

RENO MATTRESS PLUS

Double twisted steel wire mesh mattresses with high abrasion resistant (Polimac®) coated wire and pre-shaped bracing elements

applicable to European Countries only

PART 1 – PRODUCT

1.1 DESCRIPTION

Double twisted steel wire mesh Reno Mattresses Plus shall be manufactured in compliance with BS EN 10223-3, with Zn-Al alloy and a High Abrasion Resistant (Polimac® or equivalent) polymer-coated steel wire.

The base, diaphragms front, end and sides of the unit shall be manufactured from one continuous panel of mesh; the base is folded onto itself at regular intervals to form double diaphragms that are secured with spirals at the production facility.

The units are supplied together with pre-formed bracing ties (X-Ties) to connect the base panel of the mattress to the lid during the installation process on the site.

The units are manufactured in compliance with The Construction Products (Amendment etc.)(EU Exit) Regulations 2020 on the basis of UKAD 200019-00-0102 and UKTA-0836-22/0019.

[For Republic of Ireland: The units are manufactured in accordance with Construction Product Regulation CPR 305/2011 and have a CE marking in compliance with EAD 200019-00-0102.]

The management and production system of the supplier shall be certified in compliance with ISO 9001.

All listed performances must be verifiable on laboratory test reports conducted by independent research institutes, the relevant documentation shall be submitted to the supervisor for the acceptance of the material.

1.2 FUNCTIONAL CHARACTERISTICS

For the application of Reno mattresses in river training works, the values of the permissible shear stress in unvegetated conditions shall be:

Thickness (cm)	Permissible Shear Stress (*) (N/m ²)
17	445
23	534
30	637

(*) Flume test values - Design values depend on installation procedures (use of vertical ties) and actual stone characteristics (D_{50} , C_u).

The values of the permissible shear stress will be provided by the manufacturer but will have to be supported by full scale tests carried out at third-party laboratory following the ASTM D6460 test methodology.

The tensile strength of the steel wire mesh shall be 40 ± 3 kN/m, in accordance with BS EN 10223-3.

In order to allow for the design at both Ultimate (ULS) and Serviceability (SLS) limit states, the mattress manufacturer shall provide the following characteristics:

- Punch resistance of the wire mesh: 20 ± 1 kN; tests on 1x1 m sample laterally constrained following the ASTM A975-23 test methodology.
- Mesh Tensile strength: 40 ± 3 kN/m; tests carried out according to BS EN 10223-3.

1.3 MATERIALS

The double twisted steel wire mesh shall be manufactured with hexagonal 6x8 mesh type (BS EN 10223-3, Table 2), woven with a drawn steel wire core of 2.20 mm in diameter, with a minimum quantity of 230 g/m² of Zn-Al metallic coated alloy, in accordance with ISO 7989-2 and BS EN 10244-2, Table 2, Class A.

The double twisted steel wire mesh shall be resistant to outwearing accelerated ageing when subject to test in Sulphur dioxide environment (ISO 22479): after 28 cycles of discontinuous test, the mesh shall not show more than 5% of DBR (Dark Brown Rust).

The metallic coated wire core shall be protected with a high abrasion-resistant polymer coating (Polimac® or equivalent), grey in colour, with a nominal thickness of 0.5 mm, resulting in a nominal overall diameter of 3.20

mm.

1.4 POLYMER COATING

The polymer coating shall comply with the following requirements:

- Long-term durability: service life greater than 125 years at 25 °C
- Outwearing accelerated ageing in salt spray (ISO 9227): after 20,000 hours of exposure, the mesh shall not show more than 5% of DBR (Dark Brown Rust).
- Abrasion resistance in wet conditions (ISO 22182): after 40,000 abrading cycles the weight loss shall not be greater than 3%
- Abrasion resistance in dry conditions (ASTM A975): after 300 cycles the polymer coating shall not expose the metal wire.
- Resistance to UV radiation (ISO 4892-3, type 1A): after 2,500 hours of exposure to QUV-A the tensile strength and elongation at break of the base compound shall not change more than 25% from the initial test results.
- Brittleness temperature: lower than -35°C (ASTM D746).
- Corrosion spread test (ASTM A975): after 2,500 hours immersion of the wire sample in a HCl solution the maximum corrosion length shall be less than a mesh repetition.

1.5 LACING

The steel rings used for fastening operations shall be made of stainless steel and have the following characteristics:

- Diameter: 3.00 mm
- Tensile strength > 1,550 MPa
- Pull-apart strength > 2.0 kN

1.6 VERTICAL TIES (X-Ties)

To secure a tighter packing of the filling stones and improve the hydraulic performances of the mattresses, pre-shaped vertical ties (X-Ties) connecting the base panel to the lid and supplied together with mattresses, shall be installed on the site (1 unit/m²).

X-Tie is a pre-shaped bracing system made of Galmac® and polymer-coated steel wire with two pre-assembled components: the vertical leg connecting the base panel to the lid and the inclined tie to keep the vertical leg into position during the stone filling operations; the upper part of the vertical leg is eventually fixed to the lid by means of two C-rings.

1.6 ENVIRONMENTAL AND SUSTAINABILITY PROPERTIES

1.6.1 Environmental Product Declaration

Reno Mattress Plus units shall have a Type III Environmental Product Declaration (EPD) registered and certified in accordance with ISO 14025 and BS EN 15804, to evaluate the environmental impact and give the possibility to calculate the Life Cycle Assessment (LCA) of the designed technical solution.

Such sustainability performances/requirements have to be reported in the Type III EPD certificate; certifications of not authorised bodies or self-certificates issued by the manufacturer, are not allowed.

The value shall be declared, as per Table 1, in terms of Global Warming Potential (GWP 100 years) and expressed in *kg CO₂-Equiv./kg*.

Table 1 – Environmental and sustainability properties

Global Warming Potential (GWP 100 years)	ISO 14025 BS EN 15804	certified numeric value	[kg CO ₂ -Equiv./kg]
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1.6.2 Environmental Harmlessness

The polymer coated steel wires shall be tested to ensure their Environmental Harmlessness according to the following procedures:

- Synthetic Precipitation Leaching Procedure (SPLP) preparation as per EPA 1312 and Metals in Water by ICPMS (low level) as per EPA 6020B in which the presence or not of 31 different metals shall be analysed using atomic spectroscopy.

The results shall be in compliance with: (a) Water Framework Directive 2000/60/EC; (b) CCME Water Quality Guidelines for the Protection of Aquatic Life, Freshwater; (c) U.S. EPA National Recommended Water Quality Criteria (Aquatic Life, Freshwater), 2006.

- PFAS test in water by SPE/LCMS as per EPA 537.1 in which the presence or not of 28 different PFAS shall be analysed, showing that the polymer coated steel wires are PFAS free. Resulting in a concentration lower than 2 ng/L of PFOS and PFOA and < 4 ng/L for other PFAS.
- ELUATE Tests on the environmental safeness, conducted as per M GEOK E:2016, shall ensure that the polymer coating is not critical for the environment.
- Smoke toxicity tests conducted as per ISO 5659-2 and EN 17084 shall ensure a Gases Conventional Index of Toxicity after 8 minutes sampling CIT_G (8) < 0.10 and a HCl concentration < 36 ppm

PART 2 – EXECUTION

The product's conformity shall be certified by a third-party Notified Body, according to the The Construction Products (Amendment etc.)(EU Exit) Regulations 2020, which shall assess the quality control process at the supplier's production facility.

[For Republic of Ireland: The product's conformity shall be certified by a third party Notified Body, according to CPR 305/2011, who shall assess the quality control process at the supplier's production facility. Prior to the installation, and on each consignment of gabion units to the job site, the contractor shall provide the Supervisory Body with the relevant documentation (Declaration of Performance, D.o.P.) in original form, where product and supplier names, quantities and destination are specified.]

Once Reno mattress units are assembled and the foundation has been prepared, pre-assembled units shall be placed in position empty and then fastened to adjacent mattresses along all containing edges, in order to form a continuously connected, monolithic structural unit. All connections shall be in accordance with BS EN10223-3.

On slopes, the mattress shall be laid with the width perpendicular to the slope, except for very small channels. Mattresses shall be placed and securely attached while empty.

Fourthly filling operations, both mechanical and manual, may start. The stone fill material shall be provided in the proper sizes and quality. Rocks shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. When placing the stones, care shall be taken to ensure that the polymer coating is not damaged. Filling shall be done unit by unit, but several units shall be ready for filling at any one time. Ensure that the diaphragm tops are accessible for wiring.

After the rock has been placed in the unit, sufficient hand manipulation of the rock shall be performed to minimize voids and achieve a maximum density in the mattress. In cases where several adjacent bases need to be covered simultaneously, rolls of mesh can be used in place of unit-size lids.