiral binders, length of all turns together within one spiral binder, etc.

The TAB shall inform the manufacturer of outcomes of the comparison of test results (product dimensions) with cl. 7.2 in EN 10223-8 and also (mesh size) with 7.3 in EN 10223-8.

### 2.2.4 Corrosion protection: non-ferrous metallic coating- type and class of coating mass

- a) The type of non-ferrous metallic Zinc / Aluminium alloy coating (informative types are: Zn/95/Al5, Zn90/Al10) and minimum coating mass on wires (in g/m<sup>2</sup>) shall be verified in accordance with cl. 5.2.2, EN 10244-2. The adherence wrapping test on non-ferrous metallic coated wires shall be carried out in accordance with cl. 6, EN 10218-1. The verification shall be carried out by checking the inspection documents of incoming wire products and by additional checking according to the manufacturer's control plan.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 2, EN 10244-2 for Class A. The TAB shall also inform the manufacturer about the comparison of test results with quality of adherence of coating (wrapping test 0/5), scale 2 (Figure 1, EN 10244-2).

- b) When stainless steel wire is used, it shall be given in ETA.
- c) The thickness and consequently the mass of coating of hot dip galvanized products (after welding) shall be tested according to cl. 6.2 in EN ISO 1461. The mass of hot dip galvanized coating (g/m<sup>2</sup>) shall be recorded in ETA.

### 2.2.5 Additional corrosion protection: organic coating

The diameter (in mm) and minimum coating thickness of organic coated wires (possible type of organic coating is: PVC in accordance with EN 10245-2) together with concentricity (in %) shall be verified in accordance with cl. 5.2.4 in EN 10245-1 on individual samples removed from the welded panels (sintered coating) and on incoming wire samples for connection components (extruded coating), when relevant.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 2 in EN 10218-2 for sintered coating (welded panel) and for extruded coating (connection components, for example lacing wire).

### 2.2.6 Weld shear strength

The weld shear strength shall be tested in accordance with cl. 9 in EN 10223-8 and assessed in accordance with cl. 7.5 in EN 10223-8.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with cl. 7.5 in EN 10223-8.

### 2.2.7 C-ring (or similar fastener) resistance to opening $F_m$ (in kN)

The average resistance to opening (measured on minimum of 5 samples)  $F_m$  (in kN) of C-ring (or similar fastener) when tested in accordance with Annex B in this EAD shall be recorded in ETA.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with cl. 7.7 in EN 10223-8 (pull-apart resistance).

### 2.2.8 Tensile strength of gabion/mattress including connection (in kN/m)

The mechanical resistance of welded gabion/mattress is determined by tensile strength (in kN/m) of monolithic structure including connection devices as the average value from at least three tests. The test of connected welded panels shall be done according to Annex C in this EAD. In case of ring connection, the resistance of gabion/mattress including connection can be calculated as the minimum value of resistance to opening of rings according to 2.2.7 per meter and welded shear strength according to 2.2.6 per meter. The resistances shall be calculated as resistance to opening of ring / distance of rings (kN/m) and weld shear strength / centre to centre distance of wires in the relevant direction (kN/m).

### 2.2.9 Durability

#### 2.2.9.1 Sulphur dioxide test with general condensation of moisture

Sulphur dioxide test with discontinuous exposure on mesh samples (at least one sample) made from Zn/Al alloy (and advanced) and Zn/Al alloy (and advanced) + organic coated wires shall be carried out according to cl. 7.6.1 and cl. 7.6.2 in EN 10223-8. The number of cycles of discontinuous exposure after which the mesh sample does not show more than 5% of DBR (Dark Brown Rust) shall be given in ETA. For Zn/Al alloy (and advanced) + organic coated mesh samples the permeated rust shall be evaluated without removing the organic coating.

#### 2.2.9.2 Neutral salt spray test

Neutral salt spray (NSS) test on mesh samples (at least one sample) made from Zn/Al alloy (and advanced) and Zn/Al alloy (and advanced) + organic coated wires shall be carried out according to cl. 7.6.1 and cl. 7.6.2 in EN 10223-8. The number of hours of exposure after which the mesh sample does not show more than 5% of DBR (Dark Brown Rust) shall be given in ETA. For Zn/Al alloy (and advanced) + organic coated mesh samples the permeated rust shall be evaluated without removing the organic coating.

#### 2.2.9.3 UV resistance tests on organic coating material

The raw organic material durability shall be demonstrated by method of exposition according to cl. 7.6.3 in EN 10223-8. The average relationship of initial and retained tensile strength and elongation in % resulting calculated from at least three samples shall be given in ETA.

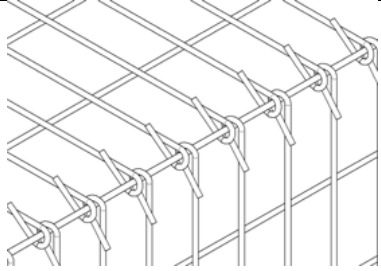
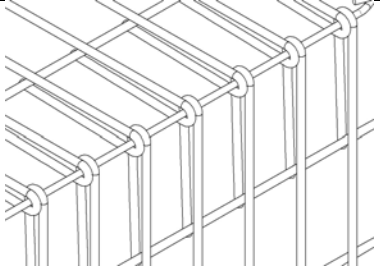
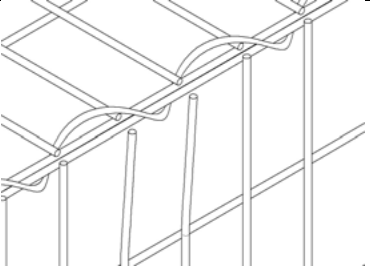
### 2.2.10 Protection against injury

For design of front sides of gabion products, which may be exposed to accessible areas due to their intended use (e.g. landscape gardening, architectural purposes, playing areas for children), the possible risk of injury shall be described according to Table 2.

The assessment shall be done on basis of technical documentation of the design. Some examples are shown in Table 2 in order to provide an illustration of design.

In case when the wire is produced with rounded tips edge it can be considered that no risk of injury caused by sharp edges of jut out wires occurs.

**Table 2** Examples of possible injury for different design of front sides of gabion products

		
Obviously no risk of injury caused by sharp edges of jut out wires	Certain risk of injury caused by short pieces of jut out wires	Major risk of injury caused by short pieces of jut out wires in case of damage and related loss of connections of end wires.

### 2.2.11 Airborne sound insulation

In case of use of gabion products as sound barriers for roads and railways the ETA may include assessment of airborne sound insulation, based on given guidance for the composition of the barrier. Although the composition and type of filling material of the barrier is to be indicated in the ETA for such cases, it does not form part of the ETA. Verification of airborne sound insulation shall be carried out according to EN 1793-2 or EN 1793-6. The results shall be expressed according to Annex A, EN 1793-2.

### 2.2.12 Sound absorption

In case of use of gabion products as sound barriers for roads and railways the ETA may include verification of sound absorption, based on given guidance for the design of the barrier. Although the composition of the barrier is to be indicated in the ETA it does not form part of the ETA. Verification of sound absorption shall be carried out according to EN ISO 354. The results shall be expressed according to Annex A, EN 1793-1.

### 3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

#### 3.1 System(s) of assessment and verification of constancy of performance

For the products covered by this EAD the applicable European legal act is: Decision 98/214/EC.

The system is: 2+

#### 3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.

**Table 3 Control plan for the manufacturer; cornerstones**

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Factory production control (FPC)</b>					
<b>including testing of samples taken at the factory in accordance with a prescribed test plan</b>					
<b>Manufacturer`s production</b>					
1	<b>Product:</b> Mesh dimensions, mesh size	2.2.3	2.2.3	1 sample / type	1 / day
	Product dimensions	2.2.3	2.2.3	1 sample / type	1 / day
	Connection component dimensions	2.2.3	2.2.3	1 sample / type	1 / day
	Organic coating on welded panels: Thickness/concentricity	2.2.5	2.2.5	3 samples / type	every 1000 m <sup>2</sup> of panels
	Weld shear strength	2.2.6	2.2.6	1 set of samples (4 pcs.) / type	1 / year
	Resistance to opening of connection components	2.2.7	2.2.7	5 samples / type	1 / year
	Sulphur dioxide test	2.2.8.1	2.2.8.1	1 sample / mesh type and wire diameter	1 / 2 years
	Neutral salt spray test	2.2.8.2	2.2.8.2	1 sample / mesh type and wire diameter	1 / 2 years
UV resistance	2.2.8.3	2.2.8.3	According to control plan	1 / 2 years	
Testing according to EN ISO 1461 (if relevant)	2.2.4c)	2.2.4c)	According to control plan	According to control plan	
<b>Incoming product</b>					
2	<b>Metallic coated wire:</b> Outer diameter Adherence Coating mass	EN 10218-2 EN 10218-1 EN 10244-2	EN 10218-2 MTF EN 10223-8	Inspection certificate of supplier, type 3.1 EN 10204  In addition 1 / each diameter	Every shipment
3	<b>Organic coated wire (when incoming product, for example for connection components):</b> Type of coating  Outer diameter	EN 10245 (relevant part) EN 10218-2	MTF  EN 10218-2	Inspection certificate of supplier, type 3.1 EN 10204  In addition	Every shipment

	Visual Thickness/concentricity	EN 10245-1 EN 10245-1	MTF EN 10218-2	1 / each diameter	
45	<b>Wire mechanical characteristics:</b> Tensile strength	EN 10218-1	EN 10223-8	Inspection certificate of supplier, type 3.1 EN 10204  In addition 1 / each diameter	Every shipment

### 3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for weldmesh gabion boxes and mattresses are laid down in Table 4.

**Table 4 Control plan for the notified body; cornerstones**

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Initial inspection of the manufacturing plant and of factory production control</b>					
1	Ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the weldmesh gabion boxes and mattresses	-	Laid down in control plan	-	1
<b>Continuing surveillance, assessment and evaluation of factory production control</b>					
2	Verifying that the system of factory production control and the specified automated manufacturing process are maintained taking account of the control plan	-	Laid down in control plan	-	1/year

## 4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance.

EN 10223-8	Steel wire and wire products for fencing and netting - Part 8: Welded mesh gabion products
EN 10204	Metallic products. Types of inspection documents
EN 10218-1	Steel wire and wire products. General. Part 1: Test methods
EN 10218-2	Steel wire and wire products. General. Part 2: Wire dimensions and tolerances
EN 10244-1	Steel wire and wire products. Non-ferrous metallic coatings on steel wire - Part 1: General principles
EN 10244-2	Steel wire and wire products. Non-ferrous metallic coatings on steel wire - Part 2: Zinc or zinc alloy coatings
EN 10245-1	Steel wire and wire products. Organic coatings on steel wire. Part 1: General rules
EN 10245-2	Steel wire and wire products. Organic coatings on steel wire. Part 2: PVC finished wire
EN 13501-1+A1	Fire classification of construction products and building elements. Part 1: Classification using data from reaction to fire tests
EN 1793-1	Road traffic noise reducing devices. Test method for determining the acoustic performance. Part 1: Intrinsic characteristics of sound absorption
EN 1793-2	Road traffic noise reducing devices. Test method for determining the acoustic performance. Part 2: Intrinsic characteristics of airborne sound insulation under diffuse sound field conditions
EN 1793-3	Road traffic noise reducing devices. Test method for determining the acoustic performance. Part 3: Normalized traffic noise spectrum
EN 1793-6	Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 6: Intrinsic characteristics - In situ values of airborne sound insulation under direct sound field conditions
EN ISO 354	Acoustics. Measurement of sound absorption in a reverberation room
EN ISO 9223	Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation (ISO 9223:2012)
EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods
EN ISO 14713-1	Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Part 1: General principles of design and corrosion resistance
EN ISO 7500-1	Metallic materials. Verification of static uniaxial testing machines. Part 1: Tension/compression testing machines. Verification and calibration of the force-measuring system



## ANNEX A – VERIFICATION OF DIMENSIONS OF PRODUCT

### A1 Scope

This annex describes the method of verification of dimensions of panels and mesh sizes by testing.

### A2 Principles

The aim of this test procedure is to verify the possibility of final assembly of gabion products on site. This is to be done by means of check of the dimensions, including related tolerances of connecting devices.

### A3 Samples and preparation of test specimens

The test samples shall represent an appropriate modelling of the grid. For each dimension 3 samples shall be verified.

### A4 Testing arrangement and execution of the test

The following dimensions shall be verified by means of callipers, metric tape or equivalent system (adequately calibrated).

- Length in total;
- Width in total;
- Mesh size in both directions.

An example of an equivalent system is illustrated in Figure A.1.

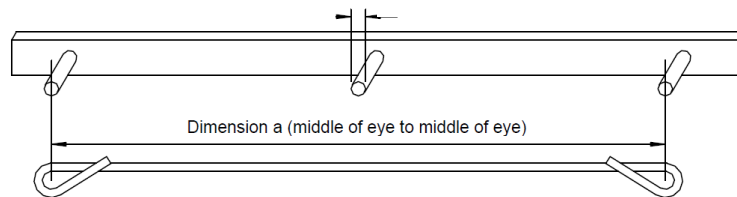


Figure A.1 – Example of testing gauge

### A5 Expression of the results

The following values shall be recorded:

- Length in total;
- Width in total.
- Mesh sizes in both directions.

### A6 Test report

The test report shall include the following:

- Name of the manufacturer and manufacturing plant;
- Name and signature of testing body;
- Model identification;
- Reference to this Annex and any deviation from it;
- Description of the test equipment;
- Date of the preparation of specimens, the date of test;
- Expression of the test results.

## **ANNEX B – C- RING (OR SIMILAR FASTENER) RESISTANCE TO OPENING, TEST METHOD**

### **B1 Scope**

The aim of this test is to show the pull-apart resistance of C-ring (or similar) fastener used to assemble gabion units.

### **B2 Test Specimen**

The test specimen is the closed C-ring (or similar fastener) itself.

### **B3 Test equipment**

The traction machine shall be in accordance with the requirements of EN ISO 7500-1 and shall be at least of Class 1. The testing apparatus shall be able to memorize or record the maximum force resulting opening staples.

### **B4 Test Conditions**

#### **B4.1 Method of sample fixing**

The specimen shall be maintained by suitable means such as yokes, shackles or other mounting for the tensile test. The equipment shall keep the test sample so that the load is applied along the longitudinal axis of the C-ring (or similar) fastener through the closure.

#### **B4.2 Test procedure**

Speed of application of the load is 5 mm/min with an uncertainty of less than 5 %, until the complete opening of the tested C-ring (or similar fastener).

#### **B4.3 Number of samples per type fastener**

For determination of the average opening load at least 5 samples for each type of C-ring (or similar fastener) shall be tested.

#### **B4.4 Determination of the opening load**

The opening load is considered to be a maximum load achieved during the test i. e. the force corresponding to the maximum recorded and stored by the testing apparatus fitted to the testing machine value or the maximum value on force – opening diagram recorded.

### **B5 Test report**

The test report shall include at least the following information:

- Name of the laboratory and the name of the operator who performed the tests;
- The characteristics of the testing machine and its calibration certificate;
- Identification of the tested C-ring (or similar fastener) (supplier and material nature of the surface treatment, dimensions, etc.);
- The date of test and results (opening load, mean and standard deviation of the results by C-ring type (or similar fastener), with appropriate, observations justify the results, force – opening diagram – if relevant).

## **ANNEX C - VERIFICATION OF TENSILE STRENGTH OF WELDED PANELS INCLUDING CONNECTION**

### **C1 Scope**

This Annex describes the method of verification of the tensile strength welded panels, including connectons, by testing.

### **C2 Principles**

The principle of this test procedure is to apply tensile forces on the test specimen in order to verify the behaviour of the connection of the panel in respect to deformation, including welding points and connecting devices.

### **C3 Samples and preparation of test specimens**

For each wire diameter the test specimen consists of at least 3 meshes, representative for the complete design.

### **C4 Testing arrangement and execution of the test**

The test conditions shall represent an appropriate modelling of the mesh. The application of loads shall be done by means of a testing machine according to EN ISO 7500-1/AC class 1. In principle the testing temperature shall be within the range of +10°C to + 30°C. The tensile force shall be increased with a rate 10mm/min. until reaching the maximum load of breaking of wires.

### **C5 Expression of the results**

The following shall be monitored and recorded:

- Tensile forces recorded during the entire test;
- Observations during application of tensile forces with respect to the behaviour of connecting devices and welding points;
- Breaking force and description of failure mode.

### **C6 Test report**

The test report shall include the following:

- Name of the manufacturer and manufacturing plant;
- Name and signature of testing body;
- Model identification;
- Reference to this Annex and any deviation from it;
- Description of the test equipment;
- Date of the preparation of specimens, date of test and laboratory conditions;
- Dimensions of test specimens;
- Expression of monitored phenomena according to cl. C5 of this Annex.