

# STEELGRID® HR SYSTEM

## HIGH RESISTANCE GEOCOMPOSITE MESH SYSTEM

The new **Steelgrid®** HR System is an innovative complete system for rockfall mitigation and slope consolidation works. The **Steelgrid®** HR System combines a patented high strength steel wire mesh geocomposite which is used in conjunction with anchor plates, specific U-bolts and mesh connectors. The **Steelgrid®** HR mesh is a composite of double twisted steel wire hexagonal mesh with high tensile strength steel cables, woven into the mesh during the manufacturing process.

The corrosion protection for the steel wire mesh and ropes of **Steelgrid®** HR System is guaranteed by two types of coatings: GalMac C2 (Zn95%+Al5%) and GalMac C3 (Zn90%+Al10%), both in Class A according to EN 10244-2. This makes the **Steelgrid®** HR System and accessories ideal for rockfall protection in all continental environments.

Innovation in the Maccaferri manufacturing process adapts the traditional twisting process to create a 'hybrid mesh'; the mesh features a combination of full and half-hexagonal shaped mesh apertures. To provide high tensile strength and punching resistance at low-strain, the steel cables lie predominantly straight within the hexagonal mesh. As the mesh offers immediate resistance to loads at minimal strain, there is no requirement to pre-tension the mesh.



Fig. 1: Steelgrid® HR 30

The post-manufacturing alignment of the steel cables within **Steelgrid®** HR can vary depending on the rope spacing and position within the roll. Performance testing is carried out in compliance with this natural variability. When the mesh is installed and loaded, the ropes lie straight within the mesh offering high strength and stiffness (strength at low strain) in comparison with traditional double twist and single twist meshes; elongation of **Steelgrid®** HR is in the range of 5-7% compared with 16-23% for double twist meshes depending on mesh/wire combinations. Punching resistance, tested in accordance with UNI 11437, shows a greater improvement with average increases of 20-40% compared with double twist meshes.

Table 1: Longitudinal Tensile Performance

Steelgrid® HR variant	Nominal longitudinal tensile strength
HR 20	255 ± 5 kN/m
HR 30	180 ± 10 kN/m
HR 50	130 ± 10 kN/m
HR 100	83 ± 5 kN/m

Certification accompanying materials:

Prior to the installation and for each delivery the contractor shall deliver to the DL Declaration of Performance (DOP), issued in the original, in which must be specified the type and trade name of the product, the name of the producing company, the company to which the product is delivered, the location of the site and the quantities supplied.



Steelgrid® HR System

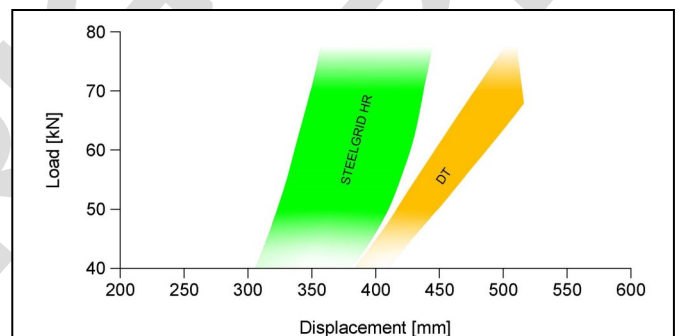


Fig. 2: Punch test performance comparison

Table 2: Punch test performance (UNI 11437)

Steelgrid® HR variant	Ultimate punching force	Ultimate punching displacement
HR 20	195 ± 5 kN	230 ± 10 mm
HR 30	155 ± 12 kN	400 ± 50 mm
HR 50	125 ± 12 kN	450 ± 50 mm
HR 100	90 ± 8 kN	450 ± 50 mm

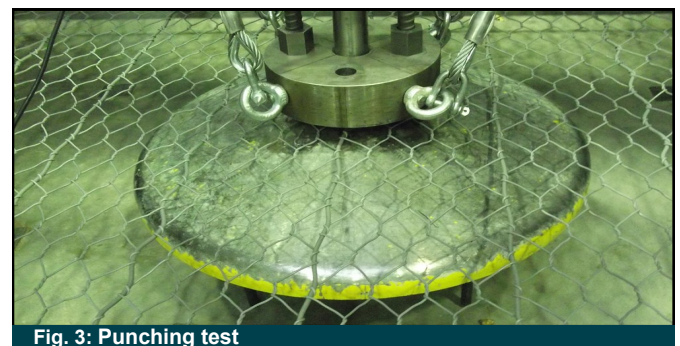


Fig. 3: Punching test

ETA n. 16/0758



**Steelgrid® HR system** is installed in the same general way as conventional double twist mesh. It is easy to handle and will not require extensive modification of existing method statements and installation techniques. The inclusion of the steel ropes greatly enhances the transfer of loads from the mesh into the anchorage system thereby increasing safety, capacity and durability of the mesh as a complete system. The accessories supplied by Maccaferri together with the **Steelgrid® HR system** (especially the steel plate to be combined together with possible anchors) deliver a system characterized by high performance and reassurance.

## Steel wire used for double twist hexagonal mesh

- 1. Tensile strength:** the wire used to manufacture the mesh shall have a tensile strength between 350-550 N/mm<sup>2</sup> as per EN10223-3:2013. Wire tolerances (Table 4) are in accordance with EN10218-2 (Class T1).
- 2. Elongation:** Elongation shall not be less than 8%, according to EN10223-3:2013.
- 3. GalMac® coating:** minimum quantities of GalMac® shown at Table 4 meet the requirements of EN10244-2 (Table 2-Class A).
- 4. Adhesion of GalMac®:** the adhesion of the GalMac® coating must be in accordance with EN 10244-2.
- 5. Outwearing accelerated aging test** in a general condensation of moisture containing sulfur dioxide (80 cycles for GalMac C2, 112 cycles for GalMac C3) in accordance with EN ISO 6988 the mesh shall not show more than 5% of red rust.  
When subjected to the neutral salt spray test (ISO 9227) after 1800 hours (GalMac C2) and 3000 hours (GalMac C3) of exposure the mesh shall not show more than 5% of DBR (Dark Brown Rust).

## Steel wire ropes

- Surface finish of component rope wires:** Zinc-Aluminium alloys (Zn95%+Al5% and Zn90%+Al10%) coated in Class A according to EN 10264-2.
- Rope outside diameter:** 8 mm.
- Rope construction:** "6x7+WC or 6x19+WC" described in accordance with EN 12385-2 2008 and EN 12385-4 2008.
- Minimum nominal grade of rope:** 1770 N/mm<sup>2</sup> according to EN 12385-4 2008 (1960 N/mm<sup>2</sup> for Steelgrid HR 20 only).
- Minimum breaking load (MBL) of rope:** 40.7 kN as defined in EN 12385-4 2008 (45.0 kN for Steelgrid HR 20 only).

Table 3: Standard production data

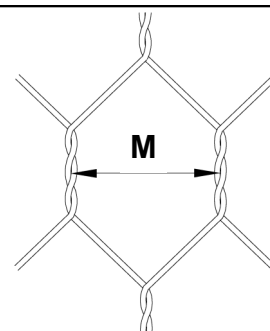
Steelgrid® HR variant	Nominal roll width (by truck)	Nominal roll width (by container)	Nominal roll length
HR 20	3.25m	2.75m	25/40m
HR 30	3.15m	2.85m	25/40m
HR 50	3.25m	2.75m	25/40m
HR 100	3.10m	2.85m	25/40m

All sizes and dimensions are nominal. Confirmation should be sought from regional office prior to placement of an order. Mesh production tolerances of ±3% of the length, ±5% of the width, ±8% of rope spacing shall be permitted.  
The product, once unrolled, might present undulations.

Table 4: Standard double twist mesh and wire data

Mesh type	D (mm)	Ø Wire (mm)
8x10	80	2.70
Mesh wire diameter	Ø mm	2.70
Wire diameter tolerance	(±) Ø mm	0.06
GalMac® minimum quantity	gr/m <sup>2</sup>	245
Longitudinal rope diameter	Ø mm	8.00

The tolerance on the opening of mesh 'M' being the distance between the axis of two consecutive twists, is according to EN 10223-3



Double Twist Hexagonal Mesh detail information



U-bolt wire rope grip ("HR Grip")



Steel plate ("HR Plate")



Mesh connectors ("HR Link")

**WARNING:** Install all rockfall and mesh products in accordance with National or Local Legal and Security Requirements. If the installation is performed by working in suspension or using security ropes, personal protective equipment against fall risk must be connected with anchor points in agreement with EN 795 or other relevant regional equivalent standards and practices.

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Maccaferri operates under strict quality assurance and management procedures. Please visit the website of your local subsidiary for details of their Certifications.