EUROPEAN ASSESSMENT DOCUMENT

EAD 200026-00-0102

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STEEL MESH SYSTEMS FOR REINFORCED FILL

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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).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD covers:

- Steel reinforcement (double twisted wire mesh) with facing unit type I (Figure 1);
- Steel reinforcement (double twisted wire mesh) with facing unit type II (Figure 2);
- Steel reinforcement (double twisted wire mesh) with double side facing unit type II (Figure 3);
- Steel reinforcement (double twisted wire mesh) with facing unit type III (Figure 4);
- Double side reinforced fill system 90/90 in combination with facing unit type IV (Figure 5);
- Double side reinforced fill system 90/inclined in combination with facing unit type IV (Figure 6);
- Double side reinforced fill system inclined/inclined in combination with facing unit type IV (Figure 7).

The products are produced from components:

- Non–ferrous metallic coated (Zn/Al alloy) wires with organic coating extruded onto the metallic coated wire in hexagonal, double twisted wire mesh (reinforcement component);
- Non–ferrous metallic coated (Zn/Al alloy) wires with organic coating extruded onto the metallic coated wire and non–ferrous metallic coated ropes with organic coating inserted into hexagonal double twisted wire mesh in regular distances (Figure 8);
- Non-ferrous metallic coated (Zn/Al alloy) wires (or with organic coating) in welded wire panels (facing components in systems III and IV).

The connection components are as follow:

- Non–ferrous metallic coated wires with/or without organic coating extruded onto the metallic coated wire or stainless steel wires (lacing wires or rings).

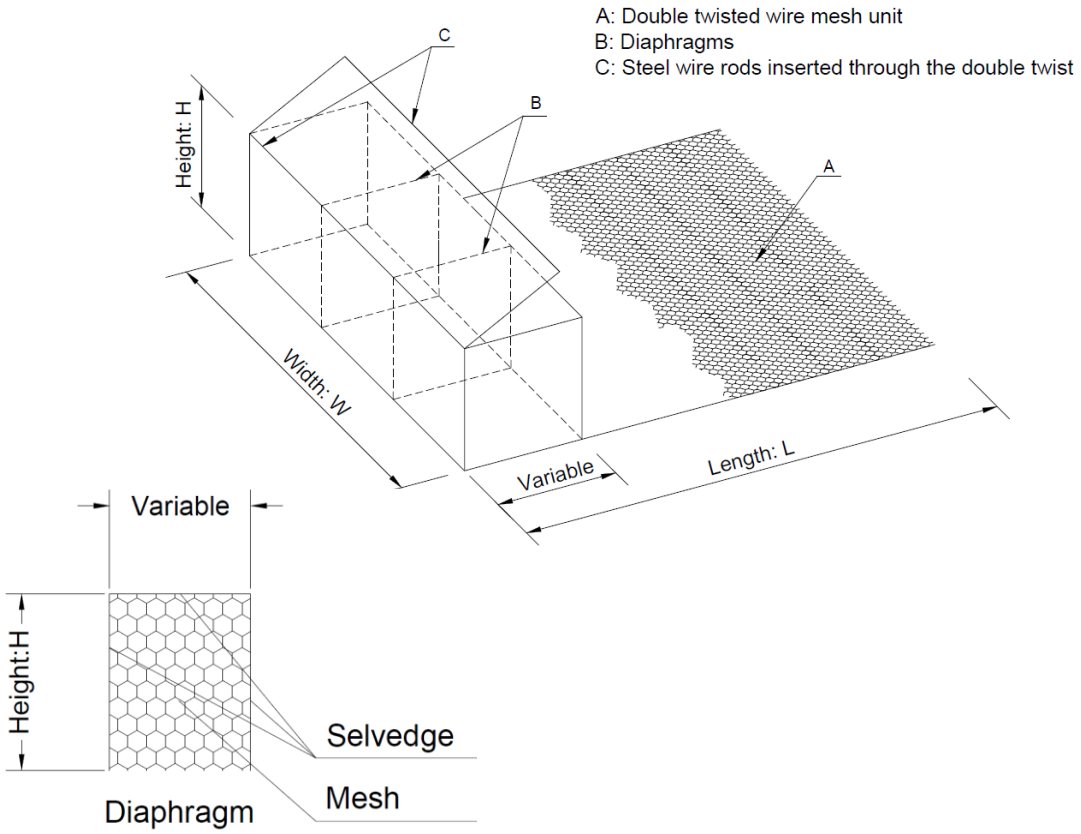


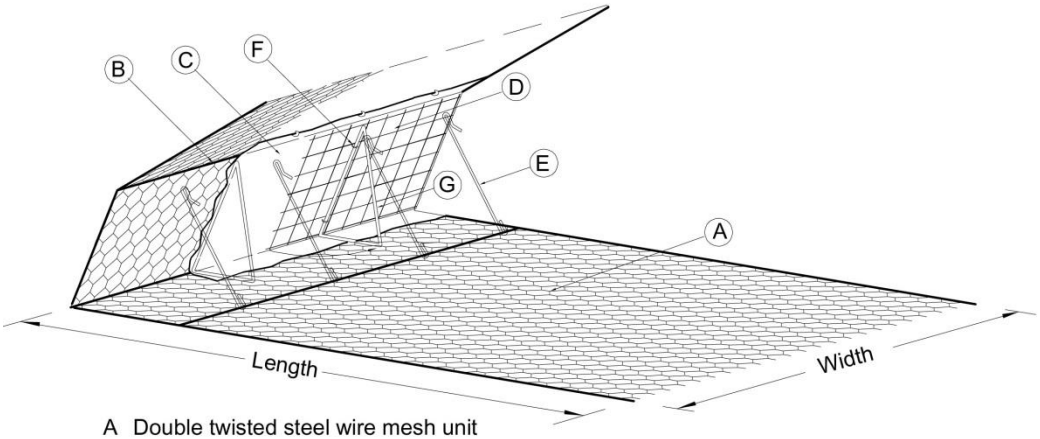
Figure 1 – Example of steel reinforcement with facing unit type I

The geosynthetics, geotextiles and biodegradable erosion control blankets are not covered by this EAD.

They shall be according to: EN 13249: 2000 + A1: 2005, EN 13250: 2000 + A1: 2005, EN 13251: 2000 + A1: 2005, EN 13252: 2000 + A1: 2005, EN 13253: 2000 + A1: 2005, EN 13254: 2000 + A1: 2005, EN 13255: 2000 + A1: 2005, EN 13257: 2000 + A1: 2005, EN 13265: 2000 + A1: 2005 or shall be biodegradable.

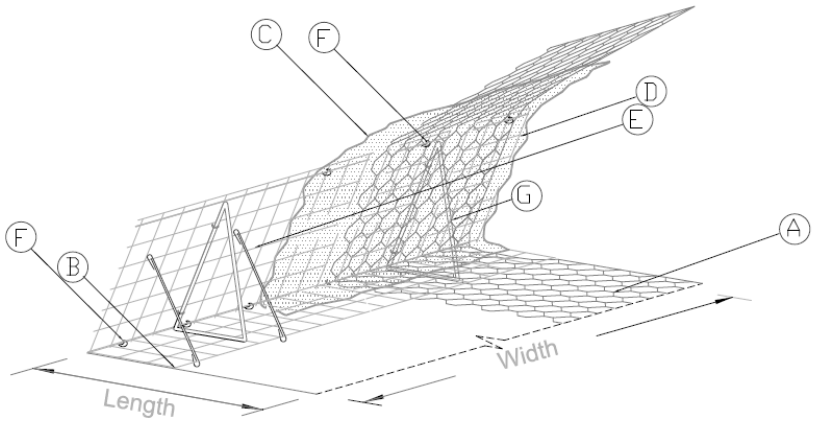
Welded panels (in facing unit type II), triangles and struts which serve as a formwork during construction, are not covered by this EAD.

The rectangular frame stiffeners, triangles and tie rods which serve as a formwork during construction of each system, are not covered by this EAD.



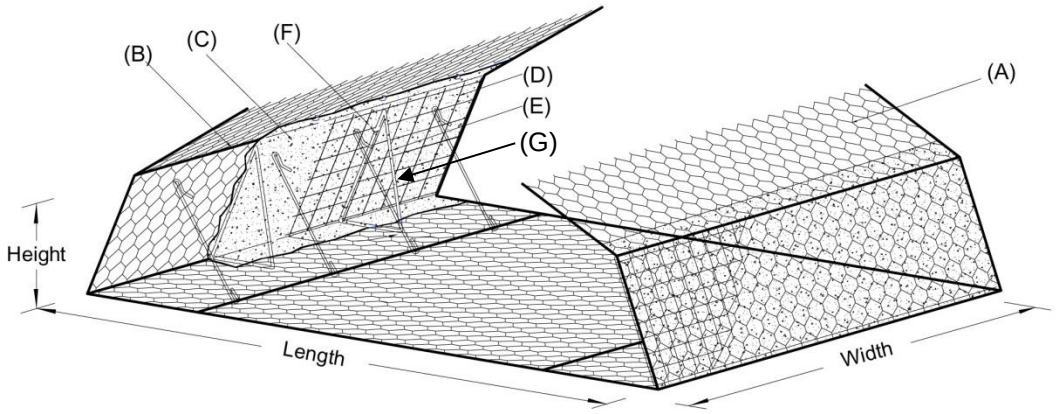
A Double twisted steel wire mesh unit
B Steel wire rods inserted through the double twist
C Erosion control blanket - *not covered by this EAD*
D Welded wire mesh panel - *not covered by this EAD*
E Tie rods - *not covered by this EAD*
F C-Rings
G Triangular steel brackets - *not covered by this EAD*

Figure 2a – Example of steel reinforcement with facing unit type II



A Double twisted steel wire mesh reinforcement
B Welded wire mesh base panel - *not covered by this EAD*
C Erosion control blanket - *not covered by this EAD*
D Welded wire mesh panel - *not covered by this EAD*
E Tie rods - *not covered by this EAD*
F C-Rings
G Triangular steel brackets - *not covered by this EAD*

Figure 2b – Example of steel reinforcement with facing unit type II – with external welded panel



A Double twisted hexagonal steel wire mesh
B Steel wire rod, inserted through the double twist
C Erosion control blanket - *not covered by this EAD*
D Welded wire mesh panel - *not covered by this EAD*
E Tie rods - *not covered by this EAD*
F C-Rings
G Triangular steel brackets - *not covered by this EAD*

Figure 3 – Example of steel reinforcement with double side facing unit type II

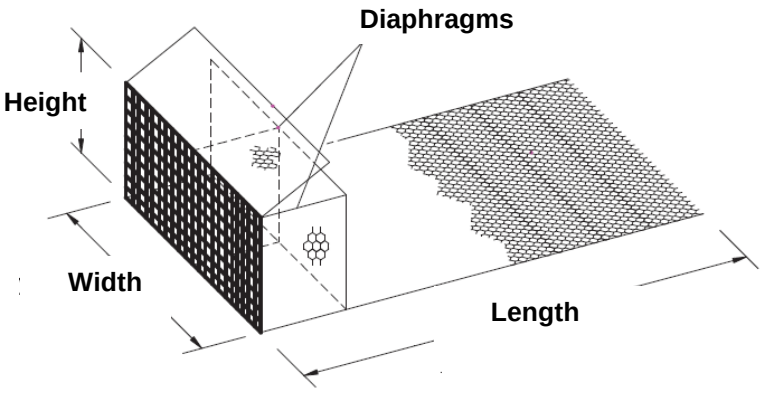
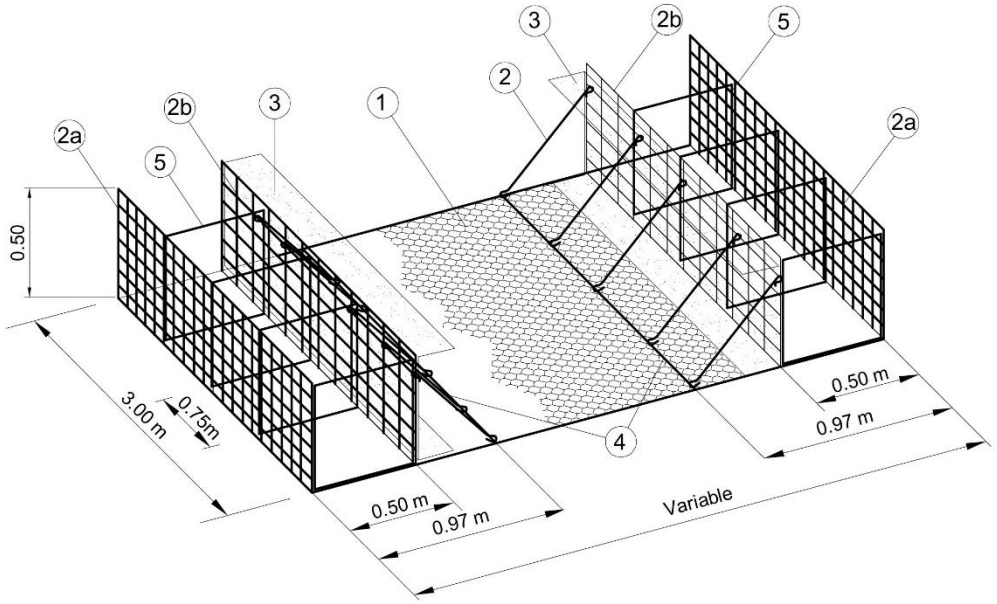
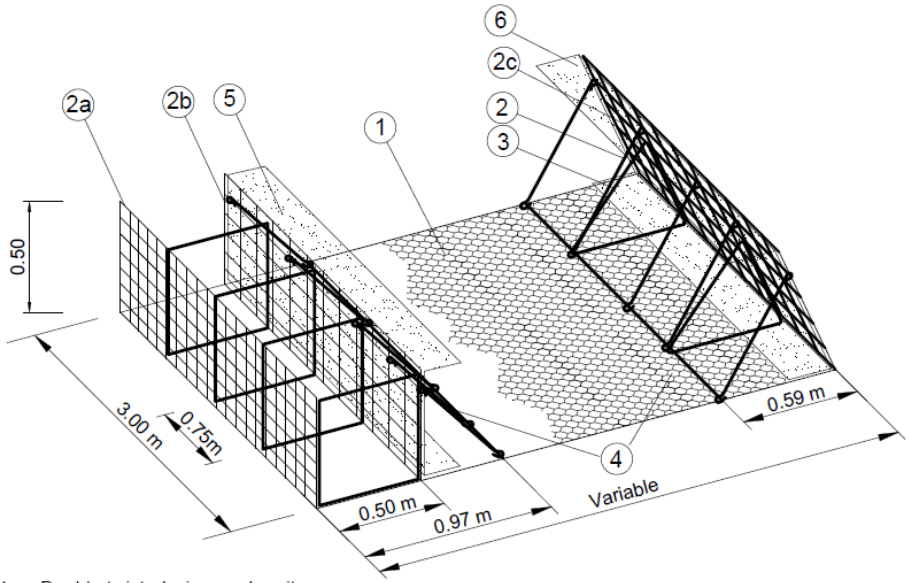


Figure 4 – Example of steel reinforcement system with facing unit type III



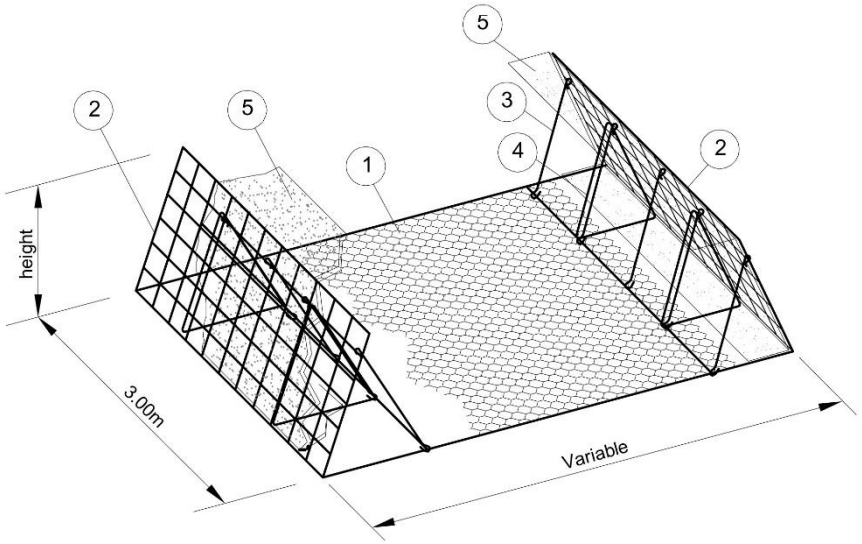
1 - Double twisted wire mesh unit
2a - Welded wire mesh panel 50x50mm, Ø 5.00 mm, Zn/Al alloy coated
2b - Welded wire mesh panel 100 x 90 mm, Ø 5.00 mm
2 - Tie rods - *not covered by this EAD*
3 - Non-woven geotextile - *not covered by this EAD*
4 - Steel rod through the double twist
5 - Rectangular steel brackets - *not covered by this EAD*

Figure 5 – Example of double side reinforced fill system 90/90: facing unit type IV



1 - Double twisted wire mesh unit
2a - Welded wire mesh panel 50x50mm, Ø 5.00 mm, Zn/Al alloy coated
2b - Welded wire mesh panel 100x90 mm, Ø 5.00 mm
2c - Welded wire mesh panel 90x83 mm, Ø 6.00 mm, Zn/Al alloy coated
2 - Tie rods - *not covered by this EAD*
3 - Triangular steel brackets - *not covered by this EAD*
4 - Steel rod through the double twist
5 - Non-woven geotextile - *not covered by this EAD*
6 - Erosion control blanket - *not covered by this EAD*

Figure 6 – Example of double side reinforced fill system 90/inclined: facing unit type IV



1 - Double twisted wire mesh unit
2 - Welded panel 90x83 mm, Ø 6.00 mm, Zn/Al alloy coated
3 - Tie rods - *not covered by this EAD*
4 - Triangular steel brackets - *not covered by this EAD*
5 - Erosion control blanket

Figure 7 – Example of double side reinforced fill system inclined/inclined: facing unit type IV

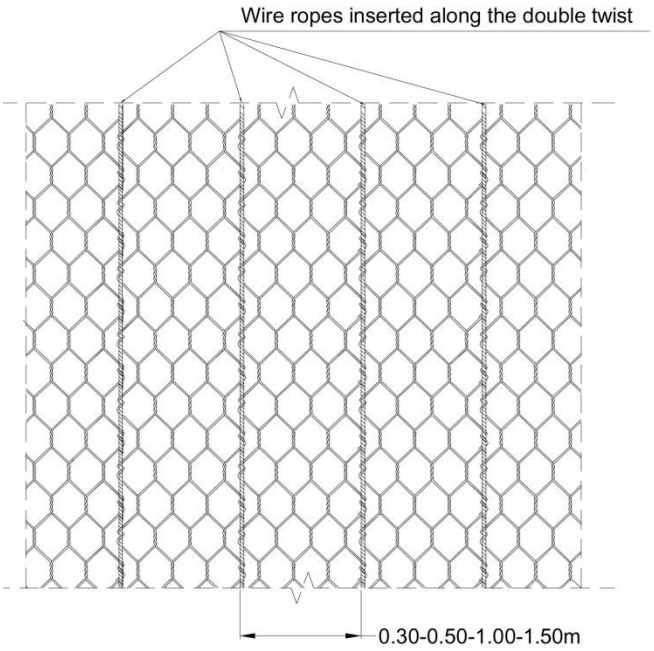


Figure 8 – Example of double twisted steel wire mesh reinforced with longitudinal steel wire ropes

The connection between the double twisted wire mesh panels is made with lacing wire (single-double loop), or with wire C-rings with a maximum distance of 200 mm (Figure 9).

The connection between the vertical welded panels and the steel brackets is made with wire C- rings.

The connection between the tie rods and double twisted wire mesh is realized through the inserted wire into the mesh to which the struts are connected directly.

The connection between the double twisted wire mesh and welded panels in facing units type IV are as follow:

- On the external vertical face by edge connection executed in factory (1) (Figure 11);
- On the external inclined face by edge connection executed in factory (1) (Figure 11);
- On the internal panels with wire rings (C-rings) in maximum distance of 200 mm.,

Note 1 – The wires of hexagonal double twisted wire mesh are directly woven into the wire of the welded panel.

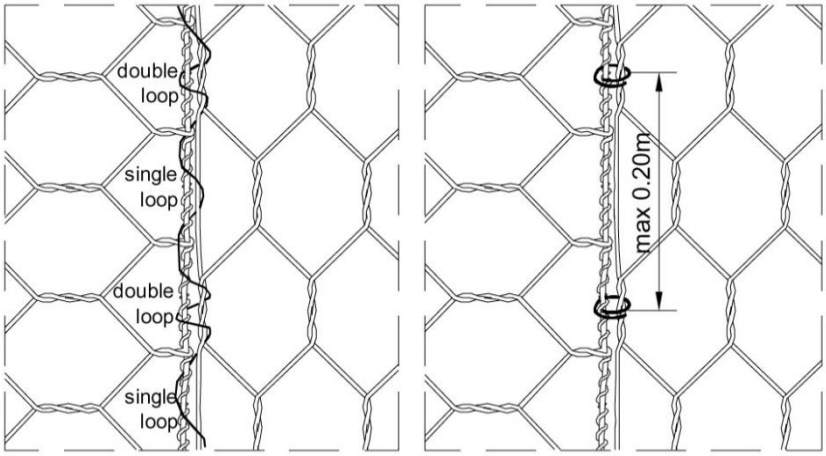


Figure 9 – Example of connection by lacing wire or by C-rings

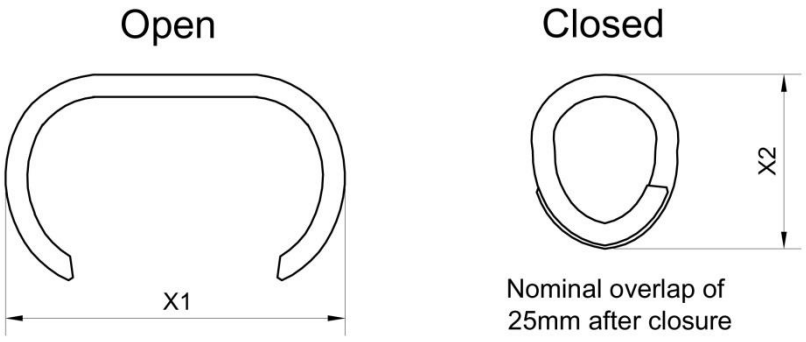


Figure 10 – Example of shape and dimensions of C-rings

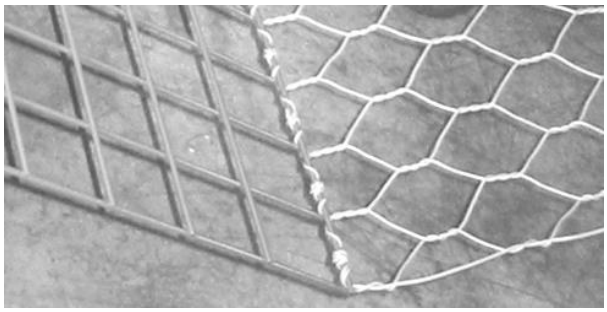


Figure 11 – Example of connection between reinforcement and external welded panels in facing units III and IV

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)

Steel mesh systems for reinforced fill made of hexagonal double twisted wire mesh and welded panels (if relevant) are intended to be used for:

- Earth retaining structures (vertical, battered or inclined walls, bridge abutments, bulk storage facilities) with a facing to retain fill placed between the reinforcing layers;
- Reinforced steep slopes with built –in deformable facing units;
- Self-standing embankments.

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 steel mesh systems for reinforced fill products for the intended use, in accordance with Annex A in EN 10223-3, in relation to different wire coating and corrosive categories (according to EN ISO 9223) of environment, when installed in the works when durability tests are performed according to cl. 2.2.12.1, 2.2.12.2 and 2.2.12.3 in this EAD, moreover

When tested according to 2.2.12.1:

for non-ferrous metallic coating Zn95/Al5 and Zn95/Al5 + organic coating the number of cycles is 28;

for non-ferrous metallic coating Zn90/Al10 and Zn90/Al10 + organic coating the number of cycles is 56;

for non-ferrous advanced metallic coating and non-ferrous advanced metallic coating + organic coating the number of cycles is 56;

When tested according to 2.2.12.2:

for non-ferrous metallic coating Zn95/Al5 and Zn95/Al5 + organic coating the number of hours in exposure is 1000;

for non-ferrous metallic coating Zn90/Al10 and Zn90/Al10 + organic coating the number of hours in exposure is 2000;

for non-ferrous advanced metallic coating and non-ferrous advanced metallic coating + organic coating the number of hours in exposure is 2000;

When tested according to 2.2.12.3:

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

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[1].

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

1.3.1 Reinforcing system unit

Facing System Unit is a combination of facing and reinforcement components used to produce a complete reinforced soil structure.

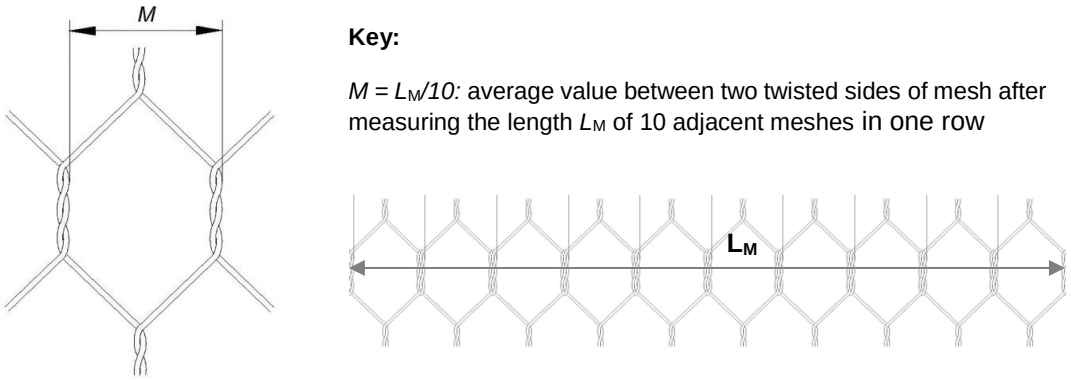
1.3.2 Steel wire mesh reinforcement

Steel wire mesh reinforcement is a generic term to describe horizontal reinforcing layers placed within a soil fill. Steel wire mesh reinforcement is in the form of double twisted hexagonal wire mesh or double twisted wire mesh with optional steel wire ropes, inserted longitudinally to the weave direction at regular distances (Figure 8).

1.3.3 Facing unit

Facing unit is the exposed external part of the reinforcing system unit which retains the fill between layers of reinforcement and protects the soil fill against erosion.

1.3.4 Mesh size



Key:

M = L_M/10: average value between two twisted sides of mesh after measuring the length L_M of 10 adjacent meshes in one row

Figure 12 – Mesh size

1.3.5 Mesh designation

Definition of double twisted mesh type related to typical dimension of mesh, for example 6x8, 8x10.

[1] 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.

1.3.6 Double twisted wire mesh reinforced with wire ropes

Mesh formed from steel wires and ropes, assembled during the production of double twisted wire mesh of variable sizes.

1.3.7 Lacing wire

Non-ferrous metallic-coated steel wire and/or with organic over-coating or stainless steel wire 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.

1.3.8 C-rings

Rings of C-shape made from high strength steel wire with non-ferrous metallic coating or stainless steel wire, used to connect the double twisted wire meshes together.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of steel mesh systems for reinforced fill 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 (level, class, description)
Basic Works Requirement 1: Mechanical resistance and stability			
1	Reinforcement mesh designation Reinforcement mesh size	2.2.1	M (mm)
2	Reinforcement, welded panel (facing units III and IV) and connection component wire diameter	2.2.2	D_w (mm)
3	Reinforcement, welded panel (facing units III and IV) and connection component wire tensile strength and elongation	2.2.3	f_t (N/mm^2) ε (%)
4	Rope characteristics: diameter designation wire tensile strength grade breaking force	2.2.4	D_r (mm) description (N/mm^2) (kN)
5	Inserted rope to rope distance in reinforcement Welded panel overall dimensions (facing units III and IV) Wire spacing in welded panels (facing units III and IV)	2.2.5	a, b (mm) L_p, W_p (m) and inclination (°) A_{hor}, A_{ver} (mm)
6	Corrosion protection: non-ferrous metallic coating (wire and rope) type class of coating mass	2.2.6	 description description
7	Additional corrosion protection: organic coating (wire and rope): type coating thickness and wire/rope diameter coating concentricity Organic coating in double twist region of reinforcement mesh: coating integrity	2.2.7	 description (mm) (%) description
8	Tensile resistance of mesh (reinforcement)	2.2.8	p_m (kN/m)
9	Punching resistance and deflection of mesh (reinforcement)	2.2.9	F_m (kN) δ_m (mm)
10	Weld shear strength of welded panels for facing units III and IV	2.2.10	(%)
11	C-ring (or similar fastener) resistance to opening	2.2.11	$F_{C,m}$ (kN)
12	Durability in artificial atmospheres sulphur dioxide neutral salt spray UV resistance of organic coating	2.2.12	 Number of cycles with surface DBR ≤ 5% (Number) Exposure time with surface DBR ≤ 5% surface (hours) % of retained tensile strength and elongation (%)

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

2.2.1 Reinforcement mesh designation, reinforcement mesh size *M* (in mm)

The mesh size *M* (in mm) shall be measured according to cl. 3.1 in EN 10223-3 (see also 1.3.2 in this EAD). The mesh size *M* shall be measured on at least three samples. The mesh designation in relation to the mesh wire and selvedge and end wire (if relevant) diameter shall be checked.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 2 in EN 10223-3.

2.2.2 Reinforcement, welded panel and connection component wire diameter D_w (in mm)

The diameter D_w (in mm) of mesh wire and welded panel (facing units III and IV) wire, connection wires, selvedge and end wires 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.

2.2.3 Reinforcement, welded panel and connection component wire tensile strength f_t (in N/mm²) and elongation ε (in %)

The tensile strength and elongation of mesh, welded panel (facing units III and IV) and connection components` wires and selvedge and end wires shall be verified according to cl. 3 in 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. 5.2 in EN 10223-3 for mesh, selvedge, edge and lacing wire, with cl. 6.9 in EN 10223-3 for connection component (C-ring) wire and with cl. 7.4 in EN 10223-8 for welded panel wire.

2.2.4 Rope characteristics: diameter D_r (in mm), designation, wire tensile strength grade (in N/mm²) and breaking force (in kN)

The rope diameter D_r (in mm) designation of rope according to EN 12385-2+A1, rope wire tensile strength grade (in N/mm²) according to EN 12385-4+A1, maximum breaking load (in kN) according to Table 5, EN 12385+A1 shall be verified by checking the inspection documents of incoming rope products and by additional checking according to the manufacturer`s control plan.

2.2.5 Product and connection component`s dimensions *a, b* (in mm), L_p, W_p, A_{hor}, A_{ver}

1) The nominal spacing – rope to rope centre distance *a, b* (in mm) - of inserted wire rope (Figure 8) in reinforcement shall be measured on at least three separate meshes. The rope distances shall be expressed in ETA.
2) The welded wire panel dimensions in facing unit types III and IV (wire spacing in both directions A_{hor} (in mm) and A_{ver} (in mm)), overall dimensions of panels L_p (in mm), W_p (in mm) shall be measured on at least three separate panels (within the reinforcing system unit). The nominal dimensions and tolerances on them shall be expressed in ETA.

2.2.6 Corrosion protection: non-ferrous metallic coating (wire and rope): type and class of coating mass

The type of non-ferrous metallic Zn/Al alloy coating on mesh wires and inserted rope wires (informative types are: Zn95/Al5, Zn90/Al10) and minimum coating mass on wires (in g/m²) shall be verified in accordance with cl. 5.2.2 in EN 10244-2. The adherence wrapping test on non-ferrous metallic coated mesh wires shall be carried out in accordance with cl. 6 in 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 coating type (Zn95/Al5, Zn90/Al10) and class of coating of inserted ropes shall be performed by checking the inspection documents of incoming wire products and by additional checking according to the manufacturer`s control plan.

When stainless steel wire is used for any component, it shall be given in ETA.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 1 and Table 2 in EN 10244-2 for Class A and/or in specific case for Class E (when PA6 additional organic coating is used) for mesh wire and according to Table 2 in EN 10264-1, class A or B, for inserted rope wires.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 1 and Table 2 in EN 10244-2 for Class A or class B for C-rings.

The TAB shall also inform the manufacturer about the comparison of test results with quality of adherence of coating tested according to cl.6, EN 10218-1 (wrapping test 0/5), scale 2 (Figure 1, EN 10244-2).

2.2.7 Additional corrosion protection: organic coating

2.2.7.1 Organic coating on wire: type, coating thickness and wire/rope diameter, coating concentricity

The diameter (in mm) and coating thickness of organic coated reinforcement and welded panel (facing unit III and IV) wires (possible types of organic coating are: PVC in accordance with EN 10245-2, PE in accordance with EN 10245-3, PA6 in accordance with EN 10245-5) together with concentricity (in %) shall be verified in accordance with cl. 5.2.4 in EN 10245-1. The verification shall be carried out by checking the inspection documents of incoming wire products used to produce the reinforcement and on samples taken from the welded panels and also by additional checking according to the manufacturer`s control plan.

The diameter and coating thickness on ropes shall be verified (and given in ETA) by checking the inspection documents of incoming rope products.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with cl. 6.5 in EN 10223-3 and Table 2 in EN 10218-2.

2.2.7.2 Organic coating in double twist region of mesh: coating integrity

Coating integrity in double twist region of mesh (without inserted ropes) tested according to Annex A in this EAD shall be verified at 50 % of mean value of tensile strength of mesh (without inserted ropes) as defined in Clause 2.2.8 in this EAD.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with cl. 6.6 in EN 10223-3.

2.2.8 Tensile resistance of mesh p_m (in kN/m)

The mechanical resistance of double twisted wire mesh is determined by mean value of tensile strength p_m (in kN/m) and its tolerance corresponding to 95% level of confidence of mesh in the direction parallel with the axis of twist shall be calculated from at least three test results. For mesh size/wire diameter configuration the mean value of tensile strength and its tolerance shall be recorded in ETA. The test procedure for mesh not reinforced with ropes is in accordance with cl. 9 in EN 10223-3. The test procedure for mesh reinforced with ropes is according to Annex B in this EAD. If any type of reinforced mesh (mesh with inserted rope) has not been tested, the mean value of tensile strength p_m (in kN/m) can be defined as for the not reinforced mesh of the same type (mesh size/diameter of wire).

2.2.9 Punching resistance of mesh F_m (in kN) and deflection δ_m (in mm)

The mean value of punching resistance F_m (in kN) and mean value of deflection δ_m (in mm) (tested according to Annex B in ISO/FDIS 17746) of double twisted wire mesh and their tolerances corresponding to 95% level of confidence shall be calculated from at least three test results and shall be recorded in ETA. If any type of reinforced mesh (mesh with inserted rope) has not been tested, the punching resistance F_m (in kN) and mean value of deflection δ_m (in mm) can be defined as for the not reinforced mesh of the same type (mesh size/diameter of wire).

2.2.10 Weld shear strength of welded panels (in %)

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.

2.2.11 C-ring (or similar fastener) resistance to opening $F_{C,m}$ (in kN)

The mean resistance to opening (measured on minimum of 5 samples) $F_{C,m}$ (in kN) of C-ring when tested in accordance with Annex C 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).

2.2.12 Durability

2.2.12.1 Sulphur dioxide test with general condensation of moisture of Zn/Al alloy coated mesh samples

Sulphur dioxide test with discontinuous exposure on reinforcement and facing unit welded panels (facing units III and external panels in facing units IV), when relevant, samples shall be carried out according to cl. 6.7.1 and cl. 6.7.2 in EN 10223-3. For Zn/Al alloy and Zn/Al alloy + organic coating or equivalent advanced coated mesh samples, the number of cycles of discontinuous exposure after which each mesh sample does not show more than 5% of DBR (Dark Brown Rust) shall be given in ETA. For Zn/Al + organic coated mesh samples the permeated rust shall be evaluated without removing the organic coating.

2.2.12.2 Neutral salt spray test with general condensation of moisture of Zn/Al alloy coated mesh samples

Neutral salt spray (NSS) test on reinforcement and facing unit welded panels (facing units III and external panels in facing units IV), samples shall be carried out according to cl. 6.7.1 and cl. 6.7.2 in EN 10223-3. For Zn/Al alloy and Zn/Al alloy + organic coating or equivalent advanced coated mesh samples, the number of hours of exposure after which each mesh sample does not show more than 5% of DBR (Dark Brown Rust) shall be given in ETA. For Zn/Al + organic coated mesh samples the permeated rust shall be evaluated without removing the organic coating.

2.2.12.3 UV resistance tests on organic coating material

The raw organic material durability shall be demonstrated by method of exposition according to cl. 6.7.3 in EN 10223-3. The average relationship of initial and retained tensile strength and elongation in % resulting calculated from at least three samples shall be given in ETA.

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 1998/214/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 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)**					
Manufacturer`s production					
1	**Product:** Mesh dimensions, mesh size Welded panel dimensions Connection component dimensions Coating integrity Tensile resistance of mesh Weld shear strength Opening resistance of connection components Sulphur dioxide test Neutral salt spray test UV resistance	. 2.2.1 2.2.5 2.2.5 2.2.7.2 2.2.8 2.2.10 2.2.11 2.2.12.1 2.2.12.2 2.2.12.3	 2.2.1 2.2.5 2.2.5 2.2.7.2 2.2.8 2.2.10 2.2.11 2.2.12.1 2.2.12.2 2.2.12.3	 1 sample / type 1 sample / type 1 sample / type 1 samples / type 3 samples / type 1 set of samples (4 pcs.) / type 5 samples 1 sample / mesh type and wire diameter 1 sample / mesh type and wire diameter According to control plan	 1 / day 1 / day 1 / day 1 / year 2 / year 1 / year 1 / year 1 / 2 years 1 / 2 years 1 / 2 years
Incoming product					
2	**Wire chemical composition:** For welded panel wire	Manufacturer`s technical file for prescribed weldability (C_{ev})	Manufacturer`s technical file	Inspection certificate of supplier, type 3.1 EN 10204	
3	**Metallic coated wire:** Outer diameter Adhesion Coating type and mass	 2.2.2 2.2.2 2.2.6		Inspection certificate of supplier, type 3.1 EN 10204 In addition 1 / each diameter	 Every shipment
4	**Rope characteristics:** Designation Wire tensile strength grade Non-ferrous metallic coating type and mass Breaking force	 2.2.4 2.2.4 2.2.4 2.2.4		Inspection certificate of supplier, type 3.1 EN 10204 In addition 3 / each diameter	 1 / year

5	**Organic coated wire:** Outer diameter Thickness/concentricity Organic coated rope: Outer diameter Visual Coating thickness	 2.2.7.1 2.2.7.1 2.2.4 2.2.4 2.2.4		Inspection certificate of supplier, type 3.1 EN 10204 In addition 1 / each diameter 1 / each diameter	 Every shipment Every shipment
6	**Wire mechanical characteristics:** Tensile strength	 2.2.3		Inspection certificate of supplier, type 3.1 EN 10204 In addition 1 / each diameter and each coating type	 Every shipment

3.2 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 steel mesh systems for reinforced fill 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 steel mesh systems for reinforced fill	-	Laid down in control plan	-	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	-	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 10223-3	Steel wire and wire products for fencing and netting - Part 3: Hexagonal steel wire mesh products for civil engineering purposes
EN 10223-8	Steel wire and wire products for fencing and netting - Part 8: Welded mesh gabion products
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 10264-1	Steel wire and wire products. Steel wire for ropes. Part 1: General requirements
EN 10264-2	Steel wire and wire products. Steel wire for ropes. Part 2: Cold drawn non alloy steel wire for ropes for general applications
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 10245-5	Steel wire and wire products. Organic coatings on steel wire. Part 5: Polyamide coated wire
EN 12385-1+A1	Steel wire ropes. Safety. Part 1: General requirements
EN 12385-2+A1	Steel wire ropes. Safety. Part 2: Definitions, designation and classification
EN 12385-4+A1	Steel wire ropes. Safety. Part 4: Stranded ropes for general lifting applications
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
EN ISO 9223	Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation
ISO/FDIS 17746	Steel wire rope net panels and rolls — Definitions and specifications

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 prepared for the evaluation of the integrity of the polymer coating inside the double twists of the net is made of panel central ones.

A.3 Sampling

For each type of double twist wire mesh produced with organic coated wire 1 panel (see Figure A.1) in order to perform the longitudinal tensile test (according to cl. 9, EN 10223-3), shall be sampled.

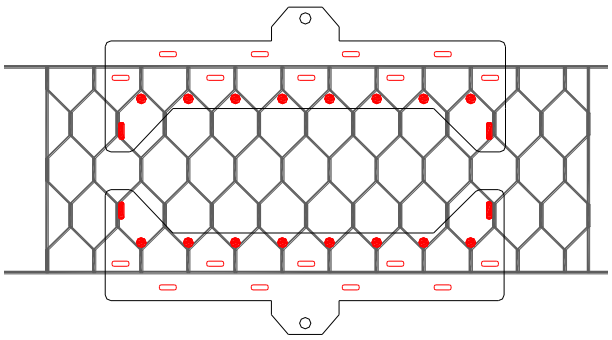


Figure A.1 - Panel

Each panel samples is subject to tensile strength test according to cl.9, EN 10223-3, up to 50% of the characteristic tensile strength values.

For each tensioned panel the double twist region (sample) will be verified (see Figures A.2, A.3 and A.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 Figures A.2, A.3 and A.4.

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 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

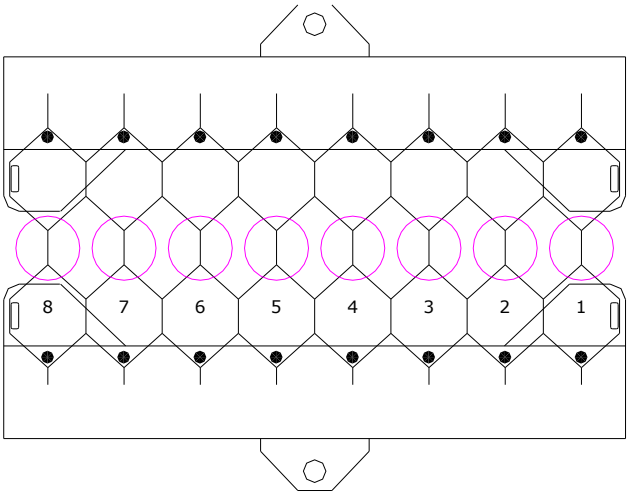


Figure A.2 – Sample for 10 x 12 mesh type

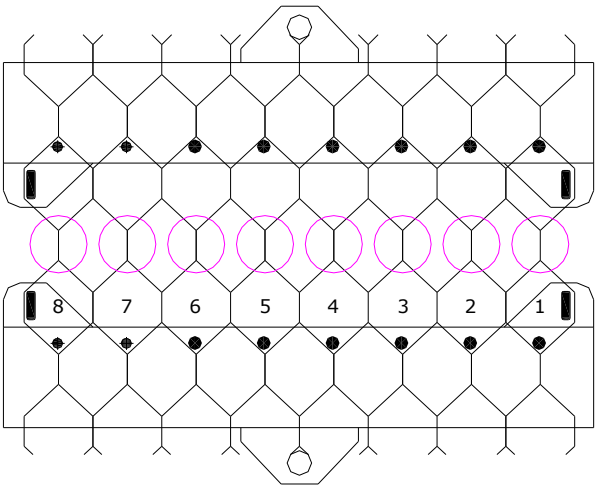


Figure A.3 – Sample for 8 x 10 mesh type

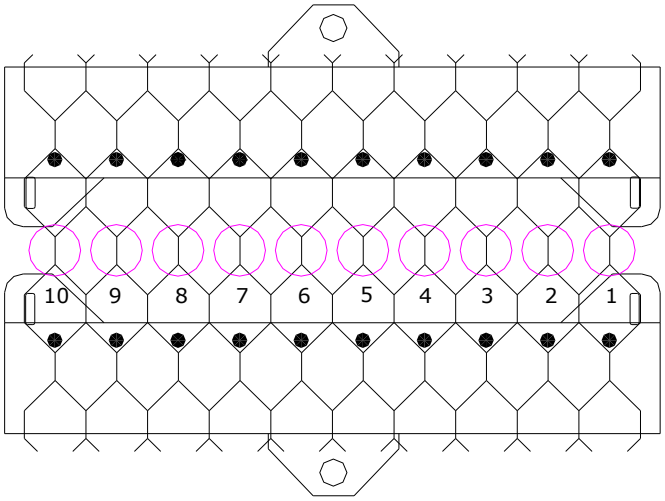


Figure A.4 – Sample for 6 x 8 mesh type

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 shall be classified into 4 categories:

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 characteristic values of tensile strength of mesh (whenever the underlying steel wire is clearly visible), the integrity is not fulfilled and the test cannot be accepted.

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 – TENSILE TEST ON DOUBLE TWISTED WIRE MESH REINFORCED WITH WIRE ROPES

B.1 Scope

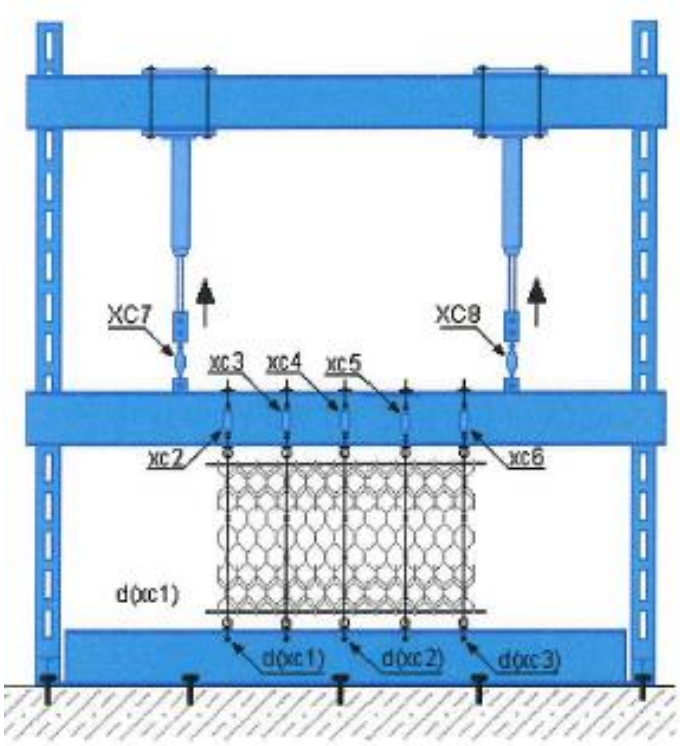
The aim of this test is to determine the tensile strength of double twisted steel wire mesh reinforced with ropes.

B.2 Test Specimen

The width of a specimen shall not be less than six repetitions of a mesh pattern, nor shall the length be less than ten repetitions (Figure B.1).

B.3 Test apparatus

The test apparatus consists from traction machine and rigid steel heads to allow the specimen to be connected to them.



XC7, XC8	load gauges for measurement of total tensile force of mesh specimen
xc2, xc3, xc4, xc5, xc6	load gauges for measurement of tensile forces in individual ropes

Figure B.1 – Double twisted wire mesh with woven ropes – test method

B.4 Test procedure

The tests shall be run with the load applied parallel to the axis of woven ropes. Insert the rope and wires of mesh into the machine grips and the axially free sliding adjustable spreader system attachment points such that the gripped ropes and wires will be maintained in the mesh geometry characteristic of field use and attached in such a manner as to eliminate failure at the grips. The load is than applied at a uniform rate 10 to 6 mm/minute. The load shall initially be taken to a preload of 4 kN of the specified minimum strength and the machine head travel stopped. The mesh gage dimensions shall be recorded at this time and taken as the initial dimensions of the specimen where such dimensions are required. Loading shall then continue uniformly in increments of 10% of the specified minimum strength until first fracture of rope occurs.

Uniform distribution of applied tensile load into all ropes is the key issue of proper testing. The tensile force in ropes shall increase directly, while the tensile strength in the wire meshes, due to twisting layout of the wires, shall increase indirectly. The acceptable failure mode is by breaking of one of the ropes.

B.5 Test report

The test report shall contain:

- Name of laboratory and name of operator who performed the tests;
- Date of test;
- Detailed and particular description of test specimen: mesh construction, mesh size, component characteristics (diameter of wires, construction of ropes, breaking forces);
- Nominal dimensions of test specimen;
- Description of testing apparatus;
- Description of failure mode;
- Total load at collapse;
- Tensile forces in individual ropes at collapse;
- Elongation at break.

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

C.1 Scope

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

C.2 Test Specimen

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

C.3 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.

C.4 Test Conditions

C.4.1 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.

C.4.2 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.

C.4.3 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.

C.4.4 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.

C.5 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).