

memory[®]-steel

REINFORCEMENT FOR CONCRETE AND MASONRY



memory[®]-steel

A shape memory alloy like memory[®]-steel remembers its original shape and changes the atomic crystal structure when pre-strained in longitudinal direction. During the activation (heating process on construction site) a deformation back into the original crystal lattice structure takes place. If this deformation is prevented by anchoring to the concrete structure, prestressing takes place.



New possibilities

STRENGTHENING FOR CONCRETE CONSTRUCTIONS AND MASONRY

This unique ability enables numerous applications in the field of structural reinforcement and repair. Robust and easyto-install solutions are possible for applications in building, industrial and bridge construction as well as for earthquake strengthening. Cleverly used and combined, our sustainable and 100% recyclable systems can extend the service life of a structure.

- Easy-to-install flexural and shear reinforcement of reinforced concrete
- Simple seismic strengthening of masonry
- Active and immediately load-bearing reinforcement (prestressing)
- High ductility (joint formation/force redistribution possible)
- Increases the service life of the structure

- Robust anchoring in the core concrete
- Corrosion and fire protection by mortar/concrete covering
- Reduction of deflections and crack opening
- Stress relief of the internal reinforcement
- Increased serviceability
- Combination with fibre composite materials possible
- Minimal space requirement



Building/industrial construction



Bridge construction

Seismic strengthening

EVOLUTION IN CONSTRUCTION: MEMORY®-STEEL SETS NEW STANDARDS

Increasing the service life: memory[®]-steel re-bar is applied to the structure in Sika concrete repair mortar and prestressed by heating. re-bar is load-bearing immediately after cooling and actively relieves the structure. Sika repair mortar is used to replace old, damaged concrete. The Sika mortar layer serves as an alkaline deposit (corrosion protection) and protects in the event of fire.



Thanks to the active prestressing, less deflection and subsequent crack opening can be expected. The prestressing force is transferred into the healthy core concrete of the existing structure. re-bar as a robust flexural or shear reinforcement increases the service life of a structure. Stresses in the existing steel reinforcement in the concrete are actively reduced.

SERVICE LIFE:

STRESS IN EXISTING REINFORCEMENT:



Ductile reinforcements with memory®-steel: Thanks to the high material ductility of >20%, concrete failure in the compression zone is decisive in flexure. Force redistribution and optimum utilisation of the load-bearing system are also possible after strengthening and prestressing (σ_p) with memory[®]-steel. memory[®]-steel is therefore particularly suitable for earth-quake reinforcement and strengthening of masonry.



THE FUTURE IS NOW: MEMORY[®]-STEEL FOR ROBUST AND DURABLE STRUCTURES





Tested supplementary Sika products:

- SikaGrout[®]-314 N pouring grout (horizontal)
- Sika MonoTop[®]-452 N concrete repair mortar (horizontal)
- Sika MonoTop[®]-422 PCC concrete repair mortar (inclined and vertical surface)
- Sika MonoTop[®]-412 Eco/-4012 sprayed mortar (vertical and overhead)
- Sika Anchor Fix®-3030 anchor adhesive



re-bar 10 & 16



The ribbed memory[®]-steel re-bar 10 and 16 is used in various areas of structural reinforcement (for concrete and masonry / for statically and dynamically loaded elements).

The bars are connected and installed using screw couplers. After its anchoring to the concrete base, re-bar is heated/prestressed. In its final state, re-bar is fully embedded in Sika repair mortar. The bars act as internal prestressing with bond. Minimum component dimensions and concrete covers in accordance with the local standard are required as protection against the effects of fire.

Material properties	Max. tensile strength	Design value tensile strength	Elongation at break	Modulus of elasticity (for calculation)*
re-bar 10 & 16	>700 N/ mm ²	520 N/ mm ²	20%	70 kN/mm ²

*After heating/activation the elastic modulus is 160 kN/mm² up to a stress increase of 50 N/mm², after which it decreases to 70 kN/mm². This value is used for calculation.

Product data	Nom. diameter	Cross-section	Weight	Desing value tensile force
re-bar 10	10.7 mm	89.9 mm ²	0.71 kg/m	46.7 kN
re-bar 16	16.5 mm	211.2 mm ²	1.67 kg/m	109.8 kN

Prestressing	Heating temperature	Prestress t _o	Prestressing force t_0	Relaxation
re-bar 10	200 °C (Electricity)	350 N/mm ²	31.5 kN	15 % t _∞
	300 °C (Gas)	400 N/mm ²	36.0 kN	15 % t _∞
re-bar 16	200 °C (Electricity)	260 N/mm ²	54.9 kN	15 % t _∞
	300 °C (Gas)	320 N/mm ²	67.6 kN	15 % t _∞

Robust anchoring: The force is transferred via mortar bond. Thanks to the use of bent glued-in end hooks the forces are anchored deep into the core concrete (1). For slim concrete beams, the anchoring zone can be supplemented with additional stirrups (2, 3). For seismic reinforcement of masonry, anchoring must be carried out in the concrete (ceiling, floor slab, concrete socket) (4).



re-plate 120/1.5



The memory[®]-steel re-plate 120/1.5 is used for smaller reinforcements of slender concrete slabs in building construction (dry interior / for statically loaded elements).

End-anchored on both sides, re-plate acts as an external tension strip without bond. re-plate is supplied pre-strained and pre-punched from the factory. The mechanical end anchoring is carried out with a Hilti direct fastening system. The plate is heated with a gas burner or an infrared heater to activate the prestress.

Material properties	Max. tensile strength	Design value tensile strength*	Elongation at break	Modulus of elasticity (for calculation)**
re-plate 120/1.5	>700 N/ mm ²	460 N/ mm ²	20%	70 kN/mm²

* Design values for 12 nails with concrete compressive strength (cube) >20 N/mm² (with safety factor 1.3)

** After heating/activation the elastic modulus is 160 kN/mm² up to a stress increase of 50 N/mm², after which it decreases to 70 kN/mm². This value is used for calculation.

Product data	Width / Thickness	Cross-section	Weight	Desing value tensile force
re-plate 120/1.5	120 mm / 1.5 mm	180 mm ²	1.37 kg/m	83.1 kN

Prestressing	Heating temperature	Prestress t ₀	$\begin{array}{l} \text{Prestressing} \\ \text{force } \mathbf{t}_{_{\mathrm{O}}} \end{array}$	Relaxation
re-plate 120/1.5	160 °C (Infrared)	300 N/mm ² *	54.0 kN	15 % t _∞
	300 °C (Gas)	380 N/mm ^{2**}	68.4 kN	15 % t

* if corrosion protection was applied on both sides in the factory

** if corrosion protection is applied on one side on site.

Standard corrosion protection: re-plate is cleaned on both sides, grouted on the sides after prestressing (Sikaflex[®] PRO-3 Purform) and corrosion protection (Macropoxy[®] EG-1 Plus, formerly SikaCor[®] EG-1 Plus) is applied to the cleaned surface on the outside. Double-sided corrosion protection applied in the factory is possible (activation with an infrared heater).

Cost-effective fire protection: The fire protective spray plaster SikaCem[®] Pyrocoat is applied by machine onto the replate (VKF/AEAI approval Switzerland). The corresponding layer thicknesses are shown in the table below.



Fire protection measures and the specified layer thicknesses are guide values and must be adapted to the locally applicable regulations and standards.





Since 2012, re-fer has been a global leader in structural reinforcement using patented memory[®]-steel technology. Thanks to our customer proximity and experience, we combine research and development with up-to-date construction practice. Our engineering department supports you in your projects and offers training on our strengthening solutions. Sales outside Switzerland are handled by our partner Sika.

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