METHOD STATEMENT

850 73 05 Application of Sikacrete®-213 F
Fire Protection Mortar

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ENGINEERED REFURBISHMENT

BUILDING TRUST

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1 SCOPE

This Method Statement describes the step-by-step procedure for applying **Sikacrete®-213 F** fire protection mortar, on concrete structures.

2 SYSTEM DESCRIPTION

2.1 WHAT IS SIKACRETE®-213 F

Temperatures above 400°C destroy concrete, because the vapour pressure of the capillary water (free water) and of the interlayer and gel water (chemical bonded) causes it to spall. The load-bearing effect of the steel reinforcement is also greatly reduced at temperatures above 250°C.

The high heat insulating effect of **Sikacrete®-213 F** protects the concrete, reinforced concrete or structural steelwork from these extreme heat stresses. **Sikacrete®-213 F** is a hydraulic bound, vermiculite-based spray applied mortar. It is a ready-to-use fire protection mortar in dry packs for application by the wet spray process. The pack size is 8 kg.

2.2 WHERE IS SIKACRETE®-213 F TO BE USED

- As protection for structural members for concrete, reinforced concrete at risk from fire, especially in tunnelling or in buildings (beams and columns).
- As protection for carbon and glass fibre reinforced polymer strengthening systems – for more information related to fire protection of strengthening system, refer to the article "Design and protection in case of fire - SikaWrap and Sika Carbodur" prepared by Sika's Technical Department.

2.3 FIRE RESISTANCE

Thanks to high-performance, multilayer-lattice silicate forming admixtures, **Sikacrete®-213 F** withstands all conventional heat stresses due to fire. The layer thickness of the mortar required is dependent on the fire resistance required. The outstanding characteristics of the special mineral aggregates and admixtures in **Sikacrete®-213 F** enable the thickness of the fire-resistant mortar layer to be kept to a minimum.

2.4 REFERENCES / CERTIFICATES

Sikacrete®-213 F was tested at the Testing Gallery Hagerbach, Switzerland (Accredited according to ISO IEC 17025 by the Swiss Federal Office of Metrology (OFMET)) after the European Standards RWS and ISO.

- Dutch RWS Curve (Rijkswaterstaat).
- ISO 834 (ETK) fire curve.
- Lachenbrand fire curve.

Sikacrete®-213 F was tested and certified by UL as effective mean of fire protection system for reinforced concrete members (reinforced restrained columns and beams) / carbon reinforced fibres strengthening systems Sika Carbodur® and SikaWrap®.

2.5 LIMITATIONS

- Minimum application and substrate temperature: +5°C
- Maximum application and substrate temperature: +35°C
- The mortar must not be applied on wet or surfaces with condensation present.
- The substrate temperature must therefore be at least 3°C above the dew point.
- Minimum layer thickness per layer: 10 mm
- Maximum layer thickness per layer: 40 mm.
- **Sikacrete®-213 F** must not assume any load-bearing function.
- **Sikacrete®-213 F** is a sacrificial layer and must be replaced in the event of a fire.

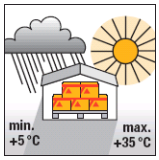
- **Sikacrete®-213 F** must not be exposed to weathering (frost, freeze / thaw, moisture, etc.) without additional protection.

3 PRODUCT

Sikacrete®-213 F is a ready-to-use dry product which need to be mixed with water.

Sikacrete®-213 F is supplied in 8 kg bags. Pallet: 45 x 9 kg = 360 kg.

3.1 MATERIAL STORAGE



Materials shall be stored properly in undamaged original sealed packaging, in dry cool conditions. Refer to specific information available on the Product Data Sheet regarding minimum and maximum storage temperatures. Do not allow contact with oxidising materials. Protect from moisture.

3.2 SYSTEM BUILD-UP

3.2.1 TUNNELS

	Typical Build-up	Frost	Frost & Humidity	Humidity	Freeze & Thaw	Mechanical Cleaning
Sika MonoTop®-1010	X	X	X	X	X	X
Sikacrete®-213 F	X	X	X	X	X	X
Reinforcing Mesh	X	X	X	X	X	X
Sika MonoTop®-3020*						X
Sikagard-705 L or Sikagard-706 Thixo		X	X		X	
Reactive Resin Protective Coating**			X	X	X	X

Note*: Other resurfacing mortars such as Sikadur®-331 W, Sika MonoTop®-725 Tunnel or equivalent can also be used.

Note:** Protective coating such as Sikagard®-340 WCT, Sikagard®-260 W PU or equivalent.

3.2.2 BUILDING (COLUMNS AND BEAMS) – FRP PROTECTION

	Typical Build-up	Thickness < 30 mm	Thickness > 30 mm	Increased Mechanical Protection*	Humidity	Freeze & Thaw
Sika MonoTop®-1010	X	X	X	X	X	X
Sikacrete®-213 F	X	X	X	X	X	X
Reinforcing Mesh			X			
Resurfacing Mortar*				X		
Sikagard®-705 L / Sikagard-706 Thixo						X
Sikagard®-675 W GB ElastoColor				X	X	X

Note*: Resurfacing mortar such as Sika MonoTop®-3020 or equivalent (e.g. when there is a need of increased resistance to mechanical damage as in the case of a column in a car park).

3.2.3 TUNNELS

In tunnel applications, the use of wire mesh reinforcement is always required regardless of the application thickness. Rear bracing or fixing of the reinforcement can prevent sections of the fire protection being removed to expose the substrate.

If additional frost and / or freeze / thaw resistance is required, the **Sikacrete®-213 F** fire protection layer shall be protected by a surface coating.

Maximum layer thickness per layer shall be lower than 40 mm.

Substrate: Cement laitance removed (roughness > 2 mm).

Wire mesh: Flat galvanised mesh (50x50 mm or 19x19 mm, e.g. Bekaert Armanet Flat or equivalent).

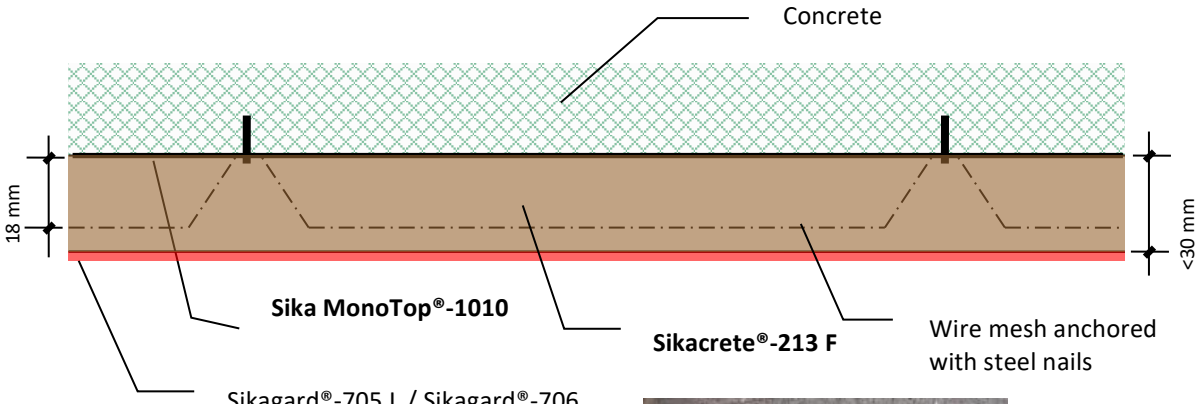
Anchorage: Hilti Kwik nail X-CR 48 P8 S15 or equivalent, 8 per m^2.

Bonding bridge: Sika MonoTop®-1010 or equivalent.

Fire protection mortar: **Sikacrete®-213 F**, 10 - 40 mm, wet sprayed then trowel finished.

Coating: 2 coats of Sikagard®-340 WCT or Sikagard®-260 W PU or equivalent.

Consumption: ~6 kg of powder/m^2 per 10 mm layer thickness – excluding wastage.



Cross-section of the Fire Protection System Structure.

The wire mesh is anchored with steel nails.

Note: If mechanical cleaning resistance is required, and to facilitate (to avoid rough surface for ease of cleaning), prior to apply the protective coating Sikagard®-340 WCT or equivalent, a resurfacing mortar such as Sika MonoTop®-725 Tunnel, Sika MonoTop®-3020 or equivalent, may be applied in order to smoothen the surface of the fire protection mortar.

3.2.4 BUILDING (COLUMNS AND BEAMS) – FRP PROTECTION

In building application, the use of wire mesh will depend on the thickness of application. Above 30 mm, a galvanised wire mesh (e.g. 3 mm – 1/8th Φ and spacing 50x50 mm – 2 x 2 inches) shall be mechanically installed on the surface of the concrete members.

A protective coating such as Sikagard®-675 W GB ElastoColor can be applied on the prepared surface of the fire protection mortar.

If additional mechanical resistance is required (e.g. on concrete column in car park), prior to apply the protective coating Sikagard®-675 W GB ElastoColor, a resurfacing mortar such as Sika MonoTop®-3020 or equivalent shall be applied in order to strengthen the surface of the fire protection mortar.

3.2.5 PRE-PROJECT PREPARATION

Especially in tunnels, water containing cracks in the member requiring protection MUST be pre-sealed, or the water must be blocked or removed. This prevents the fire protection layer becoming saturated with water and leading to premature failure later.

4 HEALTH AND SAFETY

4.1 RISK ASSESSMENT

The risk to health and safety from falling objects or defects in the structure shall be properly assessed.

Where structures may be unsafe, appropriate action shall be carried out to make the working area safe.

4.2 PERSONAL PROTECTION

Work safely!

Protective clothing must be worn. Wear always gloves and eye protection. Wash hands with suitable soap after handling products and before food consumption.

FOR DETAILED INFORMATION REFER TO THE RELEVANT MATERIAL SAFETY DATA SHEET.

4.3 FIRST AID

Seek immediate medical attention in the event of excessive inhalation, ingestion or eye contact causing irritation. Do not induce vomiting unless directed by medical personnel.

Flush eyes with plenty of clean water occasionally lifting upper and lower eyelids. Remove contact lenses immediately. Continue to rinse eyes for 10 minutes and then seek medical attention.

Rinse contaminated skin with plenty of water. Remove contaminated clothing and continue to rinse for 10 minutes and seek medical attention.

FOR DETAILED INFORMATION REFER TO THE MATERIAL SAFETY DATA SHEET.

5 ENVIRONMENT

5.1 CLEANING TOOLS / EQUIPMENT

Immediately after use, clean all tools and application equipment with water. Hardened / cured material can only be mechanically removed.

If resurfacing mortar and / or protective coating system is being used, refer to the respective Product Data Sheet for information related to the cleaning operation.

Uncured material and leachates must not be allowed to enter the groundwater or drainage systems.

5.2 WASTE DISPOSAL

Do not empty surplus material into drains; dispose responsibly through licensed waste disposal contractors in accordance with legislation and local / regional authority requirements. Avoid run off onto soil or into waterways, drains or sewers.

FOR DETAILED INFORMATION REFER TO THE MATERIAL SAFETY DATA SHEET.

6 SURFACE PREPARATION

6.1 CONCRETE

The concrete shall be clean and free of dust, dirt, oil, efflorescence and any other residual coatings. Any cement laitance must be removed.

Recommended roughness of the concrete surface shall be > 2 mm to achieve adequate bonding.

The concrete substrate should be roughened with ultra-high-water jet pressure or wet blasting and well pre-wetted but no water film at the surface prior to application.

6.2 GLASS OR CARBON FIBRE REINFORCED POLYMER

Refer to the respective Method Statement for more precision.

Installed Sika Carbodur® or SikaWrap® Strengthening Systems shall be at least 1 day old prior to install the fire protection.

SikaWrap®:

An additional layer of Sikadur®-330 resin must be applied over the final laminating layer (maximum 0.5 kg/m^2) and broadcast whilst still wet with Sikadur®-501 quartz sand (or equivalent) to improve the adhesion of the fire protection mortar.

Sika Carbodur®:

The surface shall be degreased and dedusting. If Sikadur®-330 is available on site (e.g. in case of shear and flexural strengthening work), apply the resin on the prepared laminate surface and broadcast whilst still wet with Sikadur®-501 quartz sand (or equivalent) to improve the adhesion of the fire protection mortar; in case it is not available, use Sikadur®-30 and broadcast as indicated earlier.

7 APPLICATION

7.1 BEFORE APPLICATION

Working space shall be clean and tidy with no obstructions.

Record the relative humidity, substrate and ambient temperature.

Do not apply the fire protection mortar if substrate temperature is at dew point. Only apply when the temperature is +3°C above dew point.

External applications shall be adequately protected. Do not apply fire protection mortar in windy or rainy conditions, or if there is a risk of frost within 24 hours.

7.2 PRIMING SUBSTRATE

7.2.1 TUNNELS

In tunnel applications, a bonding primer such as Sika MonoTop®-1010 or equivalent shall be used. The primer shall be sprayed only once the reinforcing mesh has been installed. There will be overspray on the reinforcing mesh which shall not be removed.

Do not spray too large a surface at a time, as the subsequent application of **Sikacrete®-213 F** shall be carried out when the primer is still tacky.

7.2.2 BUILDINGS

In building application, for beams and columns, a bonding primer such as Sika MonoTop®-1010 or equivalent is also needed. If steel mesh is being used, the primer shall be placed once, the mesh has been installed (there will be overspray on the reinforcing mesh which shall not be removed).

7.3 MIXING

Pre-mixing in a drum type mixer / planetary mixer:

- 7.1 to 9.8 litres of clean, potable water per bag (8 kg) of **Sikacrete®-213 F**.
- Mixing time: at least **5 minutes**.

7.4 APPLICATION METHOD

7.4.1 LARGE SURFACE

On large surface areas, especially in tunnels, **Sikacrete®-213 F** shall be applied using the wet mix process.

The application shall be done by sections of width ~2 m (maximum ~6 m^2). The sections are limited by timber strips previously treated with releasing compound. These strips can also be used for assessing thickness control. The sections will be sprayed using the 'chess board' technique.

Wait until the freshly placed sections are fully hardened before spraying the empty bays.

7.4.2 SMALL / MEDIUM SIZE SURFACE

On small / medium surface areas, **Sikacrete®-213 F** can be applied using hopper gun or by hand using the traditional rendering techniques.

7.4.3 FINISHING

Sikacrete®-213 F can be worked and trowel finished shortly after its application. Due to its fine granulometry, the mortar can simply be left 'as sprayed' or 'unfinished' as it is known. Above a layer thickness of 40 mm, the fire protection mortar must be applied in several layers.

If the surface of the fire protection mortar needs to be smoothened, it must be applied in various layers to prevent the first layer of **Sikacrete®-213 F** separating from the substrate during working of the surface. The 1st layer acts as a scratch coat (applied on top of the bonding bridge layer – refer to clause 7.2), so it must harden sufficiently (to 'fingernail hard' – which usually takes a few hours) before the subsequent layer is applied and then this can be trowel finished. To minimise irregularities, and to achieve the best result of the surface finish of **Sikacrete®-213 F**, while the mortar is still fresh, it is possible to spray a thin layer after the last one to ease the floating process. This last step / process helps to obviate shrinkage cracks too.

If the mortar is to be given a surface impregnation or coating later, any surface laitance layer must be prevented or removed.

A cement laitance layer, also called a laitance skin, is an accumulation of cement binder and fines on the surface, which forms a thin, hard and brittle layer. It occurs if the surface is worked (e.g. when compacted or trowelled), particularly if worked for too long in finishing. This is recognisable from its cement rich dense, shiny surface, this is formed as a separate layer, not fully bound, or adhering to the substrate. Therefore, any cement laitance layers must always be removed from the surface before carrying out any coating works (e.g. by abrasion – light blast cleaning or wire brushing, etc.), as appropriate.

Tip: The most economical way to prevent / remove a laitance layer is to rub and abrade the mortar surface with a wooden or synthetic float approximately 24 hours after application.

*The surface finish of **Sikacrete®-213 F** can vary according to the location and requirements: trowel finished (left), coarse (unfinished) sprayed (centre) or trowel finished and over coated (right).*

7.5 APPLICATION ON CFRP

The prepared CFRP (refer to section 6.2 above) shall be degreased and dedusted prior to place the fire protection.

Sikacrete®-213 F is applied using the above described technique without the need of any primer.

7.6 CURING

Sikacrete®-213 F is hydraulically bound, which means that the product should be cured like a standard spray applied cement-based mortar: The freshly applied mortar must therefore not be exposed during this curing period to:

- Sun;
- Wind;
- Rain or
- Vibration.

In tunnel applications, care shall be taken about the ventilation during the application process as this may generate some cracking at the surface. It may be required to have a mist of water being sprayed during application (refer to the enclosed pictures). Alternatively, whenever possible, the ventilation shall be stopped during and after application of the fire protection mortar.

If no coating is to be applied, high performance curing compound (> 90% curing efficiency) can also be used to cure properly the freshly applied mortar.

7.7 OVERCOATING

7.7.1 WITH RESURFACING MORTAR

Wait at least 28 days before to apply any resurfacing mortar either cement based like Sika MonoTop®-3020 or Sika MonoTop®-725 Tunnel, or water-based epoxy like Sikadur®-331 W.

Refer to the Application Instructions of the relevant product.

7.7.2 WITH PROTECTIVE COATING

When a coating or hydrophobic impregnation needs to be applied onto **Sikacrete®-213 F**, the mortar surface (either **Sikacrete®-213 F**, Sika MonoTop®-3020 or Sika MonoTop®-725 Tunnel) shall be dry (< 6% moisture when measured with Tramex method).

Refer to the relevant protective coating Method Statement for more details.

8 EQUIPMENT

This fire protection mortar is designed for the mechanical application. Suitable for application machines are:

- Spiral pump systems with pneumatic spraying. Either plastering machines with integral mixers or machines with an external mixer can be used.

e.g.: Euromair CP 80 plaster pump with integral mixer

e.g.: Putzmeister SP 11 TMR with integral mixer

Hopper gun available from various suppliers in many hardware shops

9 INSPECTION, SAMPLING, QUALITY CONTROL

The information provided in these paragraphs, follows the recommendations of EN 1504-10 Annex A and Technical Guideline of ICRI No 03732 – 2002. As part of established 'Good Practice', the applicator shall also provide Site QC Reports containing the following recommended site record details.

9.1 BEFORE AND AFTER THE PREPARATION WORKS

Characteristic	References	Frequency	Parameters
Concrete delamination	Hammer sounding	Once before application	
Cleanliness of surface	Visual	After preparation and immediately before application	

9.2 BEFORE, DURING AND AFTER THE MATERIAL APPLICATION

Characteristic	References	Frequency	Parameters
Substrate humidity	Visual, site sampling and lab analysis, etc.	Before and throughout the application	No damp patches
Temperature (ambient and substrate)		Throughout the application	Within the Product Data Sheet limits
Ambient humidity		Throughout the application	Within the Product Data Sheet limits
Precipitation		Daily	As recorded
Wind		Daily	Less than 8 m/sec or provide protection
Batch number		Each time new material is provided on site	As recorded
Density of fresh mortar / spray mortar			Published data
Cracking	Visual	Following day and prior to hand-over	Minimal
Tensile bond strength	EN 1542	Upon completion but at least 28 days after the last application	~0.3 N/mm^2
Compressive strength	EN 12190	As per Engineer's specification	Published data
Density of harden mortar	EN 12190		Published data
Layer thickness			As specified

10 LEGAL NOTE

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika'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. Sika 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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