

# Method Statement re-plate

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# 1 Scope

This method statement supplements the product data sheet of the re-plate system. The application of the prestressed reinforcement is carried out by qualified specialist companies trained by re-fer. The specialist company ensures that all aspects of safety during application and activation (heating) are observed by the employees.

This document must be used and referred to, in combination with all other relevant product data sheets, any safety data sheets of third-party products and the respective project specifications.

## 2 System description

re-plate is a method for the external strengthening and prestressing of slender reinforced concrete slabs, preferably in dry interior rooms in building construction. The mechanical end anchorage is composed of a Hilti direct fastening system. The static design of the reinforcement system is carried out by a specialist engineer with suitable qualifications.

### 2.1 Limitations

This product must only be used in accordance with its intended purpose.

Local differences in some products may result in performance variations. The latest and relevant local product data sheet must be used or referenced.

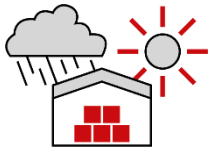
For any other specific construction / build information refer to the architect's, Engineer's or specialist contractor's details, drawings, specifications, and risk assessments.

## 3 Products

Brand	Description
re-plate 120/1.5	The external strengthening plate made of memory <sup>®</sup> -steel is used for structural reinforcement of concrete structures (for components subjected to static, in exceptional cases non-static, loads). re-plate is delivered pre-stretched, pre-punched and cut to size according to the parts list at the factory (also available with additional corrosion protection).
Hilti universal nail X-CR 48 P8 S15	Nails for direct fastening applied with appropriate powder-actuated fastening tool and shot cartridges.
SikaCem <sup>®</sup> Pyrocoat	1-component, passive fire protection spray plaster system for machine or manual application indoors on concrete and steel, based on vermiculite, perlite, and cement.
SikaCem <sup>®</sup> Pyrocoat Base	Adhesive primer for SikaCem <sup>®</sup> Pyrocoat.
SikaCor <sup>®</sup> EG-1	2-component, micaceous iron oxide intermediate coating based on epoxy resin as additional corrosion protection for re-plate.
Sikaflex <sup>®</sup> PRO-3 Purform <sup>®</sup>	1-component, moisture-curing, elastic polyurethane sealant for gouging re-plate and concrete base.

Detailed information on the products is provided in the corresponding product data sheets.

### 3.1 Material storage



The materials must be stored in unopened original packaging in a dry and cool place. With regard to the minimum and maximum storage temperature, the respective information in the product data sheets must be respected. **Products must be protected from direct sunlight!** re-plate may only be transported in its original packaging or with other adequate protection against mechanical damage and heat exposure.

## 4 Equipment

### 4.1 Tools

Application of re-plate:



T-supports



Drill



Hilti powder-actuated fastening tool



Heating device Gas



Heating device infrared



Temperature sensor with contact pin

Application of fire and corrosion protection:

- Agitator with mixing paddle
- Trowel
- Mixing container
- Typical equipment: Putzmeister MP 25 / PFT G4 / M-Tec Duo-mix
- Glue gun and cartridges
- Brush

## 4.2 Cleaning

On site, the re-plate must be degreased on both sides before installation (Sika® Colma Cleaner) and cleaned with warm water. Care must be taken not to touch/contaminate the lamella after cleaning both sides.

All tools and accessories must be cleaned immediately after use (e.g. with Sika® Colma Cleaner). Cured material can only be removed mechanically.

## 5 Health and safety

### 5.1 Risk assessment



The risks to health and safety from everything including any defects in the structure, working procedures and all of the chemicals used during the materials installation must be properly assessed and safely accommodated.

Any working areas on platforms and temporary structures must also provide a stable and safe area to work. All work and working procedures must be carried out fully in accordance with the relevant local health and safety legislation.

### 5.2 Personal protection

#### Ensuring safety at work!



Safety shoes, gloves and other suitable skin protection must be always worn. It is strongly recommended to use new or clean disposable protective clothing during the preparation and application of the material. Heat-resistant protective gloves should be worn during the heating process.

As corrosion protection and fire protection products can cause skin irritation, nitrile-based protective gloves must always be worn when handling them. Protective cream must always be applied to hands and unprotected skin before starting work.

Suitable eye protection must always be worn during handling, mixing and installation of the products. Carrying an eye wash with you at all times is recommended.

Always wash hands with suitable soap and clean water after handling the products and before eating food, smoking, going to the toilet and after finishing work.

The work area must be well ventilated, and workers should take regular breaks in the fresh air to avoid health problems. Dust produced when drilling concrete can be dangerous. A vacuum cleaner can be used. Always wear a dust mask or respirator when drilling concrete. The concrete dust must not be inhaled.

For detailed health and safety information, refer to the relevant safety data sheet of the third-party product.

### 5.3 First aid



If the corrosion protection and fire protection products meet the eyes or mucous membranes, glasses must be taken off or contact lenses removed and the eyes rinsed with clean, warm water for 10 - 15 minutes and then a doctor must be consulted.

**FIRST AID** If chemicals come into contact with the skin, it must be cleansed immediately and rinsed thoroughly with clean, warm water.

For detailed health and safety information, see the corresponding safety data sheet of the third-party product.



## 5.4 Waste disposal

Do not empty any surplus material into drainage or water systems; dispose of all waste materials and packaging responsibly through licensed waste disposal facilities or contractors, fully in accordance with local legislation and the authorities' requirements. Also avoid any chemical materials run-off into soil or into waterways, drains or sewers.

Any waste must be disposed of in accordance with local legislation.

## 6 Substrate preparation

The re-plate lamellas are applied on the raw concrete base. Plaster, thermal insulations, paint, residues of adhesives or impurities in the area of the re-plate lamellas are fully removed. The substrate must be dry. Concrete protrusions and gypsum-based coatings must be cleared away. After checking the concrete quality of the substrate, the re-plate lamellas are applied. Flammable or smoke-producing materials around the reinforcement must be removed beforehand or protected during the heating process.

The spatial conditions regarding minimum geometric requirements must be checked. Also, the compressive strength of the concrete substrate must be verified in advance based on the minimum requirements according to the re-plate product data sheet.

During application, it must be ensured that the concrete surface in the area of the reinforcement is freely accessible (free of electrical cables etc.). It must be ensured that there is a minimum distance of 30 cm from the concrete ceiling for the installation of the lamellas and the heating process. Free accessibility must be ensured in the area of the end anchoring.

### 6.1 Preliminary testing of substrate

The quality of the supporting base is determined, for example, with a concrete testing hammer according to the local standard. For reinforcement with re-plate, the minimum concrete compressive strengths according to the data sheet must be observed.

## 7 Application

Before the installation on site, we always recommend preparing a checklist (see example in section 11.2) to ensure that all necessary tools and materials are available on site. The surrounding preconditions must be checked.

Information on the purchase of the necessary processing equipment, devices for activation and temperature measuring gauges can be obtained from re-fer's technical service. A re-fer application technician is available for site visits at a charge. Only licensed applicators are permitted to apply re-plate.



Figure 7.1



Figure 7.2



Figure 7.3

## 7.1 Positioning of plates

The position of the plates is marked on the concrete (laser, chalk line, etc.). re-plate is provisionally pressed and fixed to the supporting base with T-supports (props with support rail) [Figure 7.1]. Make sure that the lamella does not sag anywhere and that the distance between the support rails does not exceed 0.3 m.

## 7.2 Anchoring

A minimum of 12 nails per side (total 24 nails) are required for the re-plate end anchoring. The lamella has extra holes. The concrete must be pre-drilled through the pre-punched holes in the plate [Figure 7.2]. Always ensure that the drill bit is sharp to ensure a correct drilled hole and to prevent spalling of concrete grains. For an optimal drilling, the use of a low size drilling machine with small impact energy (e.g. type Hilti TE 2-A22 rotary hammer or similar) is recommended.

<b>Drilling depth:</b>	<b>Drilling diameter:</b>
40 mm	3.5 mm

In case of drilling failures (reinforcement hit, drilling bit broken off in concrete, etc.), reserve holes can be used, and an additional double row of nails must be placed.

The anchoring is done with a Hilti direct fastening system. The Hilti tool below is to be used with the appropriate shot cartridges to shoot the universal nails into the pre-drilled hole [Fig. 7.3]. The firing power can be adjusted on the device and adjusted to the strength of the concrete. After shooting, the nail head with the washer shall fit closely on re-plate.

<b>Hilti powder-actuated fastening tool:</b>	<b>Hilti powder cartridge:</b>	<b>Hilti universal nails:</b>
DX5 Kit	DX cartridge 6.8/11 M10 BULK red	X-CR 48 P8 S15
DX6 Kit	DX cartridge 6.8/11 M10-X10 T titan	

For the application, the minimum edge and centre distances as well as the geometric specifications according to the product data sheet must be observed. If these cannot be complied with or if other arrangements are required, re-fer should be contacted.

## 7.3 Activation of prestressing

For the activation with a gas burner, re-plate is heated to 300-350°C in sections of approx. 0.5 m length [figure 7.4]. A second person accompanies the process and controls/records the temperature with a temperature sensor [figure 7.6]. For activation with infrared (165°C), the infrared radiant heater IR-3000 [figure 7.5] is pressed against re-plate (incl. temperature control). The heating length of the radiant heater is approx. 1.30 m.

<b>Required power supply for infrared radiant heater:</b>
3x400 V, CEE 16A, 400V, 5-pole

Temperature control with an infrared thermometer is not possible because the surface of the re-plate reflects too much.



Figure 7.4



Figure 7.5



Figure 7.6

## 7.4 Note for combination with Sika® CarboDur® lamellas

Often re-plate is used to cover the service load and the fire load, Sika® CarboDur® CFRP lamellas for the remaining ultimate load. If both types of reinforcement are installed in the same direction, the slack applied CFRP reinforcement is always installed after the pre-tensioned re-plate reinforcement. If re-plate is applied transversely over CFRP lamellas, an E-glass fabric tape must be inserted at the crossing points as a thermal protection. The glass fabric tape should have an application temperature of up to approx. 450 °C (e.g. isoGLAS® 450, 3 mm thick). CFRP lamellas cannot be bonded over re-plate, as there would be no adhesive bond locally.

## 7.5 Note on plastering and coating work

re-plate can be covered with cement-bound plaster. Larger gaps (>2 mm) are filled with plaster. The plaster is prepared with a notched trowel and an alkali-resistant E-glass fabric (4x4 mm, approx. 0.5 m web) is worked in centrally over re-plate to create an approx. 4-5 mm thick mesh embedding. Plasters based on gypsum in the wet condition or with long-term moisture can lead to corrosion reactions. For this reason, re-plate should not have any contact surface with gypsum.

If coatings, paints or similar are applied on re-plate, their chemical compatibility with memory®-steel must be checked. In case of doubt, an intermediate coating SikaCor® EG-1 is to be applied. The lamellas can be gouged on both sides with Sikaflex® PRO-3 Purform® and are cleaned (Sika® Colma Cleaner). Immediately after that, the coating is applied (two-layers with approx. 120 µm thickness each). Make sure not to touch/contaminate the surface after cleaning. Country-specific requirements (e.g. Switzerland, SIA 257, Tab. 1) must be observed.

If re-plate comes into contact with cement slurry (cement milk) during subsequent mortar or concrete work, it must be cleaned immediately.

# 8 Application of fire protection

## 8.1 Preparations

If fire protection is required for the re-plate reinforcement measure, the concrete substrate and the lamellas are cleaned. Sika® Colma Cleaner is suitable for cleaning the lamellas to ensure that they are free of grease, oil, and impurities. With a layer thickness of approx. 1 mm, the plaster primer SikaCem® Pyrocoat Base is painted or sprayed on over the entire surface [Figure 8.1]. The corresponding product data sheet and the processing guidelines must be observed.



## 8.2 Fire protection system

Then a fine layer of approx. 10 mm SikaCem® Pyrocoat is sprayed on. At the sides, the re-plate strips are underfilled with spray plaster by squeezing it in. The spray plaster serves to level out unevenness and is used for mesh embedding [Figure 8.2]. For this purpose, an alkali-resistant glass-fibre plaster mesh is worked into the plaster layer over the entire length of re-plate. SikaWrap®-350 G Grid or equivalent (total glass fibre grammage 280 g/m<sup>2</sup>) is suitable as a glass fibre mesh. Afterwards, the spray plaster is applied to the required layer thickness. Missing areas and holes are closed by a smoothening [Figure 8.3]. The layer thicknesses given in the product data sheet are guide values and may have to be adjusted to the locally applicable official regulations and standards. The relevant product data sheet and the processing guidelines of re-plate and SikaCem® Pyrocoat must be observed.

The fire protection can be applied either locally over re-plate (0.5 m wide strips) or over the entire surface.



Figure 8.1



Figure 8.2



Figure 8.3

## 9 Application of corrosion protection

To prevent stress corrosion cracking in humid and chloride-containing environments (also during the entire construction phase), SikaCor® EG-1 is applied to re-plate in the factory as a protective coating. For this purpose, the lamella is blasted with corundum in the factory and the coating SikaCor® EG-1 is applied. Due to this protective coating (short-term thermal resistance of approx. 180°C), the heating temperature of the prestressing process is limited to 165°C. Accordingly, the infrared heater must be used.

After application, activation and cooling on site, re-plate is gouged on both sides with Sikaflex® PRO-3 Purform® to prevent water from penetrating between the concrete base and the reinforcement. In addition, any damaged areas of the corrosion coating and the anchoring nails are painted over with SikaCor® EG-1.

re-plate, however, is primarily used only in dry interior spaces in building construction.

## 10 Inspections and tests

Visual inspection and documentation of the installation and the heating temperatures is required at all stages. Preliminary examinations of the concrete compressive strength are to be made according to Chap. 6.1. For a follow-up check of the prestressing force, re-fer's technical service can be contacted. A special testing device is used to calculate, based on the crossbow principle for prestressing strands, the prevailing force in the re-plate via the expansion path and the measured lifting force.

## 11 Appendix

### 11.1 Weldability of memory®-steel

Thanks to the weldability of memory®-steel, special solutions for e.g. end anchorages are possible. Welding must be carried out by a licensed stainless-steel welder (tungsten tip, inert gas, welding material «Böhler A7» 1.6 mm wire or equivalent) and can be prefabricated in the factory or created on site. For this, more detailed information is to be obtained from re-fer.

### 11.2 On-site checklists

The lists below are suggestions that need to be adapted to local needs.

For the application of re-plate:

▪ Safety helmet	▪ Drill
▪ Protective goggles	▪ Drilling bits
▪ Dust mask	▪ T-supports
▪ Hearing protection	▪ Heating device gas
▪ Protective gloves	▪ Heating device infrared (incl. cables)
▪ Powder-actuated fastening tool	▪ Temperature sensor
▪ Powder cartridges	▪ re-plate lamellas
▪ Universal nails	

Additionally for the application of the fire or corrosion protection:

▪ Mixing container	▪ Possibly wooden battens for formwork
▪ Agitator / mixing paddle	▪ Possibly a levelling board
▪ Trowels	▪ Brush
▪ Spray gun for fire protection	▪ Glue gun
▪ SikaCem® Pyrocoat and Base	▪ SikaCor® EG-1
▪ Alkali-resistant E-glass mesh	▪ Sikaflex® PRO-3

	Yes	No
Has the concrete quality for the anchors been checked in advance?		
Have the necessary preparations of the subbase been made?		
Can the planned type of heating (gas or infrared) be used?		
Are the necessary electrical power supplies available?		
Can geometric requirements for the construction be met?		
Are there any obstacles? Is the ceiling level?		
Are there any deviations or changes to the engineer's specifications?		
Are there any problems (e.g. for the installation of the nails etc.)		
If so, please describe and explain in more detail:		

## 12 Legal note

The information, and - in particular - the recommendations relating to the application and end-use of re-fer products, are given in good faith based on re-fer's current knowledge and experience of the products when properly stored, handled, and applied under normal conditions in accordance with re-fer's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the products suitability for the intended application and purpose. re-fer reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local product data sheet for the product concerned, copies of which will be supplied on request.

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