

GP-CSIV-W2 EN 998-1 M10 EN 998-2

PALLADIO®
RINFORZA NHL M10



Ready-mixed, rheoplastic, fibre-reinforced mortar with high mechanical strength, based on NHL 5 natural hydraulic lime and selected aggregates with a grain size up to 3 mm , suitable for reinforcement work using both traditional and CRM reinforced plaster.

Product description

PALLADIO RINFORZA NHL M10 is a ready-to-use, rheoplastic, fibre-reinforced mortar with high mechanical strength, based on NHL 5 natural hydraulic lime and selected aggregates with a grain size up to 3 mm, specific for structural reinforcement, improvement and seismic upgrading of existing buildings, including historic ones.
PALLADIO RINFORZA NHL M10 conforms to UNI EN 998-2 as masonry mortar with strength class M10 and conforms to UNI EN 998-1 as CSIV class plaster .
PALLADIO RINFORZA NHL M10 is ideal for structural reinforcements carried out with the reinforced plaster techniques: traditional type in combination with steel nets,
CRM type in combination with composite material mesh, and in all cases in which a mortar with high mechanical performance compatible with existing masonry is required.

Specifications

- Specific for the execution of reinforcement systems using CRM reinforced plaster
- Suitable for the execution of reinforcement systems using traditional reinforced plaster
- High material compatibility with historical masonry. Does not add water-soluble salts and does not react in the presence of sulphates.
- High mechanical compatibility with historical masonry thanks to the low elastic modulus
- High breathability thanks to composition based on NHL 5 natural hydraulic lime
- Mechanical compressive strength after curing greater than 10 N/mm²
- Very workable, versatile and easy to apply

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Supply and Storage

PALLADIO RINFORZA NHL M10 is supplied in special bags on pallets with stretch wrapping.
Store in a cool, dry and non-ventilated place. Keep packaging intact.
It can be supplied in silos on request.
The product in its original packaging and correctly stored will be usable for 12 months from the date of the production batch.

Fields of use

PALLADIO RINFORZA NHL M10 is a mortar specifically designed for interventions when high mechanical properties are required without compromising compatibility with existing masonry, including historic masonry:

- Implementation of structural reinforcement works using the CRM reinforced plaster technique, on masonry and vaults in brick, absorbent natural stone, tuff or mixed
- Implementation of structural reinforcement works using the traditional technique of reinforced plaster in combination with electro-welded steel mesh, on masonry and vaults in brick, absorbent natural stone, tuff or mixed
- Repair of damaged masonry walls using the “sew-stich” technique
- Creation of reinforced bedding joints
- Draw up, even reinforced, of joints in exposed masonry work
- Realisation of new masonry with high performance requirements
- Realisation of high mechanical performance breathable plasters, both internal and external, also on valuable masonry work

Surface Preparation

Structural reinforcement interventions must be preceded by a correct analysis and preparation of the substrate in a workmanlike manner, in accordance with the project indications and the prescriptions of the supervision of works.
As a general rule, the objective is to obtain a monolithic body, in which the reinforcement intervention and the existing masonry work together homogeneously.
To this end, the following steps should be considered:

1. In the case of work on wall faces and intradoses of vaults, completely remove the pre-existing plasterwork, clean completely the structural elements to be reinforced, until a sound and compact support is obtained. In the case of extrados reinforcement of vaults, remove the pavement and backfills.
2. If necessary, and in accordance with the project provisions and the supervision of the Works Department, proceed to repair the masonry using materials that correspond as much as possible to the originals or use repair interventions of the “sew-stich” tecnique, using the same RINFORZA NHL M10 as bedding mortar. In the case of disordered masonry, with the presence of cavities and loose material, evaluate the intervention with consolidating injection using the product PALLADIO INIEZIONE NHL.
3. In any case, immediately before applying the product, clean and saturate the support surface by washing at low pressure, allowing excess surface water to evaporate and taking care to remove dust and loose parts, as well as traces of oils, grease, waxes, etc. Remove any efflorescence and saline concentrations by washing or mechanical means (brushing, sandblasting, hydro-blasting), taking care to remove any residues from the foot of the masonry. The substrate must be clean, sound and compact, with an adequate degree of roughness.

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Application

Product preparation

PALLADIO RINFORZA NHL M10 is suitable for application with a plastering machine with continuous mixing. After pouring the product into the hopper, the plastering machine must be adjusted in order to obtain a mortar plastic consistency. The product should be applied evenly on the masonry, starting from the bottom with a thickness of no more than 2 cm per layer. Subsequent layers should be applied after 24 hours, when the previous one has reached a suitable consistency. Do not overlap more than 50 mm without the use of a supporting mesh. To avoid deterioration of the mechanical characteristics of the material, the plastering machine must be suitably equipped, especially regarding the choice of the stator/rotor unit (lung/screw). In any case, it is advisable to carry out the necessary tests to correctly set up the machine.

In the case of manual application, PALLADIO RINFORZA NHL M10 is prepared by mixing each 25 kg sack with a maximum of approx. 4.5 litres of water (approx. 18%).

1. Place clean water in the concrete mixer at a rate of approx. 3 litres per bag of RINFORZA NHL M10.
2. Introduce the mortar powder, adding it slowly and with a continuous flow , mixing for about 3 minutes until a lump-free and homogeneous mix is obtained, taking care to remove the deposited powder from the interior sides of the concrete mixer.
3. Add the remaining clean water, approx. 1.5 litres per bag, up to a maximum total of 4.5 litres per bag (approx. 18%).
4. Mix furtherly for approx. 3 minutes until a plastic and perfectly homogeneous mixture is obtained. Use the prepared mortar completely, avoiding mixing the remaining quantity with the following mix.

Example 1: CRM reinforced plaster

After proper preparation of the substrate, proceed according to the following steps:

1. In the case of particularly irregular wall substrates, it is advisable to carry out a preliminary levelling with PALLADIO RINFORZA NHL M10, on a suitably moistened substrate but without free water on the surface, taking care to respect the minimum and maximum thicknesses as declared and working in several coats. The various coats applied must be left rough and not smoothed, in order to facilitate the adhesion of subsequent coats. Once the irregularities have been filled, subsequent work must be carried out within 24 hours and in any case to be evaluated depending on the environmental conditions. In the case of non-absorbent areas, such as portions of concrete, these must be suitably treated by performing a covering rendering with a suitable structural mortar of the GALILEO MURATURA type. This in order to roughen the surface and guarantee the best adhesion to the subsequent layer of structural plaster to be applied with PALLADIO RINFORZA NHL M10 within and no later than 48-72 hours from the application of the rendering.
2. Proceed with the laying of the pre-formed fibreglass mesh chosen from the certified PALLADIO line. At masonry intersections and building corners, proceed with the positioning of the respective certified preformed fibreglass corner elements. For a correct positioning of the fibreglass reinforcement elements, it is recommended that in correspondence of the overlapping areas, the elements are overlapped by at least 20 cm, while for the corner elements it is recommended that the elements are completely overlapped with the mesh itself.
3. Proceed with drilling the holes on the substrate according to the project plan. As indication, a minimum number of 4 connectors per m² can be calculated. In any case, both the number of holes, as well as the drilling pattern, must be properly evaluated considering the multiple characteristics of the masonry subject to intervention such as type, thickness, quality and geometry. It is understood that the type of connector, as well as the number of holes, their length and the drilling pattern must be duly

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assessed, analysed and fully defined by the structural designer or structural engineer of the site in question. In correspondence with the cantilevers and masonry hammers, it may be evaluated whether to increase the number of connectors. In order to carry out a workmanlike intervention, it is strongly recommended to use PALLADIO GLASS CONNECTOR L connectors, pre-formed in GFRP glass fibre, produced using the pultrusion technique and certified as a specific component for reinforcement packages with reinforced plasters.
-In the case of reinforcement on only one side of the panel, proceed with drilling the 12 mm diameter holes. In such a case, the depth of the holes must be sufficient to reach the outermost layer of the side opposite to the one where the application of the reinforcement is carried out. As indication, a minimum depth of 2/3 of the wall thickness may be considered.
-In the case (recommended) of reinforcement application on both sides of the panel, the hole must be through. For further details, please refer to the specific product data sheet.

4. Carry out thorough cleaning of the holes using compressed air. If the connectors are to be fixed by means of chemical anchors based on epoxy resin or vinylester of the PALLADIO line, avoid washing with water. In the presence of perforated bricks we recommend, in order to reduce the dispersion of the chemical anchor inside the cavities, to insert inside the previously realised holes common socks or metal containment cages with a diameter suitable with that of the previously realised hole and with length equal to that of the perforation.
5. Proceed installing the connectors inside the holes. The fastening of the pre-formed L-shaped connectors to the support must be done using suitable certified anchors based on vinylester resins, from the PALLADIO line. The chemical anchor must be injected into the previously prepared holes for approximately 2/3 of their total volume. Once the holes have been filled, it will be possible to proceed with the manual insertion of the connectors. It is also possible, in order to guarantee a better anchorage of the net and to optimise the redistribution of the stresses, to position, between the net and the connectors, 20x20 cm ^{2} gussets, obtained from the net or pre-printed, mounted at 45°to the main directions of the net.

NOTE #1
As an alternative to pre-formed fibreglass connectors, should it be necessary and always in agreement with the designer or structural project leader of the site, it is possible to use helical connectors in AISI 304/316 stainless steel of the PALLADIO HELICAL BAR type with a diameter of no less than 8-10 mm. However, this choice is not recommended in the presence of stone masonry.
The helical bars are to be installed dry inside pre-drilled holes previously made in the masonry support according to the design diagram:
- In the case of installation of the reinforcement system on one side of the masonry face only, the pre-drilling, with a diameter smaller than that of the bars*, must be carried out to a depth of approximately 2/3 of the wall thickness
- If the reinforcement system is installed on both sides of the wall face, the pre-drilled hole, with a diameter smaller than that of the bars*, must be drilled through on both sides.
* The diameter of the pre-holes must be smaller than that of the chosen helical bars. In any case, this aspect should be analysed directly in site by means of tests on the involved substrate.
Following proceed by removing all loose material inside the pre-holes with compressed air. Screw the helical bars using the appropriate mandrel, to be installed in the screwdriver equipped with SDS-Plus coupling and set only in percussion mode if possible.
The bars will have a length equal to the thickness of the support to be reinforced, increased by the portions that must protrude from the support. The indicative length of

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the latter is approximately 10 cm. The portions of the bars that protrude out of the support will later be turned L-shaped in adherence to it, thus mechanically fixing the mesh and any pre-formed angles.
As indicated for fibreglass connectors, in order to guarantee a better anchorage of the net and to optimise the redistribution of stresses, it is possible to position 20x20 cm² gussets, obtained from the net or pre-formed, mounted at 45°to the main directions of the net.

NOTE #2
In any case, regardless of the type used, it is advisable to limit the deepening of the connectors, within their respective pre-holes, to a distance of approximately 1cm from the previously prepared support. This will make it possible to fix the reinforcement system, mesh and relative angles, in a position slightly detached from the substrate and thus guarantee that, at the end of the subsequent plastering operation, the reinforcement system will be completely encapsulated within the structural plaster. Therefore, proceed by fixing the structural mesh to the head of the connectors by means of common clamps in such a way as to ensure that it remains in a position far away from the support during the plastering phase.

6. Proceed on a suitably wet and clean substrate, with the application of PALLADIO RINFORZA NHL M10, up to a minimum thickness of 3 cm net of the levelling of the substrate, as defined in accordance with the Italian Guidelines. The application must be carried out in layers respecting the maximum thickness of 2 cm. The first layer will basically serve to fill the space behind between the mesh and the substrate and cover the mesh and connector system. The second layer of plaster should achieve a minimum thickness of 3-5cm. This must be applied in fresh-on-fresh conditions, within 24 hours from the application of the previous one, which must always be assessed depending on the environmental conditions present.

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Example no. 2: Repair using the 'sew-fit' technique
The repair of cracks in brickwork or mixed masonry using the 'sew-stitch' technique is carried out according to the following steps:

1. Carry out the removal (splitting) of the heavily deteriorated or disintegrated external elements by checking palm by palm the stability of the individual ashlars and bricks. Strip out loose bedding joints. It is preferable to proceed by manual rather than mechanical means, in order to avoid harmful blows and vibrations. If needed, make appropriate provisional works, preferably by putting the shoring in place.
2. Clean surfaces by washing with low pressure water.
3. Proceed with the reconstruction (stitching) of the portion of masonry removed, starting from the bottom and using, where possible, the removed ashlars of good quality or, in any case, materials as similar as possible to the originals and mechanically compatible. Reposition the ashlars, taking care to adequately anchor them to the existing masonry. Use PALLADIO RINFORZA NHL M10 as bedding mortar, with limited thickness joints, to control the rearrangement deformations. Load the reconstructed portions progressively using hard brick wedges to be inserted between the reconstructed and existing portions. In the case of exposed facade maintain the bedding mortar at the necessary depth from the surface of the facade to carry out subsequent grouting.

Warnings

- Consult safety data sheet before use.
- The product contains no organic components.
- An increase in the overall percentage of organic components in a CRM system, including the reinforcing mesh coating, may correspond to a decrease in permeability, durability and fire behaviour.
- Do not add additives, binders, aggregates or other components outside the mixing water.
- Do not apply on existing plaster and substrates that are not adequately clean and compact.
- Do not apply on gypsum-based substrates and smooth concrete.
- Do not apply on large portions of non-absorbent substrates. Use GALILEO MURATURA.
- Apply for layers up to 20 mm thick. Do not apply more than 50 mm without the use of a supporting mesh.
- Apply PALLADIO RINFORZA NHL M10 at a temperature between +5°C and +30°C; in case of low temperatures (5°C÷10°C) it is advisable to mix the material with warm water (30°C÷40°C).
- Wait for the plaster to cure completely (28 days) before proceeding with finishing work. It is recommended, in any case, to carry out a reinforced smoothing cycle.
- If any doubt about the suitability of the substrate or about the applicability of the product, please contact our Technical Assistance.

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For the application of this product and the corresponding inorganic matrix system, it is recommended to rely on contractors with specific and proven skills in the application of composite materials on masonry and concrete structures. In particular, installation personnel must have specific training in the application of reinforcement systems for structural purposes. The contractors must also verify that the products comply with the prescriptions indicated by the Designer. In case of unavailability of materials with the indicated requirements, the contractors must agree about possible alternatives with the Designer and/or the Works Manager.
The indications contained in this technical data sheet are indicative, general and nonbinding, they do not constitute specifications and do not in any way replace the design phases.

Specification item
Execution of repair, structural reinforcement, improvement or seismic upgrading of masonry, tuff, natural stone artefacts and structures, using the CRM reinforced plaster technique. The work will be carried out using plaster and masonry mortar with high mechanical resistance, Class M10 according to UNI EN 998-2, based on NHL 5 natural hydraulic lime (such as PALLADIO RINFORZA NHL M10 by Fornaci Calce Grigolin S.p.A.), with a maximum grain size of 3 mm, adhesion to the brick of no less than 0.8 N/mm2, water absorption class W2. The mortar must be laid with a minimum total thickness of 3 cm. The alkali-resistant glass fibre mesh, impregnated with thermosetting epoxy resin, 550 g/m2 , with 80 x 80 mm mesh (such as PALLADIO GLASS MR 88 by Fornaci Calce Grigolin S.p.A.) shall be monolithically fixed to the support by means of preformed L-shaped, alkali-resistant connectors in fibreglass impregnated with thermosetting epoxy resin (such as PALLADIO GLASS CONNECTOR L by Fornaci Calce Grigolin S.p.A.) to be anchored to the support by means of a vinylester resin based chemical anchor (such as PALLADIO FIS V 410 C or PALLADIO INIEZIONE VE by Fornaci Calce Grigolin S.p.A.). Alternatively, in the case of reinforcement arranged on both sides of the panel, it is possible to use helical bars in Aisi 304 stainless steel (type PALLADIO HELICAL BAR), to be folded L-shaped outside the perforation.

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TECHNICAL DATA	RESULTS
Specific weight	1550 kg/m³ deter.in free fall
Maximum diameter	3 mm
Water in the mix	approx. 18%
Max. application thickness per layer	20 mm
Flexural strength at 28 days	3,0 N/mm²
Compressive strength at 28 days	≥ 10 N/mm²
Compressive modulus of elasticity at 28 days	10 ± 1 GPa
Theoretical consumption	approx. 16 kg/m² per 1 cm thickness
Permeability to water vapour μ	20
Reaction to fire	class A1
Adhesion to brick	> 0,8 N/mm²
Water absorption	W2
Fracture type (FP)	A
Specific weight of hardened material	approx. 1900 kg/m³
Thermal conductivity λ	0,98 W/mK

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