



Rev 0  
02/22



# GRAUTEK R

Sulphate-resistant fiber-reinforced thixotropic mortar with compensated shrinkage



## DESCRIPTION

GRAUTEK R is a premixed, cement-based, single-component, fiber-reinforced mortar to be mixed with water in order to obtain thixotropic, shrinkage-compensated mixtures. GRAUTEK R develops high initial and final mechanical strength, it is waterproof, durable even in highly harsh environments and ensures high adhesion to steel and concrete. Thanks to its special formulation, GRAUTEK R is particularly suitable in sulfate containing environments because it is sulfate resistant.

GRAUTEK R contains no metal parts and is chloride free.

## FIELDS OF USE

GRAUTEK R is suitable for structural restoration, maintenance and renovation of damaged concrete and reinforced concrete structures exposed to extremely harsh environments. GRAUTEK R is especially suited for:

- structural restoration of reinforced concrete pillars, beams, floors and walls, including prefabricated ones, subject to sulphate aggression;
- volumetric reconstruction and jacketing of concrete structures with thickness up to 4 cm for each layer;
- hydraulic works, infrastructures, viaducts and tunnels, even on structures in contact with sea water;
- restoration of the cortical layer of the concrete and repair of the concrete cover detached as a result of the oxidation of the reinforcing bars.

## TECHNICAL SPECIFICATIONS

STATE	powder
COLOUR	cement gray
AGGREGATE $D_{max}$	2,0 mm
APPARENT DENSITY	1,2 kg/dm <sup>3</sup>
CHLORIDE IONS CONTENT ( $\leq 0,05\%$ )	0,012%

Optimal performances are achieved at 20°C and 50% RH. Curing and placing times may vary during wintertime. Respect the indicated mixing ratio and do not use the content of open or damaged bags. Store the product at room temperature for 24 hours prior to the placing.

## APPLICATION SPECIFICATIONS

MIXTURE COLOUR	Gray
MIXING WATER	3.8 ÷ 4.2 l/bag
MIXTURE VOLUME MASS	2170 Kg/m <sup>3</sup>
pH MIXTURE	> 12
MIXTURE FLOW UNI EN 13395	35-45 mm $\pm$ 10 mm
APPLICATION TEMPERATURE	5 - 35°C
MIXING DURATION	60 minutes (20°C 50% U.R.)
COMPLETE HARDENING	28 days (at 20°C)

TECHNICAL DATA SHEET



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WAITING TIME BETWEEN LAYERS	at least 30 min (23°C 50% U.R.)
THICKNESS	2 to 6 cm
CONSUMPTION	19 Kg/m <sup>2</sup> for cm of thickness (21,7 Kg/m <sup>2</sup> for cm of thickness of fresh mortar)

## ADVANTAGES

GRAUTEK R's features enable structural restoration of artifacts, that are subject to high physico-chemical and environmental aggression.

The intervention is highly reliable and long-lasting, which means that it significantly reduces the maintenance costs.

The product's specific features are:

- Resistance to sulfates and chemicals: GRAUTEK R has a high compactness, low capillary porosity and high resistance to aggressive agents in the environment such as chlorides and sulfates and to lubricating oils, thanks to the peculiar composition of its constituent elements. It also features an excellent resistance to freeze-thaw cycles.
- Absence of hairline cracks and plastic shrinkage cracks: GRAUTEK R doesn't feature cracks nor plastic shrinkage cracks thanks to the use of special fibers that counteract the cracking phenomenon.
- Counteracted air expansion: used in conjunction with the curing additive, it allows the expansive phenomenon to take place even with air curing.
- Placing versatility: GRAUTEK R can be applied by trowel or by spraying it, in thicknesses up to 4 cm in a single layer. GRAUTEK R can also be pumped over long distances, sprayed on, and can be subjected to stress after a short curing time.

## TECHNOLOGY

### CONTRASTED EXPANSION

The additives in the mortar facilitate the development of the expansive phenomenon even in the absence of maturation in a sufficiently humid environment, ensuring peak performance even under actual site conditions. The shrinkage control gives the mortar dimensional stability and absence of cracks, resulting in a better adherence of the mortar and monolithicity with the support.

The internal-curing technology at large improves performances in hot climates.

## METHOD OF USE

### CLEANING OF THE SUPPORT

- remove all inconsistent pieces of concrete, including grout slurry, from the area to be repaired, by mechanical chiseling or by high-pressure washing, paying attention not to damage the structures.
- remove stains, efflorescences or impregnations of oil, grease, paint, lime, dust, dirt, etc.;
- remove any previous restoration work if it is irreparably damaged or deteriorated.

### SUPPORT PREPARATION

- Roughen the surface with mechanical means such as bush-hammering machines, chisel guns or hydrodemolition (the latter does not cause any damage to the substrate and is recommended for large areas) until the healthy and compact concrete is reached to facilitate the adhesion of the mortar to the support. The surface must turn out to have a roughness of at least 5 mm, while the edges that delimit the restoration area must be scarified for a depth of at least 10 mm with a sharp-edged finishing. The roughening of the superficial layer is fundamental both to facilitate the adhesion of the mortar and to guarantee the correct development of the expansion phenomenon.
- Moisten the surface with pressurized water until it is saturated. This procedure makes it possible to prevent the support from absorbing the mixture water, which could cause cracking phenomena and a reduction of the adhesive capacity of the mortar. It also



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enables the removal of residue caused by the roughening of the concrete substrate. Excess water must evaporate completely before performing the restoration.

## PROTECTION OF THE REINFORCING BARS

- Sandblast the reinforcing bars and remove all inconsistent parts such as rust flakes or material fragments that may trigger the corrosion process or affect adhesion. Scarification of the substrate by hydrodemolition also effectively cleans the irons, making the sandblasting process unnecessary.
- Protect the reinforcement rods by applying the alkaline, corrosion inhibitor (PROTEK) treatment.

## ADDITIONAL REINFORCEMENT

- For coatings thicker than 2 cm, it is recommended to place an electro-welded mesh with spacers (at least 1 cm from the support) and to provide a concrete cover of at least 1,5-2 cm.

## MORTAR PREPARATION

GRAUTEK R mortar is mixed in a site concrete mixer. Pour the mixing water in the mixer as according to the suggested mixing ratio: 3.8-4.2 litres of water per each 25 kg bag of GRAUTEK R.

Pour the product little by little, without interruption, stirring for at least 4 ÷ 5 minutes until the mixture is homogeneous and smooth. Check that all the product has been correctly mixed and that there is no powder residue on the walls of the concrete mixer. A low-speed drill, with a mixing pod, can be used in order to prepare small amounts of product. An admixture added to the mix at a dosage of 1% of the weight of the mortar (0.3 kg per bag) acts as an internal curing agent, and facilitates the air expansion phenomena. The additive affects the mortar curing, so it is advisable to adjust the dosage according to the room temperature. In hot climates the additive enables a good maintenance of workability while in case of temperatures between 5 and 10 ° C, in order to avoid an excessive slowdown of the setting time, the dosage can be reduced.

## WARNINGS

### IN WARMER CLIMATES

- Store GRAUTEK R in the shade;
- Carry out the work in the early morning hours, and pause them during the sunniest hours. It would be better to start the work in the late afternoon hours, provided that the structure has been subjected to continuous wetting for at least 6 hours before the start of work;
- To get the best performance out of GRAUTEK R, a proper curing is required, using the additive, which can be applied by spraying it or by using a brush.

### IN COLDER CLIMATES

- Store GRAUTEK R in a heated room if possible;
- Do not apply the product at temperatures below 0°C;
- Start works late in the morning;
- Make sure that the support is not frozen.
- Water saturation of the substrate: carry out all substrate preparation operations and saturate the concrete or brick with water for at least 6 ongoing hours before placing GRAUTEK R. Free water on the surfaces must be removed with compressed air or rags.

## APPLICATION

GRAUTEK R can be applied by using a trowel or by spraying it. The product must be applied on clean surfaces, which should be roughened and saturated with water as indicated in the previous paragraph. As an indication, GRAUTEK R's finishing times are around half an hour during the summer season and around 1 hour during the cold season.



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## THICKNESS UP TO 2 CM

With such a limited thickness it is not possible to place an electro-welded mesh and therefore it is necessary to create an accentuated roughness in the substrate, so as to guarantee a valid contrast to the initial expansion of the placed mortar. A simple sandblasting of the substrate is not sufficient.

## THICKNESS OVER 3 CM

Place an electro-welded mesh with spacers to keep it uniformly detached from the substrate by at least 1 cm and provide a concrete cover of at least 1.5 - 2 cm.

## CURING

The admixture, added to the mix in the dosage of 1% of the weight of the mortar, acts as an internal curing agent, regulating water evaporation, reducing shrinkage and cracking, and facilitating the curing process. Additives in GRAUTEK R enable a proper expansion in air, reducing shrinkage phenomena by 20-50% if compared to the non-additive product. To ensure proper curing of the product even when the climate is dry or the surfaces are excessively exposed to wind or sunlight, we recommend the use of a curing film (TEKNAPUR).

## SPECIFICATIONS

For structural restoration works, volumetric reconstructions, and thick coatings in highly harsh environments, a thixotropic, fiber-reinforced, sulfate resistant mortar with compensated shrinkage, such as GRAUTEK R by TEKNA CHEM will be used, in accordance with UNI EN 1504-3, Class R4, to be applied with a thickness up to 4 cm for coat. The product must be characterized by a high adhesion to the support and the development of high initial and final mechanical strengths.

## PACKAGING AND STORAGE

GRAUTEK R is packaged in 25 kg polythene bags. In the original package, properly stored indoor in a dry place, the product maintains its characteristics for one year.

## WARNINGS

Since it is a cement-based product it features the same recommendations as for the use of cement.

See the safety data sheet.

## LEGAL NOTES

The information contained in this technical data sheet, even though it represents the most advanced stage of knowledge, does not exempt the user from running accurate preliminary tests under their own conditions of use and operation. We therefore decline any responsibility for the improper use of the product.

### Rate B.009.220.02.a

#### Premixed thixotropic mortar, fiber-reinforced with synthetic fibers

Supply and application of contrasted expansion mortar with air curing, containing polyacrylonitrile synthetic fibers and for the rebuilding of degraded concrete structures.

The placing of the mortar must be carried out after having adequately prepared the support (to be calculated separately).

The product shall meet the following performance characteristics:

- Compressive strength at 28 days = 55 MPa (UNI EN 12190)
- Compressive strength at 7 days = 40 MPa (UNI EN 12190)
- Flexural strength at 28 days = 7 MPa (UNI EN 196/1)
- Flexural strength at 7 days = 6 MPa (UNI EN 196/1)
- Compressive elastic modulus at 28 days between 26 GPa ÷ 30 GPa (UNI EN 13412)
- Adherence to concrete (UNI EN 1542) = 2 MPa



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- Thermal compatibility measured as adhesion (UNI EN 1542) after 50 freeze-thaw cycles with de-icing salts (UNI EN 13687) = 2 MPa
- Capillary Absorption (UNI EN 13057) = 0,3 kg m<sup>-2</sup> h<sup>-0,5</sup>
- Counteracted expansion with air curing at 1 day (UNI 8147) = 0,04%

The product must be CE marked, as according to UNI EN 1504-3 with the 2+ Performance Evaluation and Verification system among those envisioned for by the EU Regulation 305/11.

## Rate B.009.220.02.a

### Premixed thixotropic fibre-reinforced mortar with synthetic fibres

Supply and application of mortar with contrasted expansion with air curing, containing polyacrylonitrile synthetic fibers and for the reconstruction of degraded concrete structures.

The application of the mortar must be carried out after adequate preparation of the support (to be calculated separately).

The product must meet the following performance characteristics:

- Compressive strength at 28 days = 55 MPa (UNI EN 12190)
- Resistance to compression at 7 days = 40 MPa (UNI EN 12190)
- Resistance to flexion at 28 days = 7 MPa (UNI EN 196/1)
- Resistance to flexion at 7 days = 6 MPa (UNI EN 196/1)
- Compressive elastic modulus at 28 days between 26 GPa ÷ 30 GPa (UNI EN 13412)
- Adherence to concrete (UNI EN 1542) = 2 MPa
- Thermal compatibility measured as adhesion (UNI EN 1542) after 50 freeze-thaw cycles with de-icing salts (UNI EN 13687) = 2 MPa
- Capillary absorption (UNI EN 13057) = 0.3 kg m<sup>-2</sup> h<sup>-0.5</sup>
- Counteracted expansion with air curing at 1 day (UNI 8147) = 0.04%.

The product must be CE marked according to UNI EN 1504-3 with the Performance Evaluation and Verification System 2+ among those provided for by the EU Regulation 305/11.



PERFORMANCE CHARACTERISTICS WATER MIXTURE 18%			
PERFORMANCE CHARACTERISTIC	TEST METHOD	REQUIREMENTS ACCORDING TO EN1504-3 FOR CLASS R4 MORTARS	PRODUCT PERFORMANCE
BLEEDING	UNI 8998		none
COMPRESSIVE STRENGTH (MPa)	EN 12190	$\geq 45$ (after 28 days)	>40 MPa a 1gg >50 MPa a 3gg >60 MPa a 7gg >80 MPa a 28gg
FLEXURAL STRENGTH (MPa)	EN 196/1	none	>5 MPa a 1g >6 MPa a 3gg >7 MPa a 7gg >8 MPa a 28gg
ELASTIC MODULUS IN COMPRESSION (GPa)	EN 13412	$\geq 20$ GPa (after 28 days)	>26 Gpa
ADHESION ON CONCRETE - ADHESIVE BOND - DIRECT DRIVE (support type MC 0,40 ratio w/c=0,40 according to EN 1766	EN 1542	$\geq 2$ MPa (after 28 days)	>2,2 Mpa
ADHESION ON CONCRETE - THERMAL COMPATIBILITY - FROST/THAW WITH THAWING SALTS (support type MC 0,40 ratio w/c=0,40 according to EN 1766	EN 13501-1	$\geq 2$ MPa (Bond strength after 50 cycles)	>2,1 MPa
AIR COUNTERACTED EXPANSION ( $\mu\text{m}/\text{m}$ )	UNI 8147 method A	none	0,4 $\mu\text{m}$ after 28 days
AIR-CONTRASTED SHRINKAGE/EXPANSION ( $\mu\text{m}/\text{m}$ )	EN 12617-4	$\geq 2$ MPa	>2 MPa
CRACKING RESISTANCE	"O Ring Test"	No crack 180 days	Passed
AIR HYGROMETRIC FREE EXPANSION	Linear bar	Convex arching at 24 hours	Passed
RESISTANCE TO ACCELERATED CARBONATION	EN 13295	Carbonation Depth(dK) $\leq$ of the reference concrete reference MC (0,45)	Passed
WATERPROOF in PRESSURE -depth of penetration-	EN 12390/8	None	None
CAPILLARY ABSORPTION	EN 13057	< 0,5	<0,1
CHLORIDE ION CONTENT	EN 1015-17	$\leq 0,05\%$	<0,02%
REACTION TO FIRE	EN 13501-1	Euroclass A1	A1



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