EUROPEAN ASSESSMENT DOCUMENT

EAD 200050-02-0102

September 2018

GABION BOXES, MATTRESSES AND SACK GABIONS MADE OF HEXAGONAL REGULAR TWISTED MESH, METALLIC PRE COATED, WITH OR WITHOUT ADDITIONAL ORGANIC COATING

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).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

A gabion is a kit consisting from closed gabion box (mattress and/or sack gabion) of specified dimensions and fittings and filled with specified stacked stone and/or stone or aggregate ballast, with basic specification according to EN 12440[1], for use in loadbearing geotechnical construction works and/or other loadbearing or non-loadbearing construction works.

A gabion box (see EN 10223-3, Cl. 3.6 and Fig. 3) is a double-twisted wire mesh container of variable sizes, uniformly partitioned into internal cells, interconnected with other similar units. In construction works it is filled at the project site to form flexible and permeable structures such as retaining walls, channel linings, revetments, weirs etc.

A mattress (see EN 10223-3, Cl. 3.7 and Fig. 4) is a double-twisted wire mesh container uniformly partitioned into internal cells with relatively small height in relation to other dimensions, having generally smaller mesh openings than the mesh used for gabions. Mattresses can be generally used for riverbank protection and channel linings.

A sack gabions covered by this EAD too, are cylinder units, described in EN 10223-3, Cl. 3.8 and Fig. 5.

This EAD covers gabion boxes, mattresses and sack gabions manufactured from or as:

- steel wire with mechanical performance according to EN 10223-3, Cl. 5.2,
- double-twisted non-ferrous metallic (zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic) coated mesh with steel wire diameter from 2,0 mm up to 5,0 mm and mesh size from 50 mm to 120 mm,
- stiffeners (e.g. diaphragms, bracing ties) made from steel wire of the same diameter as mesh itself at least,
- connection components (spirals, C-rings, clips and lacing wire) made from steel wire of diameter 1,0 up to 5,0 mm according to type of component,
- products mentioned above made of non-ferrous metallic (zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic) coated steel wire according to EN 10244-2, Cl. 3.2, 3.3, Tab. 1 and Tab. 2,
- products mentioned above made of non-ferrous metallic (zinc or zinc-aluminium or non-ferrous advanced metallic) coated steel wire, as option additionally coated by poly(vinyl chloride) (PVC) according to EN 10245-2, poly(ethylene) (PE) according to EN 10245-3 or poly(amid) (PA6) according to EN 10245-5, with ratio of diameter of core and of additional organic coated wire according to EN 10223-3, Tab. 4,
- products mentioned above made of non-ferrous metallic (zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic) coated steel wire without or with additional organic coating as described above, where connection components have different thickness and/or type of coating than mesh.

Non-ferrous metallic (zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic) coated steel wires for lacing wire, stiffeners, and connection components are used for manufacturing, assembling and installation of the product in construction works.

For connection of lid, bottom and intermediate diaphragms of the gabion (or mattresses) during the installation, the following options can be used:

1) By hand employing lacing wire. The diameter of lacing wire shall be the same or thinner than the wire from which the mesh is woven (see EN 10223-3, Cl. 3.10 and Fig. 6).

2) By spirals. Once the gabion walls are placed tightly together so that edge wires would be in contact and then around them the spiral is screwed. Ends of spiral should be bent to prevent its removal.

3) With gabion C-rings (or clips or similar connection components) employing hand or pneumatic stapler. The units to be connected are put tightly together so that the edge wires are in contact and the gabion C-rings (clips etc.) are placed by such a way they encircle the edge wires of both adjacent walls. The maximum distance between the gabion C-rings (clips etc.) should be 200 mm, see EN 10223-3, Cl. 3.11 and Fig. 7.

[1] All undated references to standards or to EADs in this EAD are to be understood as references to the dated versions listed in clause 4.

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

Products according to this EAD are not fully covered by EAD 200050-01-0102 because EAD 200050-01-0102 does not cover:

- gabion boxes and mattresses with zinc-aluminium-alloy- or non-ferrous advanced metallic coating, both with or without additional organic coating, according to EN 10244-2, Cl. 3.2 and 3.3 and Tab. 2;
- durability tests of products with zinc-aluminium-alloy- or non-ferrous advanced metallic coating, both with or without additional organic coating, in sulphur dioxide atmosphere.

In comparison to the EAD 200050-01-0102, in this EAD the following clauses and annexes have been changed: Cl. 1.1, Cl. 1.2.1, Cl. 1.2.2, Cl. 1.3, Cl. 2.1, Cl. 2.2.1, Cl. 2.2.3, Cl. 2.2.4, Cl. 3.2 in Table 2, Cl. 3.3, Cl. 3.3 in Table 3 and Cl. 4.

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 good 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)

Hexagonal woven mesh gabion boxes, mattresses and sack gabions with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating, are intended to be used in loadbearing geotechnical construction works according to EN 1997-1 as e.g.:

- earth retention,
- soil reinforcement,
- river training,
- erosion control,
- fascia systems.

They can be used too in other loadbearing and/or non-loadbearing construction works as e.g.:

- architectural claddings,
- free-standing walls and fences,
- sound barriers,
- noise mitigation works.

Gabion boxes, mattresses and sack gabions take over and re-distribute all the transversal tension and deformation of gabion filling (stacked stone and/or aggregate ballast) and retained earthwork in the final use in geotechnical structures. The mechanical resistance of gabion construction to embedded loads is in final ensured by tension resistance of gabion walls and gabion wall connection components.

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 working life of the hexagonal woven mesh gabion boxes, mattresses and sack gabions made of wire:

- with zinc coating of classes A, AB, B, C or D with/without additional organic coating for the intended use of 10 years;
- with zinc coating of class A×3 (or A×n) with/without additional organic coating for the intended use of 25 years;
- with Zn95/Al5 alloy coating of classes A, AB, B or E with/without additional organic coating for the intended use of 10 years or more according to type of additional organic coating;
- with Zn90/Al10 alloy coating of classes A, AB, B or E with/without additional organic coating or with non-ferrous advanced metallic with/without additional organic coating for the intended use of 25 years or more according to type of additional organic coating,

when installed in the works, provided that they are subject to appropriate installation. 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 is to 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. [2])

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.

1.3 Specific terms used in this EAD

Primary terms are given in EN 10223-2 and EN 10223-3.

1.3.1 Diaphragm

Hexagonal double twisted wire mesh panel made of similar mesh as a gabion/mattress itself (with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating), connected to the back, front, lid and base panels to stabilize and ensure the position and the shape of gabion/mattress.

1.3.2 Selvedge wire

A terminal wire (with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating), made from steel wire of diameter bigger than wire of mesh itself (see EN 10223-3, Cl. 6.2), used to edge the wire mesh perpendicular to the double twist. Connection of mesh to selvedge wire is secured by mechanical wrapping of the mesh wires around it at least 2,5 times or by inserting of selvedge wire throughout the twists with rounding of net around it on length of one mesh at least.

1.3.3 Edge wire

A terminal wire (with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating), made from steel wire of diameter bigger than wire of mesh itself (see EN 10223-3, Cl. 6.2), used to edge the wire mesh parallel to the double twist direction by its continuous weaving it into the wire mesh.

1.3.4 Clips

Elements made from high strength steel wire with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating or from stainless steel wire, used to assemble and interconnect the empty gabion boxes and to close and secure the units filled with stone.

1.3.5 Connection components

Elements used to assemble and interconnect the empty gabion boxes and to close and secure the units filled with stone (lacing wire, C-rings, clips and spirals).

1.3.6 Nominal value of tensile strength of the mesh

Nominal value of tensile strength of the mesh is value specified (or intended to be specified) for the product by manufacturer in his technical file.

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[2]) The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of hexagonal woven mesh gabion boxes, mattresses and/or sack gabions with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating, 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
Basic Works Requirement 1: Mechanical resistance and stability			
1	Tensile resistance of gabion wall - tensile resistance of mesh Tensile resistance of gabion wall - tensile resistance of connection of mesh and selvedge wire	2.2.1.1.1 2.2.1.1.2	Level Level
	Resistance to opening of gabion connection components	2.2.1.2	Level
	Tensile strength, elongation and diameter of wire	2.2.1.3	Level
Basic Works Requirement 3: Hygiene, health and the environment			
2	Content, emission and/or release of dangerous substances – leachable substances	Cl. 2.2.2.1	Description
Basic Works Requirement 4: Safety and accessibility in use			
3	Dimensions (length, width, height) of gabion boxes, mattresses and sack gabions	2.2.3.1	Level
	Dimension - mesh size	2.2.3.2	Level
	Dimensions (diameter, length if relevant) of connection components, selvedge and edge wires	2.2.3.3	Description / Level
Basic Works Requirement 7: Sustainable use of natural resources			
4	Protection to corrosion -non-ferrous metallic coating - type of coating - mass and/or thickness of coating - resistance to neutral salt spray - resistance to sulphur dioxide atmosphere	2.2.4.1	 Description Level Level Level
	Protection to corrosion - additional organic coating - type of coating - wire diameter with additional organic coating - thickness of additional organic coating - coating concentricity - coating integrity in double twist region of mesh - resistance of additional organic coating to ageing	2.2.4.2	 Description Level Level Level Level Level

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

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

2.2.1 Mechanical resistance to embedded load

2.2.1.1 Tensile resistance of gabion wall

2.2.1.1.1 Tensile resistance of mesh p_k [kN/m]

The mechanical resistance of double twisted mesh, used for gabion wall, in the direction parallel with the axis of twist is to be determined on three test specimens at least. The test procedure and its evaluation shall be in accordance with EN 10223-3, Cl. 6.6 and 9.3.

The test of tensile strength, elongation and diameter of wire of mesh according to 2.2.1.3 as complementary information are to be performed.

The individual values of tensile strength of mesh p_k [kN/m] are given in the ETA.

2.2.1.1.2 Tensile resistance of connection of mesh and selvedge wire $p_{k,edge}$ [kN/m]

The mechanical resistance of connection of mesh and selvedge wire of gabion wall in the direction perpendicular to the axis of twists is to be determined on three test specimens at least. The test procedure shall be in accordance with EN 10223-3, Cl. 9.3, details of test are given in Annex D.

The tests of tensile strength, elongation and diameter of wire of mesh and selvedge wire according to 2.2.1.3 as complementary information are to be performed.

The individual values of tensile strength of connection of mesh and selvedge wire $p_{k,edge}$ [kN/m] with description of tested type of connection of mesh and selvedge wire are given in the ETA.

2.2.1.2 Resistance to opening of gabion connection components F_m [kN]

The resistance to opening of gabion C-ring F_m [kN] or similar type of connection components is to be determined according to EAD 200086-00-0602, Annex A. and measured on 5 test specimens at least.

Following characteristics are given in the ETA separately:

- features of resistance to opening of gabion C-ring or similar type of connection components:
  - the individual tested values F_m [kN],
  - characteristic value F_k [kN], calculated according to EAD 200086-00-0602, Cl. 2.2.2
  - if manufacturer applies for, design value F_d [kN], calculated according to EN 1990, Annex D, Cl. D.7.3, with design value of conversion factor η_d = 0,8, taking into account effects of corrosion, micro cracking during gripping and position of C-ring on uneven edge of gabion wall.

2.2.1.3 Tensile strength, elongation and diameter of wire

The diameter D_w [mm], tensile strength $f_{t,c}$ [N/mm^2] and the elongation ε [%] of gabion wall connection components and meshes made from wire is to be determined according to EN 10218-1, Cl. 3 and EN ISO 6892-1, Cl. 3.10.1 and Cl. 19 on five test specimens at least.

Following characteristics are given in the ETA separately:

- the individual tested values of diameter D_w [mm], tensile strength $f_{t,c}$ [N/mm^2] and of elongation ε [%] of:
  - wire of mesh used for tests,
  - selvedge wire used for tests,
  - wire of connection components used for tests.

2.2.2 Content, emission and/or release of dangerous substances

The performance of the product related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer[3], after identifying the release scenarios (in accordance with EOTA TR 034:2015) taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market. Purely inorganic materials (e.g. boards, adhesives) do not have to be tested.

The identified intended release scenarios for this product (mesh / wire with additional organic coating only) and intended use with respect to dangerous substances are:

- S/W1: Product with direct contact to soil-, ground- and surface water.

The leaching of dangerous substances therefore has to be checked.

2.2.2.1 Leachable substances

For the intended use covered by the release scenario S/W1 the performance of the organic coating of wire, if organic coating is used, concerning leachable substances is to be assessed. A leaching test with subsequent eluate analysis must take place, each in duplicate. Leaching tests of the organic coating of wire are conducted according to CEN/TS 16637-2:2014 for scenario I according to Annex A, Cl. A.1. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area shall be (80 ± 10) l/m².

The each test specimen to be tested shall be prepared by cutting off the piece of finally organic coated wire of length *l* [mm] calculated according to equation:

$$l = \frac{40000}{\pi \times {D_c}^2}$$

where l cut off length of organic coated wire in mm

D_c wire diameter with organic coating according to 2.2.4.2 in mm.

After that, cut off pieces of organic coated wire are wound into a coil of diameter suitable for following preparation of eluates.

In eluates of "6 hours" and "64 days", the following biological tests shall be conducted:

- Acute toxicity test with Daphnia magna Straus according to EN ISO 6341
- Toxicity test with algae according to ISO 15799
- Luminescent bacteria test according to EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3

For each biological test, EC20-values shall be determined for dilution ratios 1:2, 1:4, 1:6, 1:8 and 1:16.

If the parameter TOC is higher than 10 mg/l, the following biological tests shall be conducted with the eluates of "6 hours" and "64 days" eluates:

- Biological degradation according to OECD Test Guideline 301 part A, B or E.

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3 The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011). The manufacturer is **not** obliged:
- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

- Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

Determined toxicity in biological tests shall be expressed as EC20-values for each dilution ratio. Maximum determined biological degradability must be expressed as "…% within …hours/days". The respective test methods for analysis shall be specified.

2.2.3 Dimensions

Following dimensions of the product and partial components are specified:

2.2.3.1 Dimensions of gabion boxes, mattresses and sack gabions

The dimensions of gabion boxes, mattresses and sack gabions shall be measured on three test specimens at least for each type of product in accordance with Annex C.

The individual values of the product dimensions (length, width, height and/or diameter) are given in the ETA.

2.2.3.2 Mesh size

The mesh size *M* [mm] shall be measured according to EN 10223-3, Cl. 3.1 in millimetres as integer on three test specimens at least. The mesh designation in relation to the mesh wire and selvedge and end wire (if relevant) diameter shall be checked.

The individual tested values and two-sided confidence interval at the confidence level 95 % according to ISO 2602, Cl. 6.2 for each mesh dimension separately are given in the ETA.

2.2.3.3 Connection components, selvedge and edge wires

The diameter of wire of connection components (and their length if relevant), selvedge and edge wires of diaphragm shall be measured according to EN 10218-2, Cl. 4.1 on 5 test specimens at least for each type of connection components, selvedge and edge wires.

To take into account provision of EN 10223-3, Cl. 6.2, 6.8 and 6.9, TAB should inform manufacturer on test results.

The individual tested values of the diameter of wire for connection components (and their length if relevant), selvedge and edge wires of diaphragm are given in the ETA.

2.2.4 Protection to corrosion

2.2.4.1 Non-ferrous metallic coating

The type of zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating with or without additional organic coating shall be expressed in the ETA.

Manufacturer can be asked by different users to express corrosion protection in different way according to user's convention.

The corrosion protection is to be determined by method(s) mentioned below according to manufacturers' specification by testing one or more of following characteristics:

- Zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating mass on wires [g/m^2] (mesh wire or other connection components) shall be measured in accordance with EN 10244-2, Cl. 5.2.2 on three test specimens at least and expressed according to EN 10244-1, Cl. 4.2.

- Thickness of zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating on wires [µm] (mesh wire or other connection components) shall be measured in accordance with EN ISO 1463 and expressed according to EN 10244-1, Cl. 4.2, on three test specimens at least.

- Neutral salt spray (NSS) test on one mesh sample at least, carried out according to EN ISO 9227, method NSS for:

    - 1000 hours for products with zinc coating or zinc coating + additional organic coating;

- 1000 hours for products with Zn95/Al5 alloy coating or Zn90/Al10 alloy coating + additional organic coating;
- 2000 hours for Zn90/Al10 alloy coating or Zn90/Al10 alloy coating + additional organic coating;
- 2000 hours for non-ferrous advanced metallic coating or non-ferrous advanced metallic coating + additional organic coating.

- Test in sulphur dioxide atmosphere on one mesh sample at least, carried out according to EN ISO 6988 for:
  - 28 test cycles for products with Zn95/Al5 alloy coating or Zn95/Al5 alloy coating + additional organic coating;
  - 56 cycles for Zn90/Al10 alloy coating or Zn90/Al10 alloy coating + additional organic coating;
  - 56 cycles for non-ferrous advanced metallic coating or non-ferrous advanced metallic coating + additional organic coating.

Following characteristics according to method(s) specified by manufacturer are given in the ETA:

- Mass and/or thickness of zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating in [g/m^2] and presence of additional organic coating (if relevant), and/or
- The number of hours and presence and quantity (%) of DBR (Dark Brown Rust) after exposure in neutral salt spray according to type of zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating, and/or
- The number of test cycles and presence and quantity (%) of DBR (Dark Brown Rust) after exposure in sulphur dioxide atmosphere according to type of zinc-aluminium-alloy- or non-ferrous advanced metallic coating, both with or without additional organic coating.

When stainless steel wire according to EN 10223-3, Cl. 5.2 is used for gabion C-ring, it shall be given in the ETA.

2.2.4.2 Additional organic coating

The type of additional organic coating shall be expressed in ETA if relevant. The additional organic coating can contribute to the working life of the product and therefore, if it is used, assessment of its durability is considered. Possible coatings are: PVC in accordance with EN 10245-2, PE in accordance with EN 10245-3, PA6 in accordance with EN 10245-5.

The corrosion protection is to be determined by method(s) mentioned below according to manufacturers' specification by testing one or more of relevant characteristics on 3 test specimens at least according to following table:

Performance	**Material of additional organic coating**		
	PVC	**PE**	**PA6**
Wire diameter with additional organic coating D_c [mm]	EN 10245-1, Cl. 5.3.4.2		
Thickness of additional organic coating in [mm]	EN 10245-1, Cl. 5.3.4.2		
Coating concentricity in [%]	EN 10245-1, Cl. 5.3.4.2		
Coating integrity in double twist region of mesh	Annex A, Cl. A.5		
Resistance of additional organic coating to ageing	EN 10223-3, Cl. 6.7.3 (ageing according to EN ISO 4892-2, 4000 hours of xenon arc lamp, test of tensile		

	strength according to EN 10245-1, Cl. 4.3.5, and EN ISO 527-1,-2)

Coating integrity in double twist region of mesh is to be verified by test at 50 % of the nominal value of tensile strength of the mesh (see 1.3.6) as defined in EN 10223-3, Cl. 6.6.

Following characteristics are given in the ETA:

- Wire diameter with additional organic coating D_c [mm], type of additional organic coating and thickness of additional organic coating in [mm],
- Coating concentricity in [%],
- Coating integrity in [kN/m],
- Resistance of additional organic coating as relationship of retained and initial tensile strength and elongation of polymer coating itself expressed in % of change of initial tensile strength.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision [98/214/EC(EU)]

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 2.

Table 2: 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
Factory production control (FPC) including testing of samples taken at the factory in accordance with a prescribed test plan					
1	**Wire:** Tensile strength, elongation, diameter	EN 10218-1	EN 10223-3	3 / each diameter	1 / production day
2	**Metallic coating of wire:** Type of coating Outer diameter Adherence by wrapping test Visual control Coating thickness or mass Neutral salt spray test Sulphur dioxide test	EN 1179, EN 12441-1 EN 10218-2 ISO 7802 Control plan EN 10244-2 EN ISO 9227 EN ISO 6988	EN 1179, ISO 7989-2 ASTM B 750 EN 10218-2 ISO 7802 Control plan EN 10223-3 EN 10244-2 EN 10223-3 EN 10223-3	1 / batch 3 / each diameter 1 / each diameter 1 1 1 / each diameter 1 / each diameter	every batch 1 / production day every batch 1 / production day 1 / production day 1 / 2 years 1 / 2 years
3	**Organic coating of wire:** Type of coating Outer diameter Visual control Thickness/concentricity Leachable substances Resistance of additional organic coating to ageing	EN 10245 EN 10218-2 EN 10245-1 EN 10245-1 CEN/TS 16637-2 EN ISO 4892-2, EN 10245-1, EN ISO 527-1,-2	Control plan EN 10218-2 Control plan EN 10218-2 Control plan Control plan EN 10223-3	batch of raw material 3 / each diameter 1 / each diameter 3 1 1 / each type of organic coating	every batch 2 / production day 2 / production day 2 / production day 1 / 5 years 1 / 2 years
4	**Mesh:** Mesh dimensions, mesh size Tensile resistance of mesh Tensile resistance of connection of mesh and selvedge wire	2.2.2.2 2.2.1.1.1 2.2.1.1.2	Control plan Control plan Control plan	1 / type 3 / type 3 / type	1 / production day 2 / year 2 / year
5	**Gabion boxes, gabion mattresses, sack gabions:** Product dimensions Connection component dimensions	2.2.2.1 2.2.2.3	Control plan Control plan	1 / type 1 / type	1 / production day 1 / production day

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
	Coating integrity Resistance to opening of gabion connection components	2.2.3.2 2.2.1.2	Control plan Control plan	1 / type 5 / type	1 / year 1 / year

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 hexagonal woven mesh gabion boxes, mattresses and sack gabions with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating, are laid down in Table 3.

Table 3: 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
Initial inspection of the manufacturing plant and of factory production control					
1	Ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the hexagonal woven mesh gabion boxes, mattresses and sack gabions with zinc- or zinc-aluminium-alloy- or non-ferrous advanced metallic coating, all with or without additional organic coating	Laid down in control plan, see Cl. 3.2 and related characteristic in Cl. 2.1 of this EAD			1
Continuing surveillance, assessment and evaluation of factory production control					
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, see Cl. 3.2 and related characteristic in Cl. 2.1 of this EAD			1/year

4 REFERENCE DOCUMENTS

EN 1179:2003	Zinc and zinc alloys – Primary zinc
EN 1990:2002/A1:2005/AC:2010-04	Eurocode: Basis of Structural Design
EN 1997-1:2004/A1:2013	Eurocode 7: Geotechnical design - Part 1: General rules
EN 10218-1:2012	Steel wire and wire products. General. Part 1: Test methods
EN 10218-2:2012	Steel wire and wire products. General. Part 2: Wire dimensions and tolerances
EN 10223-3:2013	Steel wire and wire products for fencing and netting - Part 3: Hexagonal steel wire mesh products for civil engineering purposes
EN 10244-1:2009	Steel wire and wire products. Non-ferrous metallic coatings on steel wire - Part 1: General principles
EN 10244-2:2009	Steel wire and wire products. Non-ferrous metallic coatings on steel wire - Part 2: Zinc or zinc alloy coatings
EN 10245-1:2011	Steel wire and wire products. Organic coatings on steel wire. Part 1: General rules
EN 10245-2:2011	Steel wire and wire products. Organic coatings on steel wire. Part 2: PVC finished wire
EN 10245-3:2011	Steel wire and wire products - Organic coatings on steel wire - Part 3: PE coated wire
EN 10245-5:2011	Steel wire and wire products. Organic coatings on steel wire. Part 5: Polyamide coated wire
EN 12440:2017	Natural stone – Denomination criteria
EN ISO 527-1:2012	Plastics - Determination of tensile properties - Part 1: General principles
EN ISO 527-2:2012	Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics
EN ISO 1463:2004	Metallic and oxide coatings - Measurement of coating thickness - Microscopical method
EN ISO 4892-2:2013	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps
EN ISO 6341:2012	Water quality - Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea) - Acute toxicity test
EN ISO 6892-1:2016	Metallic materials - Tensile testing - Part 1: Method of test at room temperature
EN ISO 6988:1994	Metallic and other non-organic coatings. Sulphur dioxide test with general condensation of moisture
EN ISO 7500-1:2018	Metallic materials. Calibration and verification of static uniaxial testing machines. Part 1: Tension/compression testing machines. Calibration and verification of the force measuring system
EN ISO 9223:2012	Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation
EN ISO 9224:2012	Corrosion of metals and alloys – Corrosivity of atmospheres – Guiding values for the corrosivity categories
EN ISO 9227:2017	Corrosion tests in artificial atmospheres - Salt spray tests
EN ISO 11348-1:2008	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) - Part 1: Method using freshly prepared bacteria

EN ISO 11348-2:2008	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) - Part 2: Method using liquid-dried bacteria
EN ISO 11348-3:2008	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) - Part 3: Method using freeze-dried bacteria
ISO 2602:1980	Statistical interpretation of test results. Estimation of the mean. Confidence interval
ISO 78022013	Metallic materials – Wire – Wrapping test
ISO 7989-2:2007	Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 2: Zinc or zinc-alloy coating
ISO 15799:2003	Soil quality - Guidance on the ecotoxicological characterization of soils and soil materials
CEN/TS 16637-2:2014	Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test
OECD Test Guideline 301:1992	Ready biodegradability, part A, B or E
ASTM B 750:2016	Standard Specification for GALFAN (Zinc-5% Aluminium-Mischmetal) Alloy in Ingot Form for Hot-Dip Coatings
EOTA TR 034:2015	General BWR3 Checklist for EADs/ETAs Dangerous substances
EAD 200039-00-0102:2016	Hexagonal woven mesh and gabion boxes and mattresses with zinc coatings
EAD 200086-00-0602:2017	Wire ring connection products

ANNEX A – INTEGRITY OF ORGANIC COATING ON WIRES OF DOUBLE TWISTED MESH

A.1 Scope

The aim of this test is to show the integrity of organic coating on the wires when the net is loaded by tension.

A.2 Terms and definitions

For the purposes mentioned above the following symbols and definitions are applied:

Panel: Element made of double twisted net prepared for the longitudinal tensile test with a minimum width equal to 8 times the size of the single mesh and a length allowing a distance between the equipment grip tools equal to a complete mesh length.

Sample: The sample for integrity evaluation of the polymer coating inside the double twists of the net is created by the twists in the middle part of the panel.

A.3 Sampling

Panel of double twist wire mesh made of organic coated wire according to EN 10223-3, Cl. 9 and Fig. 11 to Fig. 14 in order to perform the longitudinal tensile test is to be prepared.

Each panel sample is subjected to tensile strength test according to EN 10223-3, Cl. 9.3.3, up to 50 % of the nominal tensile strength values.

For each tensioned panel the double twist regions are to be verified (see EN 10223-3, Cl. 3.4).

From each sample, the wires in the double twist shall be cut around 10 cm long, corresponding to panel central twists as highlighted by marks in Fig. A.1.

A.4 Test arrangement

The upper and lower ends of the net sample are used to hang it to the supports of the traction machine during the tensioning and therefore they cannot be used to evaluate for the outcome of the test.

Each sample's effective width is made of a fixed number of wires in relation to the mesh type:

n × 16 wire sections for 10 x 12 mesh type

n × 16 wire sections for 8 x 10 mesh type

n × 20 wire sections for 6 x 8 mesh type

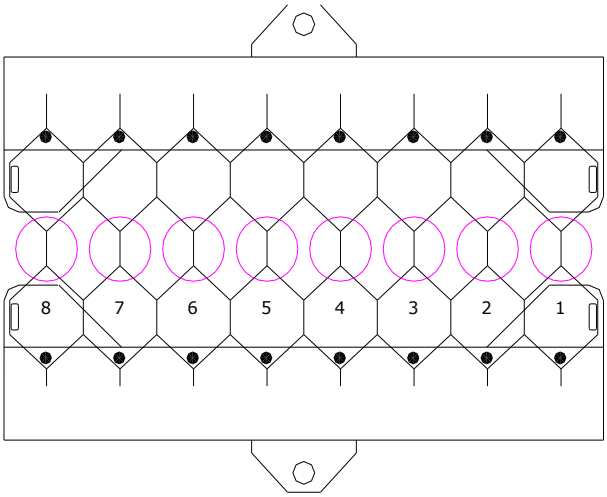

Figure A.1 – Example of sample for 10 x 12 mesh type

A.5 Evaluation of test results

For each sample visual inspection of integrity of organic coating is carried out for each wire portion in correspondence with the double twists.

Damage is to be classified into 4 categories according to EAD 200039-00-0102:

Category 1: General abrasion

Abrasion means the condition of the organic coating where the wire inside the twists has left an imprint that does not let the underlying steel wire visible.

Category 2: Splits

Split means a region of wire in which the organic coating is locally cut and raised and so the underlying steel wire can be visible.

Category 3: Cuts

Cut means a region of the wire clearly cut where organic strips are still in contact.

Category 4: Bruises

Bruise means a wire region where organic coating is pressed and the underlying steel wire can visible.

If the mesh made from organic coated wire when tested in tensile test, shows cracks in the organic coating within the double twists region at 50 % of the nominal values of tensile strength of mesh (whenever the underlying steel wire is clearly visible), the integrity of organic coating is considered to be broken.

To take into account provision of EN 10223-3, Cl. 6.6, in such situation laboratory should inform manufacturer on test result.

A.6 Test Report

The test report shall include at least the following information:

- Name of laboratory and name of operator who performed the tests;
- Characteristics of the testing machine and its calibration certificate;
- Date of test;
- Identification of the tested panel and sample (supplier and material nature of the surface treatment, dimensions, etc.);
- Documentation of test by photographs;
- Results expressed by category and/or different categories in % to the tested overall length.

ANNEX B – RESISTANCE TO OPENING OF GABION C-RING (OR SIMILAR CONNECTION COMPONENTS)

The test procedure is revoked in version 01 and replaced by the identical test according to EAD 200086-00-0602 Wire ring connection products, Annex A, EOTA, October 2017.

ANNEX C – DIMENSIONS OF GABION BOXES, MATTRESSES AND SACK GABIONS

C.1 Scope

The aim of this test is to verify dimensions of gabion boxes, mattresses and sack gabions.

C.2 Test Specimen

The test specimen is the closed gabion box, mattresses or sack gabion itself.

C.3 Test equipment

The test is to be performed by using slide gauge with accuracy 1 mm.

C.4 Number of samples

For determination of dimensions at least 3 samples for each type of gabion box, mattress or sack gabion shall be tested.

C.5 Test procedure

Three measurements of each dimension of relevant part of gabion box and/or mattresses (i.e. walls, bottom, and diaphragm) expressed as height *H* [mm], length *L* [mm] and/or width *W* [mm] on each test specimen shall be performed in accordance with EN 10223-3 Fig. 3, 4 and 5.

Diameter *D* [mm] of sack gabion is to be determined by five measurements of cross-section width [mm] of external edges of tightly wrapped product, uniformly located on its length, and than by calculation from average value of these results according to basic mathematic equation for circle circumference.

C.6 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 gabion boxes, mattress or sack gabion (supplier and material nature of the surface treatment, dimensions, etc.);
- The date of test and results (individual tested values, mean)

ANNEX D – TEST OF TENSILE RESISTANCE OF CONNECTION OF MESH AND SELVEDGE WIRE

D.1 Scope

The aim of this test is to determine mechanical resistance of connection between mesh and selvedge wire of gabion wall in the direction perpendicular to the axis of twist.

D.2 Sampling

The test specimen consisting of set of two jointed identical rectangular parts of gabion wall, jointed by properly installed wire fasteners along the two selvedge wires, with a width about 11 mesh openings along a selvedge wire, shall be cut. Each fastener in test specimen confines two selvedge and two mesh wires.

If the fasteners are also to be used to join two individual empty gabion baskets, two additional selvedge wires that are each mechanically wrapped with mesh wires shall be included so that each fastener confines four selvedge and four mesh wires.

A properly installed fastener shall meet the following requirements:

- Each interlocking fastener type shall be in a locked and closed position;
- Each overlapping fastener type shall be closed and the free ends of the fastener shall overlap a minimum of 25 mm.

D.3 Test arrangement

The width (see Fig. D.1) of test specimen (see Fig. D.1) is to be measured, when fixed in test device, in millimetres.

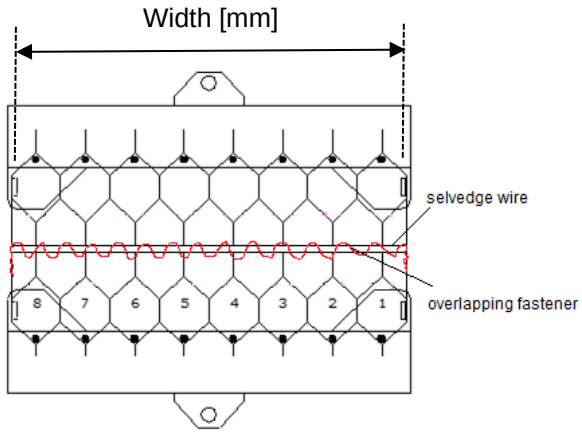

Figure D.1 – Width of test specimen

The test specimen secured in test device with grips or clamps, such that the panels are uniformly secured along the full width as given in EN 10223-3, Cl. 9.3.3, is to be fixed to test machine. The grips or clamps can be designed to transmit tension forces only.

After fixing, the test specimen is tensioned by test load with a uniform rate not to exceed 220 N/s until failure occurs.

The failure loading in kN, description of failure and description of condition of connection between mesh and selvedge wire are to be recorded.

The failure is defined as when the maximum load is reached and a drop of strength is observed with subsequent loading or alternately the opening between any two closest selvedge wires, applicable to a fastener confining either two or four selvedge wires, becomes greater than 50 mm at any place along the panel width.

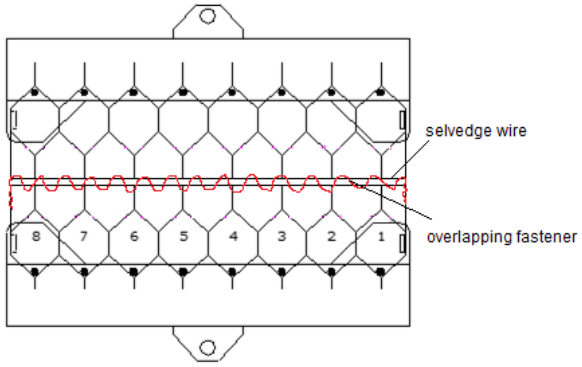

Figure D.2 – Test arrangement with overlapping fastener

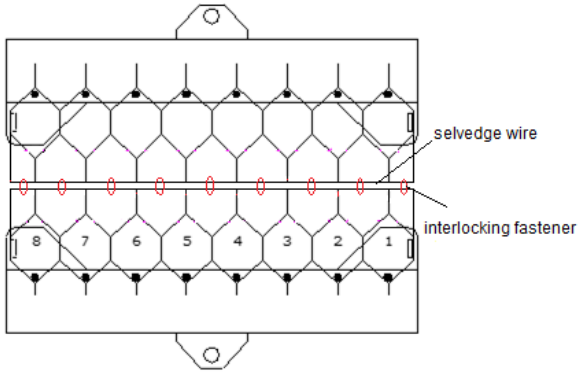

Figure D.3 – Test arrangement with interlocking fastener

Tensile resistance of connection of mesh and selvedge wire $p_{k,edge}$ [kN/m] is calculated according to EN 10223-3, Cl. 9.3.2 by the same procedure as tensile resistance of mesh.

D.4 Test Report

The test report shall include at least the following information:

- Name of laboratory and name of operator who performed the tests;
- Characteristics of the testing machine and its calibration certificate;
- Date of test;
- Identification of the tested panel and sample (supplier and material nature of the surface treatment, dimensions, etc.);
- Results of test, expressed as width of test specimen, failure loading, tensile resistance of connection of mesh and selvedge wire $p_{k,edge}$ [kN/m], description of type of failure and description of condition of connection between mesh and selvedge wire in failure;
- Documentation of test by photographs (if necessary).