EUROPEAN ASSESSMENT DOCUMENT

EAD 230004-00-0106

March 2016

WIRE RING MESH PANELS

www.eota.eu

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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 applies to wire ring mesh construction products for retaining of unstable slopes controlling and preventing rockfall and loose debris flow along roads, highways and railways.

Only the characteristics of the wire ring mesh construction products are included in this document. Anchors and/or soil nails for fixing of wire ring mesh to the unstable slope are not covered by this EAD.

This EAD covers wire ring mesh panels (according to ISO/FDIS 17745) (see Figure 1) produced from non–ferrous metallic (Zinc or Zinc/ Aluminium alloy coating , class A or Class B according to EN 10244-2 or ISO 7989-2) coated wires.

Wire ring mesh panels are ring panels where each ring is made by several loop bindings, each one obtained by looping a single steel wire. Each ring is connected with 4 or 6 adjacent rings in order to create a mesh as shown in Figure 1.

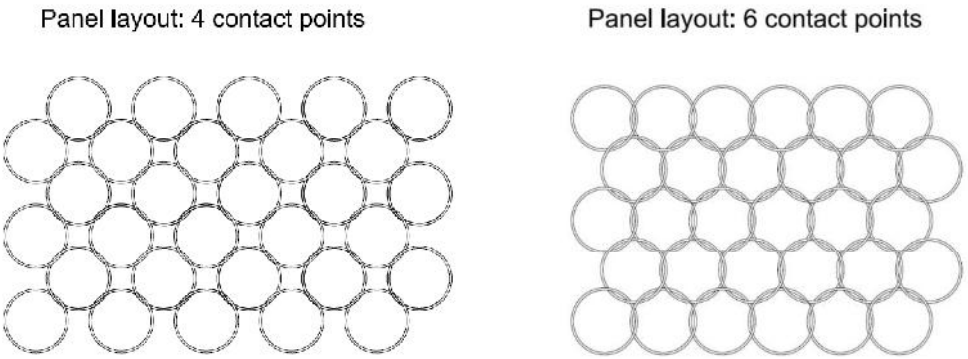


Figure 1 – Examples of ring wire net panel

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)

Wire ring mesh panels are intended to be used for:

- Retaining of unstable slopes;
- Control and prevention of rockfall and loose debris flow;
- Component of soil nailing system;

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 products for the intended use, in accordance with Annex A of ISO/FDIS 17745, in relation to different wire coating and corrosivity categories (according to EN ISO

9223) of environment, when installed in the works when durability tests are performed according to cl. 2.2.4 in this EAD, moreover when tested according to 2.2.4:

for non-ferrous metallic coating Zn class B the number of hours in exposure is 200

for non-ferrous metallic coating Zn class A the number of hours in exposure is 500

for non-ferrous metallic coating Zn95/Al5 class B the number of hours in exposure is 500

for non-ferrous metallic coating Zn95/Al5 class A the number of hours in exposure is 1000

for non-ferrous metallic coating Zn90/Al10 class B the number of hours in exposure is 1000

for non-ferrous metallic coating Zn90/Al10 class A the number of hours in exposure is 2000

for non-ferrous advanced metallic coating class B the number of hours in exposure is 1000

for non-ferrous advanced metallic coating class A the number of hours in exposure is 2000

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 Wire ring

Structure of mesh panels made by rings connected to adjacent rings.

1.3.2 Wire ring diameter

Average value ($D = L_D / 3$) of the diameter (D) of the single ring. The ring diameter is measured as a centre to centre distance through three rings (L_D).

1.3.3 Wire ring mesh panels

Structure of mesh panels made by rings connected to adjacent rings.

[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.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows, how the performance of wire ring mesh panels 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	**Ring characteristics:** Wire diameter Wire tensile strength Wire coating type Wire coating mass Ring diameter Number of loops Breaking force of 3 ring chain	2.2.1	 d (mm) f_t (N/mm^2) description description D (mm) number B_F (kN)
2	Tensile strength and elongation of mesh	2.2.2	p_m (kN/m) ε_m (%)
3	Punching resistance and deflection of mesh	2.2.3	F_m (kN) δ_m (mm)
4	Durability in artificial atmosphere Neutral salt spray test with general condensation of moisture of mesh samples	2.2.4	Exposure time with surface DBR ≤ 5% surface (hours)

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, tensile strength, coating type and mass, ring diameter, number of loops breaking force of 3 ring chain

The diameter d (in mm) of ring wire shall be tested according to cl. 4.1 in EN 10218-2 and by checking the inspection documents of incoming wire products.

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 tensile strength f_t (in N/mm^2) of ring wire shall be tested according to cl. 3 in EN 10218-1 and by checking the inspection documents of incoming wire products.

The TAB shall inform the manufacturer of outcomes of the comparison of results with specifications supplied by the manufacturer.

The types of non-ferrous metallic Zn, Zn/Al alloy or advanced coating and minimum coating mass on wires (in g/m^2) shall be tested in accordance with cl. 5.2.2 in EN 10244-2. The adherence wrapping test on non-ferrous metallic coated wires shall be carried out in accordance with cl. 6 in EN 10218-1 and by checking the inspection documents of incoming wire products.

The TAB shall inform the manufacturer of outcomes of the comparison of test results with Table 2 in EN 10244-2 or with Table 2 in ISO 7989-2.

The ring diameter *D* (in mm) shall be measured according to cl. 1.3.2 in this EAD. The ring diameter *D* shall be measured in at least three locations in three panels.

The TAB shall inform the manufacturer of outcomes of the comparison of measured results with specifications supplied by the manufacturer with the specific tolerances.

The number of loops shall be checked in at least three locations in three panels.

The breaking force on at least three samples of 3 ring chain shall be tested according to C.3.1, Annex C, ETAG 027 (used as EAD) or according to ISO/FDIS 17745. The minimum breaking force B_F (in kN) shall be given in ETA.

2.2.2 Tensile strength and elongation of mesh

The tensile strength shall be tested in accordance with Annex A in this EAD. The mean values and tolerances corresponding to 95% level of confidence shall be evaluated from test results $p_{max,i}$ (in kN/m) and $\varepsilon_{max,i}$ (in %) of at least three specimens ($i \geq 3$). The mean value of tensile strength p_m (in kN/m) and mean value of elongation ε_m (in %) and their tolerances corresponding to 95% level of confidence shall be given in ETA.

2.2.3 Punching resistance and deflection of mesh

The punching resistance shall be tested in accordance with Annex B in ISO/FDIS 17745. The mean values and tolerances corresponding to 95% level of confidence shall be evaluated from test results $F_{max,i}$ (in kN) and $\delta_{max,i}$ (in mm) of at least three specimens ($i \geq 3$). The mean value of punching resistance F_m (in kN) and mean value of deflection δ_m (in mm) of mesh and their tolerances corresponding to 95% level of confidence shall be given in ETA.

> Note – Considering that both, the non-ferrous metallic coating type and class, do not influence the test procedure and results according to cl. 2.2.1, cl. 2.2.3 and cl. 2.2.4 the test samples can be selected with any of the coating given in ETA.

2.2.4 Durability

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

Neutral salt spray (NSS) test on mesh samples (at least one sample) shall be carried out according to cl. EN ISO 9227. 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.

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 2003/728/EC.

The system is: **1**

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 size Breaking force on 3 ring chain Tensile strength and elongation of net Neutral salt spray test	. 2.2.1 2.2.1 2.2.2 2.2.4	 2.2.1 2.2.1 2.2.2 2.2.4	 1 sample/type 1 sample/type 1 sample/type According to control plan	 1 / day 1 / month 1 / year 1 each 2 years
Incoming product					
2	**Wire of mesh:** Outer diameter Adherence Coating type and mass Tensile strength	 EN 10218-2 EN 10218-1 EN 10244-2 EN 10218-1	Manufacturer‘s technical file	Inspection certificate of supplier, type 3.1 EN 10204	According to manufacturer‘s technical file

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 wire ring mesh panels 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 wire ring mesh panels	-	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 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 ISO 9223	Corrosion of metals and alloys. Corrosivity of atmospheres. Classification, determination and estimation (ISO 9223:2012)
EN ISO 9227	Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2012)
EN ISO 7500-1/AC	Metallic materials. Verification of static uniaxial testing machines. Part 1: Tension/compression testing machines. Verification and calibration of the force-measuring system (ISO 7500-1:2004)
ISO 7989-2	Steel wire and wire products. Non-ferrous metallic coatings on steel wire. Part 2: Zinc or zinc-alloy coating
ISO/FDIS 17745	Steel wire ring net panels — Definitions and specifications
ETAG 027 used as EAD	Falling Rock Protection Kit, April 2013

ANNEX A LONGITUDINAL TENSILE TEST WITH NO LATERAL CONTRACTION

A1 Test method

The test method is according to Annex C in ISO/FDIS 17745: 2016.

A2 Assessment of test results

During the test (for test set-up, see Figure A.1 (Figure A.1 is based on Figure C.1 in ISO/FDIS 17745: 2016)) the following data shall be continuously recorded:

- Longitudinal force;
- Transversal forces;
- Displacement of the movable beam in longitudinal direction (applied load direction) ΔL (in mm).

The tensile strength is determined as:

$$p_{max} = F_{max} / e \qquad \text{(kN/m)}$$

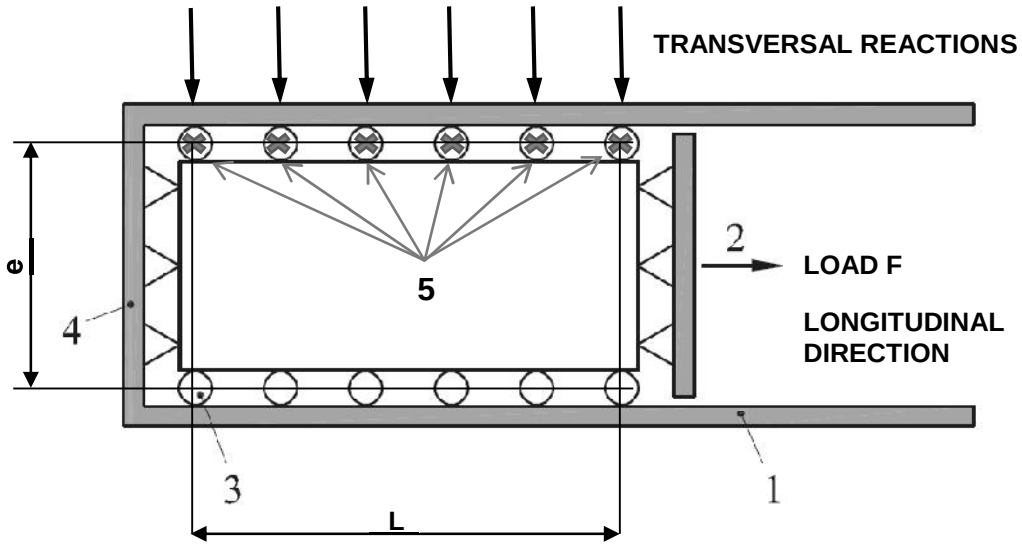
where

F_{max} in (kN) is the maximum recorded force (collapse load) in longitudinal direction

e in (m) is the overall width of supported net (transversally to the direction of applied load).

The test report shall contain the following information:

- Detailed and particular description of test specimen: ring size and number of loops, component characteristics (diameter of wires, breaking forces);
- Distances e and L;
- Longitudinal force vs. displacement in longitudinal direction (of movable beam) diagram;
- Transversal forces vs. displacement in longitudinal direction (of movable beam) diagram;
- Collapse load in longitudinal direction;
- Transversal forces in each load cell installed transversally at collapse load;
- Displacement of movable beam ΔL at collapse load and corresponding elongation $\varepsilon_{max} = \Delta L/L$;
- Description of failure modes;
- Photographic documentation of specimen before and after the test including the way of connection of mesh to the frame.



Key:

1. Fixed frame
2. Movable beam
3. Lateral constraint (movable in londitudinal direction) to which the net is connected
   Note - The number of lateral constraint depends on the configuration of sample
4. Side connection
5. Load cells to measure transversal reactions

Figure A.1 – Test set-up