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and types of construction

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European Technical Assessment

ETA-21/0724
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General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

SikaCem Pyrocoat

Product family
to which the construction product belongs

Renderings and rendering kits intended for fire resistant
applications

Manufacturer

Sika Deutschland GmbH
Kornwestheimer Straße 103-107
70439 Stuttgart
DEUTSCHLAND

Manufacturing plant

1487

This European Technical Assessment
contains

11 pages including 5 annexes which form an integral part
of this assessment

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

EAD 350140-00-1106

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Specific Part

1 Technical description of the product

Object of this European Technical Assessment (ETA) is the rendering kit for establishing the fire protective rendering "SikaCem Pyrocoat". The final product will be assessed in accordance with EAD 350140-00-1106¹ option 2.

The rendering kit consists of the factory-made mineral dry mix "SikaCem Pyrocoat" and the factory-made dry priming plaster "SikaCem Pyrocoat Base" for executing the fire protective rendering in-situ.

For fire-tests of the rendering "SikaCem Pyrocoat" on steel elements the 2-components primer "SikaCor EG-1" on the basis of epoxy-resin was used, but this primer is not part of the assessment.

The dry mix for the fire protective rendering "SikaCem Pyrocoat" is a homogeneous factory-made powder of light grey colour. The product essentially consists of the binder – a cement as described in ETA-13/0417 -, light aggregates and a small amount of additives². The dry mix "SikaCem Pyrocoat" meets the requirements of EN 998-1, class CS II.

The priming plaster "SikaCem Pyrocoat Base" bases on Portland cement and is used as a thin layer to ensure the adhesion on the substrate. The component "SikaCem Pyrocoat Base" meets the requirements of EN 998-1, class CS VI.² To improve the adhesion on the substrate, the fresh plaster should be applied of a thickness of at least 1 mm. If the fire protective layer will not be applied directly after setting, at least the next day, the plaster shall be roughened mechanically.

The fire protective rendering arises from mixing mechanically the dry mix "SikaCem Pyrocoat" with a defined amount of clean water in an appropriate mixing unit and applying it directly on the pre-treated substrate.

The application of the fresh mortar may be carried out manually by trowel or by ordinary equipment for wet application e. g. plastering machine or proportioning pump, also if necessary in more than one step or layer.

The applied rendering "SikaCem Pyrocoat" is a two-layers product that hardens and forms the final product, which sticks completely on the substrate (steel, concrete) and delays effectively the input of heat in case of fire.

The thickness of the fire protective rendering applied depends on the intended period of fire resistance, on the substrate and on the type of element to protect.

The technical characteristics of the final fire protective rendering "SikaCem Pyrocoat" and of components are given in Annex 1.

2 Specification of the intended use in accordance with the applicable European Assessment Document (EAD) N° 350140-00-1106

The fire protective rendering kit "SikaCem Pyrocoat" is intended to protect horizontal areas (Type 1), vertical areas (Type 2) and load-bearing elements made from concrete, reinforced concrete or prestressed concrete (Type 3) with and without lathwork.

The performance given in section 3 is only valid, if the construction product "SikaCem Pyrocoat" in use considers the instructions and the conditions stated in section 3.4.

¹ "Renderings and rendering kits intended for fire resisting applications", Edition September 2017, Official Journal of the EU N° C 435/07 of 15 December 2017, p 152

² The chemical composition of the components "SikaCem Pyrocoat" and "SikaCem Pyrocoat Base" are deposited with DIBt.

The test and assessment methods on which this European Technical Assessment (ETA) is based, lead to an assumption of working life of the fire protective rendering "SikaCem Pyrocoat" of at least 25 years in final use.

The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for the assessment

3.1 Safety in case of fire (BWR 2)

3.1.1 Reaction to fire

Essential characteristic	Performance
Reaction to fire*	Class A1 in accordance with EN 13501-1 ³

* the final product contains less than 1 % combustible ingredients

3.1.2 Resistance to fire

3.1.2.1 Resistance to fire and necessary thickness of the rendering on steel elements for the classification of the steel elements protected by "SikaCem Pyrocoat"

The fire tests and the assessment of the results concerning the fire protective contribution of the rendering "SikaCem Pyrocoat" on steel elements were carried out in accordance with EN 13381-4⁴ taking into account the EAD 350140-00-1106.

Under the condition that the tolerances in thickness and density of the fire protective rendering do not exceed 10 % of the nominal statement, the assessment considers the following for the design of the minimum thickness of the rendering:

- steel beams and steel columns with open cross sections⁵
- section factors (surface extent/surface area; A_m/V) of $\leq 80 \text{ m}^{-1}$ up to 310 m^{-1}
- fire resistance periods of 30 minutes up to 120 minutes

The results for designing the minimum thickness of the rendering "SikaCem Pyrocoat" for open cross sections depending on the intended fire resistance period, the section factor and the kind of element to protect are shown in Annex 2 (table 1 to 4).

The design of the rendering's minimum thickness for hollow steel profiles shall be done in accordance with EN 13381-4, considering the type of cross section (circular or rectangular hollow profiles) and using the tables for design of Annex 2. In doing so, the rendering's minimum thickness shall be rounded up.

3.1.2.2 Resistance to fire and necessary equivalent depth of concrete coverage for classification of concrete elements, reinforced concrete elements and prestressed concrete elements protected by "SikaCem Pyrocoat"

³ EN 13501-1:2019-05 Fire classification of construction products and building elements, Part 1 Classification using test data from reaction to fire tests

⁴ EN 13381-4:2013-08 Test methods for determining the contribution to the fire resistance of structural members Part 4: Applied passive protection to steel members

⁵ Tested: H-Profile; results applicable for I-, T-, U- und L-profiles

The fire tests were done in accordance with EN 13381-3⁶ and EN 1363-1⁷ and the assessment of the results concerning the fire protective contribution of the rendering "SikaCem Pyrocoat" on reinforced concrete and prestressed concrete were done in accordance with EN 13381-3⁶ and EN 1992 1-2⁸.

Under the precondition that the tolerances in density of the fire protective rendering do not exceed 10 % of the nominal statement, the assessment considers the following for the design of the equivalent thickness of the rendering:

- concrete elements of a density between 1980 kg/m³ and 2675 kg/m³
- fire resistance periods of 30 minutes up to 240 minutes
- one-sided impact of fire (walls and ceilings)

The minimal dry thickness of the fire protective rendering "SikaCem Pyrocoat" on concrete elements and elements made of reinforced or prestressed concrete refer to the axial distance "a" of the reinforcement and the critical temperature "T_{kr}" on the reinforcement of the element to protect. (see EUROCODE 2).

In doing so, 1 mm applied rendering can substitute ca 2 mm to 4 mm normal concrete. The design of the necessary minimum thickness of the rendering for elements one-sided flame stressed (ceilings and walls) shall be done in accordance with Annex 3 depending on the intended period of fire resistance.

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content and release of dangerous substances	No dangerous substances ⁹

The manufacturer's detailed written declaration concerning the chemical composition of the components of the rendering kit "SikaCem Pyrocoat" as described in clause 1 was assessed by DIBt and is deposited with DIBt.

3.4 General aspects of durability

Durability testing shall be an integral part of assessing the basic works and performance requirements. The following specific provisions for use shall be complied with to ensure the durability of the performance.

The tests and the assessment of the relevant fire performance under climatic conditions of type Z₂ – product intended for use under frost-protected indoor conditions at permanent relative humidity under 85 % RF - were carried out in accordance with EAD 350140-00-1106, clause 2.2.12

Result:

The final rendering "SikaCem Pyrocoat" without any lathing is fit for use as a rendering for fire protective application on load-bearing steel elements or on elements of concrete, reinforced concrete or prestressed concrete to improve or maintain the fire resistance of the element under use conditions of type Z₂.

3.5 General aspects of establishing the fire protective rendering

For establishing the fire protective rendering "SikaCem Pyrocoat" only the components described in section 1 shall be used.

The manufacturer's instructions for executing shall be considered when establishing the fire protective rendering "SikaCem Pyrocoat".

⁶ EN 13381-3:2015-06 Test methods for determining the contribution to the fire resistance of structural members; Part 3: Applied protection to concrete members

⁷ EN 1363-1:2012-10 Fire resistance tests; Part 1: General requirements

⁸ EN 1992-1-2:2010-12 Eurocode 2: Design of concrete structures; Part 1-2: General rules – structural fire design

⁹ In accordance with the Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 (published in the Official Journal of the EU N° L 353 of 31/12/2008, p 1)

It is in the responsibility of the manufacturer to ensure that all necessary information is communicated completely and correctly to the establisher. The full fire protective performance of the rendering can only be assumed, if the execution on site is carried out by trained workers, who have some experience with this kind of product.

Depending on the steel grade and the real intended environmental conditions, it may be advisable to protect the steel substrate against corrosion.

As a suitable primer the 2-components primer on the basis of epoxy resin "SikaCor EG-1" of Sika Deutschland GmbH can be recommended.

When establishing the fire protective rendering "SikaCem Pyrocoat", at least some samples should be prepared in parallel for determining the density, to demonstrate the conformity of the executed rendering with the requirements of his ETA.

Furthermore it is necessary to control the depth of the freshly applied rendering e. g. by a penetration needle or depth gauge. The results shall be recorded. The determined thickness of the protective layer shall never fall below the required minimum thickness.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document ETAG 018, part 3 the Decision of the commission N° 1999/454/EC of 22 June 1999 (OJ of the EU L 178 of 14 July 1999, p 42), amended by EC Decision 2001/596/EC of 8 January 2001(OJ of the EU L 209 of 2 August 2001, p 33) is the legal basis for AVCP.

So system 1 applies for the assessment and verification of constancy of performance (AVCP). See Annex 2 in conjunction with Article 65 (2) of the Regulation (EU) N° 305/2011 and the following table:

Product	Intended use	performance	System
Rendering kit "SikaCem Pyrocoat"	fire protective application on load-bearing steel elements, elements of concrete, reinforced concrete and prestressed concrete for improvement or maintenance of fire resistance	reaction to fire, period of fire resistance relevant characteristics	1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

The technical details necessary for the implementation of the system 1 for assessment and verification of constancy of performance are laid down in the control plan (confidential part of this ETA) deposited with Deutsches Institut für Bautechnik.

The CE-marking for the kit shall be affixed on every component (stick-on label or directly on the packing unit) and the commercially accompanying documents. The declaration of performance of the kit shall be done in accordance with this ETA.

Issued in Berlin on 16 September 2021 by Deutsches Institut für Bautechnik

Christina Pritzkow
p. p. Head of Department

beglaubigt:
Dr.-Ing. Dierke

ANNEX 1

TECHNICAL CHARACTERISTICS OF THE COMPONENTS AND THE RENDERING

"SikaCem Pyrocoat"

Characteristic	Nominal level as tested	Test method
dry mix "SikaCem Pyrocoat"		See control plan
apparent density	480 kg/m ³ ±10 % kg/m ³	
priming plaster "SikaCem Pyrocoat Base"		
tensile bond strength	≥ 0,08 N/mm ²	
compression strength after 28 d	≥ 10,0 N/mm ²	
rendering product "SikaCem Pyrocoat"		
density, dry	480 kg/m ³ ± 100 kg/m ³	
compression strength after 28 d	≥ 1,5 N/mm ²	
Depth/thickness of the rendering without lathwork	10 mm to 40 mm Tolerance: + 0,5 mm	

ANNEX 2

Fire protective rendering "SikaCem Pyrocoat"
Design of the minimum thicknesses for open steel profiles

Tab. 1 Fire resistance period 30 min

Design temperature [°C]	300	350	400	450	500	550	600	650	700	750
A_m/V [m ⁻¹]	minimum thickness of applied dry rendering [mm]									
≤ 80	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
80	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
90	11,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
100	11,5	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
110	12,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
120	12,5	10,5	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
130	13,0	11,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
140	13,5	11,5	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
150	13,5	12,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
160	14,0	12,5	10,5	10,0	10,0	10,0	10,0	10,0	10,0	10,0
170	14,0	12,5	11,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
180	14,5	13,0	11,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
190	14,5	13,0	11,5	10,0	10,0	10,0	10,0	10,0	10,0	10,0
200	14,5	13,5	11,5	10,0	10,0	10,0	10,0	10,0	10,0	10,0
210	15,0	13,5	12,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
220	15,0	13,5	12,0	10,5	10,0	10,0	10,0	10,0	10,0	10,0
230	15,0	13,5	12,0	10,5	10,0	10,0	10,0	10,0	10,0	10,0
240	15,0	14,0	12,5	11,0	10,0	10,0	10,0	10,0	10,0	10,0
250	15,5	14,0	12,5	11,0	10,0	10,0	10,0	10,0	10,0	10,0
260	15,5	14,0	12,5	11,0	10,0	10,0	10,0	10,0	10,0	10,0
270	15,5	14,0	13,0	11,0	10,0	10,0	10,0	10,0	10,0	10,0
280	15,5	14,0	13,0	11,5	10,0	10,0	10,0	10,0	10,0	10,0
290	15,5	14,5	13,0	11,5	10,0	10,0	10,0	10,0	10,0	10,0
300	15,5	14,5	13,0	11,5	10,0	10,0	10,0	10,0	10,0	10,0
310	16,0	14,5	13,0	12,0	11,5	10,0	10,0	10,0	10,0	10

English translation prepared by DIBt

Tab. 2 Fire resistance period 60 min

Design temperature [°C]	300	350	400	450	500	550	600	650	700	750
A_m/V [m ⁻¹]	minimum thickness of applied dry rendering [mm]									
≤ 80	18,0	16,0	13,5	10,5	10,0	10,0	10,0	10,0	10,0	10,0
80	18,5	17,0	14,5	12,0	10,0	10,0	10,0	10,0	10,0	10,0
90	19,5	18,0	16,0	14,0	11,0	10,0	10,0	10,0	10,0	10,0
100	20,5	18,5	17,0	15,0	12,5	10,0	10,0	10,0	10,0	10,0
110	21,0	19,5	18,0	16,0	13,5	11,5	10,0	10,0	10,0	10,0
120	21,5	20,0	18,5	16,5	14,5	12,5	10,0	10,0	10,0	10,0
130	22,0	20,5	19,0	17,0	15,5	13,0	11,0	10,0	10,0	10,0
140	22,0	21,0	19,5	17,5	16,0	14,0	12,0	10,0	10,0	10,0
150	22,5	21,0	20,0	18,0	16,5	14,5	12,5	10,5	10,0	10,0
160	23,0	21,5	20,0	18,5	17,0	15,0	13,0	11,0	10,0	10,0
170	23,0	22,0	20,5	19,0	17,5	15,5	14,0	12,0	10,0	10,0
180	23,0	22,0	20,5	19,0	17,5	16,0	14,5	12,5	10,0	10,0
190	23,5	22,0	21,0	19,5	18,0	16,5	15,0	13,0	11,0	10,0
200	23,5	22,5	21,0	20,0	18,0	17,0	15,0	13,0	11,5	10,0
210	24,0	22,5	21,5	20,0	18,5	17,0	15,5	13,5	11,5	10,0
220	24,0	23,0	21,5	20,0	19,0	17,0	15,5	14,0	12,0	10,0
230	24,0	23,0	21,5	20,5	19,0	17,5	16,0	14,0	12,5	10,0
240	24,0	23,0	22,0	20,5	19,0	17,5	16,0	14,5	13,0	11,0
250	24,5	23,0	22,0	20,5	19,5	18,0	16,5	15,0	13,0	11,5
260	24,5	23,0	22,0	21,0	19,5	18,0	16,5	15,0	13,5	11,5
270	24,5	23,5	22,0	21,0	19,5	18,5	17,0	15,0	13,5	12,0
280	24,5	23,5	22,5	21,0	20,0	18,5	17,0	15,5	14,0	12,0
290	24,5	23,5	22,5	21,0	20,0	18,5	17,0	15,5	14,0	12,5
300	25,0	23,5	22,5	21,5	20,0	18,5	17,0	16,0	14,0	12,5
310	25,0	23,5	22,5	21,5	20,0	19,0	17,5	16,0	14,5	13,0

English translation prepared by DIBt

Tab. 3 Fire resistance period 90 min

Design temperature [°C]	300	350	400	450	500	550	600	650	700	750
A_m/V [m ⁻¹]	minimum thickness of applied dry rendering [mm]									
≤ 80	26,5	25,0	23,5	22,0	20,0	17,0	13,5	10,0	10,0	10,0
80	27,5	26,0	25,0	23,0	21,0	18,5	16,0	12,0	10,0	10,0
90	28,5	27,0	26,0	24,5	22,5	20,5	18,0	15,0	11,5	10,0
100	29,0	28,0	26,5	25,5	23,5	22,0	20,0	17,0	14,5	11,0
110	29,5	28,5	27,5	26,0	24,5	23,0	21,0	19,0	16,5	13,5
120	30,0	29,0	28,0	27,0	25,5	24,0	22,0	20,0	18,0	15,0
130	30,5	29,5	28,5	27,5	26,0	24,5	23,0	21,0	19,0	16,5
140	31,0	30,0	29,0	28,0	26,5	25,0	23,5	22,0	20,0	17,5
150	31,5	30,5	30,0	28,0	27,0	25,5	24,0	22,5	20,5	18,5
160		30,5	30,0	28,5	27,5	26,0	24,5	23,0	21,0	19,5
170		31,0	30,0	29,0	27,5	26,5	25,0	23,5	22,0	20,0
180		31,0	30,0	29,0	28,0	26,5	25,5	24,0	22,0	20,5
190		31,5	30,5	29,5	28,0	27,0	25,5	24,0	22,5	21,0
200			30,5	29,5	28,5	27,0	26,0	24,5	23,0	21,5
210			31,0	30,0	28,5	27,5	26,0	25,0	23,5	22,0
220			31,0	30,0	29,0	27,5	26,5	25,0	23,5	22,0
230			31,0	30,0	29,0	26,0	26,5	25,5	24,0	22,5
240			31,5	30,5	29,0	28,0	27,0	25,5	24,0	22,5
250			31,5	30,5	29,5	28,0	27,0	25,5	24,5	23,0
260			31,5	30,5	29,5	28,0	27,0	26,0	24,5	23,0
270				30,5	29,5	28,5	27,0	26,0	24,5	23,5
280				30,5	29,5	28,5	27,5	26,0	25,0	23,5
290				31,0	30,0	28,5	27,5	26,0	25,0	23,5
300				31,0	30,0	29,0	27,5	26,5	25,0	24,0
310				31,0	30,0	29,0	27,5	26,5	25,0	24,0

Tab. 4 Fire resistance period 120 min

Design temperature [°C]	300	350	400	450	500	550	600	650	700	750
A_m/V [m ⁻¹]	minimum thickness of applied dry rendering [mm]									
≤ 80					31,5	30,0	28,5	26,5	23,5	19,5
80						31,5	30,0	28,0	25,5	22,5
90							31,5	30,0	28,0	25,6
100								31,5	29,5	27,5
110									31,0	29,0
120										30,0
130										31,0
140										31,5

ANNEX 3

Fire protective rendering "SikaCem Pyrocoat"

Design of the rendering for concrete structures with two-dimensional fire impact (walls, ceilings)
in accordance with EN 13381-3, Annex C

