



European Technical Assessment

ETA 11/0480
of 06.09.2016



General part

| | |
|--|--|
| Trade name of the construction product | Sprayfiber-F |
| Product family to which the construction product belongs | Rendering intended for fire resisting applications |
| Manufacturer | DOMINION PROTISA Josefa Valcárcel 3-5 ES-28027 Madrid Spain |
| Manufacturing plant(s) | According to annex N kept by ITeC |
| This European Technical Assessment contains | 19 pages including 4 Annexes which form an integral part of this assessment and Annex N, which contains confidential information and is not included in the European Technical Assessment when that assessment is publicly available |
| This European Technical Assessment is issued in accordance with Regulation (EU) 305/2011, on the basis of | ETAG 018, Part 1 edition April 2013 and Part 3 edition May 2012, used as European Assessment Document (EAD) |
| This version replaces | ETA 11/0480, issued on 08.07.2014 |

General comments

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es)).

Specific parts of the European Technical Assessment

1 Technical description of the product

Sprayfiber-F is a spray-applied fire protective rendering made of mineral wool mixed with dry and inorganic hydraulic binders.

Sprayfiber-F is sprayed dry and mixed with water at the nozzle. The binder is included as part of the dry mix in the bag.

Properties of applied rendering such as thickness range, density, adhesion values, etc., are described in Annexes 2, 3 and 4.

2 Specification of the intended use(s) in accordance with the applicable EAD

Sprayfiber-F is intended for the fire protection uses as described in Table 1, which also shows the related environmental use conditions.

Table 1: Intended use categories related to the protected element and the environmental conditions.

| Fire protection uses | | Environmental conditions |
|----------------------|---|--------------------------|
| ETAG 018-1 reference | Element intended to be protected | ETAG 018-3 reference |
| Type 3 | Load-bearing concrete elements (slabs or walls exposed to fire on one side only) | Type Z ₂ |
| Type 4 | Load-bearing steel elements | |
| Type 5 | Load-bearing flat concrete profiled sheet composite elements | |

The environmental use categories are specified in ETAG 018-3, section 2.2.2:

- Type Z₂: internal conditions excluding temperatures below 0°C, with humidity lower than 85% RH

The provisions made in this European Technical Assessment are based on an assumed intended working life of the Sprayfiber-F of 25 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, but are to be regarded only as a means for choosing the appropriate product(s) in relation to the expected economically reasonable working life of the works.

3 Performance of the product and reference to the methods used for its assessment

3.1 Performance of the product

The assessment of the Sprayfiber-F for the relevant intended uses, considering the basic requirements for construction works 2, 3 and 6, was performed following the ETAG 018 for *Fire Protective Products, Part 1: General (April 2013) and Part 3: Renderings and rendering kits intended for fire resisting applications (May 2012)*, used as EAD.

Table 2: Performance of Sprayfiber-F.

| Product: Sprayfiber-F | | Intended use: Fire resisting applications |
|--|--|---|
| Basic requirement | Essential characteristic | Performance |
| BWR 2 Safety in case of fire | Reaction to fire | A1 |
| | Resistance to fire | See Annexes 2, 3 and 4 |
| BWR 3 Hygiene, health and the environment | Release of dangerous substances | No dangerous substances (see 3.2.3) |
| BWR 6 Energy economy and heat retention | Thermal insulation, $\lambda_{90/90(23/50)}$ | 0,07 W/m·K |
| General aspects relating to the performance of the product | Durability | Type Z ₂ |
| | Adhesion (bond strength) | See 3.2.5 |

3.2 Methods used for the assessment

3.2.1 Reaction to fire

The performance of the rendering has been determined according to EN 13501-1¹.

3.2.2 Fire resistance

Fire resistance performance, classified in accordance with EN 13501-2², has been determined following the test and evaluation methods given in Annexes 2, 3 and 4.

3.2.3 Release of dangerous substances

According to the manufacturer's declaration, the Sprayfiber-F specification has been compared with the regulated dangerous substances listed on the database established on the EC construction website, with Annex VI to Regulation (EC) No 1272/2008 and with the "Indicative list of regulated dangerous substances possibly associated with construction products under the CPD, DS 041/051 Rev.12, 22 March 2012" of the EC Experts Group, to verify that Sprayfiber-F does not contain such substances, with the exception of mineral wool fibres, which meet the requirements given in Note Q of the Regulation (EC) No 1272/2008 and they are therefore not potentially carcinogenic³.

¹ EN 13501-1 *Fire classification of construction products and building elements. Part 1: Classification using data from reaction to fire tests implemented.*

² EN 13501-2 *Fire classification of construction products and building elements. Part 2: Classification using data from fire resistance tests, excluding ventilation services implemented.*

³ The mineral wool supplier is member of EUCEB (European Certification Board for Mineral Wool Products) and the product has the EUCEB's certificate.

In addition to the specific clauses relating to dangerous substances contained in this ETA, there may be other requirements applicable to the products falling within its scope. In order to meet the provisions of the EU Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.2.4 Thermal insulation

Thermal conductivity has been tested according to EN 12667⁴ and the declared values have been determined according to EN ISO 10456⁵.

Table 3: Thermal characteristics.

| | | | |
|--------------------------|------|---------|---|
| $\lambda_{10,dry,90/90}$ | 0,06 | (W/m·K) | Conductivity fractile value at 10°C at dry conditions, representing at least 90% of the production with a confidence level of 90% |
| $u_{23,50}$ | 0,02 | (kg/kg) | Moisture content mass by mass at 23°C / 50% R.H. |
| $f_{u,1}$ | 4,96 | (kg/kg) | Moisture content conversion coefficient mass by mass (dry – 23/50) |
| $\lambda_{90/90(23/50)}$ | 0,07 | (W/m·K) | Design value of conductivity at 23°C and 50% R.H. |

3.2.5 General aspects relating to the performance of the product

Durability of the rendering has been assessed for Type Z₂ according to ETAG 018-3, section 5.7.1, in relation to its fire protective intended uses as defined in Table 1.

Adhesion (bond strength) has been determined in accordance with ETAG 018-3 and EGOLF SM5⁶. The adhesion/cohesion of the rendering depends on the installed thickness and the preparation of the substrate. Bond strength guidance values of the rendering and the conditions under which they were achieved are given in Annexes 2, 3 and 4.

The ETA is issued for Sprayfiber-F on the basis of agreed data/information, deposited with the ITeC, which identifies the system components that have been assessed. Identification tests according to ETAG 018-3, section 5.7.3, have been carried out on components, which confirm that the system under assessment conforms to its declared characteristics.

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

According to the decision 1999/454/EC⁷ of the European Commission, the system of AVCP (see EC delegated regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table applies.

Table 4: AVCP System.

| Product(s) | Intended use(s) | Level(s) or class(es) | System(s) |
|---|--|-----------------------|-----------|
| Fire protective products (including coatings) | For fire compartmentation and/or fire protection or fire performance | Any | 1 |

⁴ EN 12667 *Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance.*

⁵ EN ISO 10456 *Building materials and products. Hygrothermal properties. Tabulated design values and procedures for determining declared and design thermal values.*

⁶ EGOLF SM5 (EA 05:1999) *Fire testing. Method for the measurement of bonding properties of fire protection materials applied to steel, concrete and steel/concrete composite structures.*

⁷ Official Journal of the European Communities N° L178, 14.7.1999, p. 52.

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

All the necessary technical details for the implementation of the AVCP system are laid down in the *Control Plan* deposited with the ITeC⁸ and the factory production control shall be in accordance with it. The following table specifies the cornerstones for the factory production control.

Table 5: FPC test plan for Sprayfiber-F.

| Product | Property control | Minimum frequency |
|--------------------|-------------------------|---|
| Dry mix | Incoming materials | 1 per batch supplied |
| | Bulk density of dry mix | Each change of mineral wool or twice a day |
| Hardened rendering | Density | Each 20 days of continuous production or each 3 months if the production is less than 20 days |
| | Adhesion | |
| | Insulation efficiency | |

Issued in Barcelona on 6 September 2016
by the Catalonia Institute of Construction Technology.



Ferran Bermejo Nualart
Technical Director, ITeC

⁸ The *Control Plan* is a confidential part of the ETA and only handed over to the notified certification body involved in the assessment and verification of constancy of performance.

ANNEX 1. Fire resistance performances and installation provisions for the assemblies related to the intended uses of Sprayfiber-F

A.1.1 Overview of fire resistance performances for assemblies protected with Sprayfiber-F

The fire protective assemblies in Table A.1.1 have been assessed within the framework of this ETA.

Table A.1.1: Fire protective assemblies.

| Assembly assessed within the framework of this ETA | Classification | Test standards | Intended use type according to ETAG 018 | Installation details |
|--|-------------------------|---------------------------|---|----------------------|
| Load-bearing steel elements | EN 13501-2, see Annex 2 | ENV 13381-4 ⁹ | Type 4 | Annex 2 |
| Load-bearing flat concrete profiled sheet composite elements | EN 13501-2, see Annex 3 | ENV 13381-5 ¹⁰ | Type 5 | Annex 3 |
| Load-bearing concrete elements (slabs or walls) | EN 13501-2, see Annex 4 | ENV 13381-3 ¹¹ | Type 3 | Annex 4 |

A.1.2 Installation and design provisions related to the assemblies protected with Sprayfiber-F

The system installation should be carried out in accordance with the manufacturer's instructions and the provisions given in the following Annexes.

A.1.2.1 Tools and equipment

Typical machines used to spray Sprayfiber-F are welded steel built and designed for the spraying of mineral fibres and low density pulverisable products. They usually comprise a supply hopper, a carding system, an air propulsion system, and hoses to bring Sprayfiber-F and water to the spraying nozzle. For example, a typical spraying machine is the "The Boss" 10 HP/220-3 phases/50Hz@AMPS, supplied by Contractor's Consulting Service Inc.

A.1.2.2 Substrate

Before application the substrate should be inspected and prepared. Surfaces to be sprayed shall be free from oil, grease, primers, lock down agents or of any other substance that will impair adhesion. If dirt is detected on the substrate, it is recommended to clean the substrate by spraying water with a hose. See next Annexes for substrate specifications.

Clips, hangers, supports, sleeves and other attachments to the substrate can be placed by others prior to the application of Sprayfiber-F. Ducts, piping, conduits or other suspended equipment can be installed after the application of Sprayfiber-F, in which case later inspection of the applied Sprayfiber-F will be required and, when necessary, reparation of the rendering.

⁹ ENV 13381-4 *Test methods for determining the contribution to the fire resistance of structural members. Part 4: Applied protection to steel members.*

¹⁰ ENV 13381-5 *Test methods for determining the contribution to the fire resistance of structural members. Part 5: Applied protection to concrete/profiled sheet steel composite members.*

¹¹ ENV 13381-3 *Test methods for determining the contribution to the fire resistance of structural members. Part 3: Applied protection to concrete members.*

A.1.2.3 Environmental conditions during application and construction

The air and substrate temperature accepted for the application of the rendering shall be between 2 °C and 40°C, during application and for a minimum of 24 hours after application. When air temperature is higher than 30 °C it is necessary to spray the rendering with water every 12 hours during the first 48 hours, although it is always recommended to slightly spray it with water once applied.

Depending on the temperature and the relative humidity on the jobsite, Sprayfiber-F will set in about 18 to 36 hours.

Adequate ventilation must be envisaged to allow the product to dry out after being sprayed. In closed areas where the ventilation is not adequate, it may be necessary to install a ventilation and air circulation device sufficient to obtain a renewing of air at least 4 times per hour. During winter time special considerations must be taken according to recommendations of the manufacturer.

As given in section 2 the product is intended for internal condition Z₂. Special provisions for temporary protection of the exposed rendering being subjected to rain or temperature below 0°C during construction shall be taken.

A.1.2.4 Verifications on site

The thickness should be measured at sufficient points to determine the mean and minimum thickness. A suitable method for thickness measurement is given in ETAG 018-3, section 5.0.2.

The density of the hardened rendering should be measured within the tolerances specified in the relevant Annex.

The bond strength of the rendering to the substrate should be tested on site. A suitable method is EGOLF Agreement EA 05, which can be used as a base for the site tests. The person responsible for the works will decide on the adequacy of the site tests results taking into account the reference values given in the relevant Annex. For their acceptability, the recommendations given in ETAG 018-3, section 7.3.1, or other existing criteria can be applied, under the responsibility of the person responsible for works.

A.1.2.5 Storage

The bags of Sprayfiber-F must be stored in a dry and well ventilated place until use. Do not store the bags in direct contact with the floor. The product must be stored under shelter away from oozing wall or any other wet surface. Sprayfiber-F shall be protected from frost, heat above 45°C and strong radiant sunlight. The temperature of Sprayfiber-F dry mix shall be over 0°C and the air relative humidity less than 70%. Sprayfiber-F can be stored up to 12 months from date of manufacture under dry conditions. Material damaged by moisture (open or damaged bags) should not be used.

A.1.2.6 Repair

Limited damages of Sprayfiber-F can be repaired. The damaged area shall be carefully cleaned with a knife, cutter or trowel through the whole applied thickness, down to the support. An additional zone of 250 mm all around the damaged area shall be cut at a right angle. Dust and particles generated by this operation shall be carefully eliminated. Sprayfiber-F shall be sprayed in such a way that the opening is completely filled up and the surface of the repaired area is levelled with the surrounding Sprayfiber-F. Rendering shall be sprayed with water once Sprayfiber-F has been applied.

ANNEX 2. Specification and assessment of fire protection of load bearing steel elements protected by Sprayfiber-F (intended use Type 4)

A.2.1 Classification

The assemblies described in this Annex have been tested and assessed according to ENV 13381-4 and classified in accordance with EN 13501-2.

The maximum duration of the exposure to the standard time-temperature curve defined in EN 1363-1¹², clause 5.1.1, is 240 minutes, depending on the section factor of the load bearing steel element and the thickness of Sprayfiber-F.

The assessment of the required thickness of Sprayfiber-F at a design temperature of 500°C, in function of the section factor and the exposure time, is given in section A.2.3.

A.2.2 Installation requirements

The system installation should be carried out in accordance with the provisions in A.1.2.

A.2.2.1 Supporting structure

Sprayfiber-F is applied directly on bare steel substrates.

The supporting structure consists of load-bearing steel elements with the following characteristics:

- 'H' or 'I' shaped beam and column sections with section factors (A_m/V) between 65 m⁻¹ and 300 m⁻¹.
- hollow sections with section factors (A_m/V) between 65 m⁻¹ and 300 m⁻¹.
- steel grades according to ENV 13381-4.
- three-sided and four-sided fire exposure for beams and columns.

Specifications for the components are given in Table A.2.1.

Table A.2.1. Specification of the components.

| Component | Identification | Characteristics | Mounting and fixing |
|-----------------------------|--|--|---|
| Load bearing steel sections | Steel grades according to EN 10025, with the restrictions given in ENV 13381-4 | Section factor (A_m/V) from 65 ⁽¹⁾ m ⁻¹ to 300 m ⁻¹ I/H sections and hollow sections | Steel sections blast cleaned to ISO 8501-1 SA2½ or equivalent. Surface shall be bare, free of dust, oil and grease. Steel substrate without any primer. |

⁽¹⁾ A steel member with section factor ≤ 65 m⁻¹ shall be protected with the thickness of Sprayfiber-F determined for the steel member with section factor equal to 65 m⁻¹.

A.2.2.2 Surface of steel members

No bonding primer or corrosion protective primer was applied before application of Sprayfiber-F.

A.2.2.3 Fire protective rendering

Sprayfiber-F was applied on the apparent sides of the steel element to be protected, by following its shape.

Sprayfiber-F is continuously applied with a spraying machine to the relevant thickness in layers of 15 mm to 20 mm each. During the application, the thickness of the protective material is regularly controlled with

¹² EN 1363-1 *Fire resistance tests. Part 1: General Requirements.*

a pin calibre. Any part of the structural element exposed to fire shall be covered with Sprayfiber-F at the required thickness.

Hairline cracks in the dry rendering are not accepted.

Specifications for the components are given in Table A.2.2.

Table A.2.2: Rendering specifications for fire resistance test.

| Component | Identification | Characteristics | Mounting and fixing |
|-----------|----------------|--|--|
| Rendering | Sprayfiber-F | <p>Thicknesses from 16 to 63 mm, according to the assessment rules</p> <p>Hardened density: $415 \pm 15\%$ kg/m³</p> | <p>Rendering is kept without finishing after application.</p> <p>Spray applied rendering with:</p> <ul style="list-style-type: none"> - No bonding agents - No topcoats or sealing coats - No mechanical fixings - No additives out of dry mix |

A.2.2.4 Bonding properties of Sprayfiber-F on steel members

Assessment of the bonding properties of Sprayfiber-F product when applied on steel plates has been carried out according to EGOLF SM5 procedure.

The indicated values are representative of cohesive/adhesive failure through the applied thickness of protective sprayed product Sprayfiber-F. These values are guidance values, and they neither reflect a statistical evaluation nor minimum guaranteed values.

Table A.2.3: Tensile bond strength on bare steel elements.

| Surface | Thickness of Sprayfiber-F | Mean tensile bond strength | Failure mode |
|-------------------------------------|---------------------------|----------------------------|-----------------------------|
| Steel plates according to EGOLF SM5 | 10 mm | 0,0120 MPa | Adhesive / Cohesive failure |
| | 70 mm | 0,0045 MPa | Cohesive failure |

A.2.3 Assessment of the fire performance of Sprayfiber-F on steel structures

The assessment of the fire protection performance of Sprayfiber-F when applied on steel structures has been carried out in accordance with ENV 13381-4, Annex H Numerical Regression Analysis.

The assessment relating to open H- and I-sections is given in table A.2.4.

The applicability of the results of the assessment to structural hollow sections (SHS) as compression and flexural members has been determined in accordance with ENV 13381-4, Annex B, and is shown in table A.2.5.

Table A.2.4 Resistance to fire of protected structural open section steel members.

| Section factor A_m/V (m ⁻¹) | Fire resistance classification | | | | | | |
|--|--|-----|-----|-----|------|------|------|
| | R15 | R30 | R60 | R90 | R120 | R180 | R240 |
| | Minimum thickness (mm) of Sprayfiber-F for a design temperature of 500°C | | | | | | |
| ≤ 65 | 16 | 16 | 16 | 18 | 24 | 36 | 48 |
| 70 | 16 | 16 | 16 | 19 | 25 | 38 | 50 |
| 75 | 16 | 16 | 16 | 20 | 26 | 39 | 52 |
| 80 | 16 | 16 | 16 | 21 | 28 | 41 | 54 |
| 85 | 16 | 16 | 16 | 22 | 29 | 42 | 55 |
| 90 | 16 | 16 | 16 | 24 | 30 | 43 | 57 |
| 95 | 16 | 16 | 17 | 24 | 31 | 44 | 58 |
| 100 | 16 | 16 | 17 | 26 | 31 | 45 | 59 |
| 110 | 16 | 16 | 19 | 27 | 33 | 47 | 62 |
| 120 | 16 | 16 | 20 | 28 | 34 | 49 | 63 |
| 130 | 16 | 16 | 20 | 29 | 35 | 50 | - |
| 140 | 16 | 16 | 21 | 30 | 36 | 51 | - |
| 150 | 16 | 16 | 22 | 30 | 37 | 53 | - |
| 160 | 16 | 16 | 23 | 31 | 38 | 54 | - |
| 170 | 16 | 16 | 23 | 32 | 39 | 54 | - |
| 180 | 16 | 16 | 24 | 32 | 39 | 55 | - |
| 190 | 16 | 16 | 24 | 33 | 40 | 56 | - |
| 200 | 16 | 16 | 25 | 33 | 41 | 57 | - |
| 210 | 16 | 17 | 25 | 33 | 41 | 57 | - |
| 220 | 16 | 17 | 25 | 34 | 42 | 58 | - |
| 230 | 16 | 17 | 26 | 34 | 42 | 58 | - |
| 240 | 16 | 18 | 26 | 35 | 42 | 59 | - |
| 250 | 16 | 18 | 26 | 35 | 43 | 59 | - |
| 260 | 16 | 18 | 26 | 35 | 43 | 60 | - |
| 270 | 16 | 18 | 27 | 35 | 43 | 60 | - |
| 280 | 16 | 19 | 27 | 35 | 44 | 61 | - |
| 290 | 16 | 19 | 27 | 36 | 44 | 61 | - |
| 300 | 16 | 19 | 27 | 36 | 44 | 61 | - |

Table A.2.5 Resistance to fire of protected structural hollow section steel members.

| Section factor A_m/V (m ⁻¹) | Fire resistance classification | | | | | | |
|--|--|-----|-----|-----|------|------|------|
| | R15 | R30 | R60 | R90 | R120 | R180 | R240 |
| | Minimum thickness (mm) of Sprayfiber-F for a design temperature of 500°C | | | | | | |
| ≤ 65 | 17 | 17 | 17 | 19 | 26 | 38 | 51 |
| 70 | 17 | 17 | 17 | 20 | 27 | 41 | 54 |
| 75 | 17 | 17 | 17 | 22 | 28 | 42 | 56 |
| 80 | 17 | 17 | 17 | 23 | 30 | 44 | 58 |
| 85 | 17 | 17 | 17 | 24 | 31 | 46 | 60 |
| 90 | 17 | 17 | 17 | 25 | 33 | 47 | 62 |
| 95 | 18 | 18 | 19 | 26 | 34 | 48 | - |
| 100 | 18 | 18 | 19 | 26 | 34 | 50 | - |
| 110 | 18 | 18 | 21 | 29 | 37 | 52 | - |
| 120 | 18 | 18 | 22 | 30 | 38 | 55 | - |
| 130 | 18 | 18 | 23 | 32 | 40 | 57 | - |
| 140 | 18 | 18 | 24 | 33 | 41 | 58 | - |
| 150 | 18 | 18 | 25 | 35 | 43 | 61 | - |
| 160 | 19 | 19 | 27 | 35 | 44 | 63 | - |
| 170 | 19 | 19 | 27 | 36 | 46 | 63 | - |
| 180 | 19 | 19 | 28 | 38 | 46 | - | - |
| 190 | 19 | 19 | 29 | 38 | 48 | - | - |
| 200 | 19 | 19 | 30 | 40 | 49 | - | - |
| 210 | 19 | 21 | 30 | 40 | 50 | - | - |
| 220 | 20 | 21 | 31 | 40 | 51 | - | - |
| 230 | 20 | 21 | 32 | 42 | 52 | - | - |
| 240 | 20 | 22 | 32 | 42 | 52 | - | - |
| 250 | 20 | 23 | 33 | 44 | 54 | - | - |
| 260 | 20 | 23 | 33 | 44 | 54 | - | - |
| 270 | 20 | 23 | 34 | 44 | 54 | - | - |
| 280 | 20 | 24 | 34 | 44 | 55 | - | - |
| 290 | 20 | 24 | 34 | 45 | 55 | - | - |
| 300 | 20 | 24 | 34 | 45 | 55 | - | - |

ANNEX 3. Specification and assessment of fire protection of load bearing composite concrete/profiled steel sheet elements protected by Sprayfiber-F (intended use Type 5)

A.3.1 Classification

The assemblies described in this Annex have been tested and assessed according to ENV 13381-5 and classified in accordance with EN 13501-2.

The maximum duration of the exposure to the standard time-temperature curve defined in EN 1363-1, clause 5.1.1, is 199 minutes.

The assessment of the required thickness of Sprayfiber-F in function of the type of profiled steel sheet and the exposure time, for the characteristic steel sheet temperature rise to 350 °C, the equivalent thickness of concrete, as well as the insulation and stickability performance are given in section A.3.3.

A.3.2 Installation requirements

The system installation should be carried out in accordance with the provisions in A.1.2.

A.3.2.1 Supporting structure

Sprayfiber-F is applied directly on profiled steel sheets of composite slabs cast with normal weight concrete.

The type of steel sheet to be protected is trapezoidal.

The substrate must be rigid, free of deformations or excessive vibrations before Sprayfiber-F is applied. Mid span deflection of deck spans should not be greater than $L/250$.

Specifications for the components are given in Table A.3.1.

Table A.3.1: Specification of the components.

| Component | Identification | Characteristics | Mounting and fixing |
|---|--|---|--|
| Trapezoidal profiled galvanized steel sheet | See figure A.3.1. | Thickness $\geq 1,0$ mm Width of the ribs ≤ 181 mm Depth of the ribs ≤ 90 mm S320GD steel with galvanized Z275 | Surface shall be bare, free of dust, oil and grease. |
| Concrete | Concrete strength class 25 N/mm ² Siliceous aggregates | Concrete with the same strength class or better. Density: 2240 kg/m ³ \pm 15%. | The concrete may or may not contain additional reinforcing bars for load bearing purposes. Without release agent. |

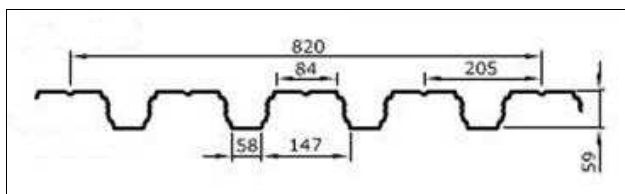


Figure A.3.1. Geometry of the trapezoidal profiled galvanized steel sheet.

A.3.2.2 Surface of steel sheets

No specific preliminary preparation of the profiled steel sheets to be protected by Sprayfiber-F is required. However, they must be bare, free of dust, oil and grease (attention must be paid to the fact that the steel sheets are normally covered by a grease protective layer).

No bonding primer is applied before application of Sprayfiber-F.

A.3.2.3 Fire protective rendering

Sprayfiber-F is applied on the apparent side of the profiled steel sheet to be protected, by following its corrugation, for exposure to fire from the steel side of the composite slab.

Sprayfiber-F is sprayed in one coat of regular thickness to reach the requested thickness according to this Annex. During the application, the thickness of the protective material is regularly controlled with a pin calibre.

Hairline cracks in the dry rendering are not accepted.

Specifications for the components are given in Table A.3.2.

Table A.3.2. Rendering specifications for fire resistance test.

| Component | Identification | Characteristics | Mounting and fixing |
|-----------|----------------|---|--|
| Rendering | Sprayfiber-F | Thicknesses from 17,3 to 25,4 mm, according to the assessment rules Hardened density: $385 \pm 15\%$ kg/m ³ | Rendering is kept without finishing after application. Spray applied rendering with: <ul style="list-style-type: none"> - No topcoats or sealing coats - No mechanical fixings - No additives out of dry mix |

A.3.2.4 Bonding properties of Sprayfiber-F on composite concrete/profiled steel sheet elements

Assessment of the bonding properties of Sprayfiber-F product when applied on trapezoidal profiled steel sheets of composite slabs cast with normal weight concrete, has been carried out according to EGOLF SM5 procedure.

The indicated values are representative of adhesive/cohesive failure through the applied thickness of protective sprayed product Sprayfiber-F. These values are guidance values, and they reflect neither a statistical evaluation nor minimum guaranteed values.

Table A.3.3. Tensile bond strength on profiled steel sheets of composite slabs cast with normal weight concrete.

| Surface | Thickness of Sprayfiber-F | Mean tensile bond strength | Failure mode |
|---|---------------------------|----------------------------|-----------------------------|
| Trapezoidal profiled galvanized steel sheet | 17,3 mm | 0,0160 MPa | Adhesive failure |
| | 25,4 mm | 0,007 MPa | Adhesive / Cohesive failure |

Samples have been taken from the flat area of the ribs. See figure A.3.2.

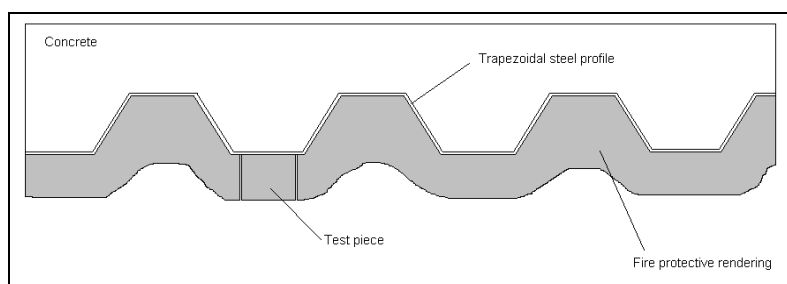


Figure A.3.2. Test specimen.

A.3.3 Assessment of the fire performance of Sprayfiber-F on composite concrete/profiled steel sheet elements

A.3.3.1 General

The assessment method used to assess the fire protection performances of product Sprayfiber-F when applied on composite concrete/profiled steel sheet elements is according to ENV 13381-5.

A.3.3.2 Temperature of the profiled steel sheet

The time to reach 350°C in the profiled steel sheets has been determined according to provisions of standard ENV 13381-5, section 13.2, and they are given in table A.3.4 for minimum and maximum thickness.

Table A.3.4. Time to reach 350°C.

| Element | Thickness of Sprayfiber-F (mm) | Time to reach 350°C (minutes) |
|---|--------------------------------|-------------------------------|
| Trapezoidal profiled galvanized steel sheet | 17,3 | 92 |
| | 25,4 | 142 |

A.3.3.3 Equivalent thickness of concrete

The effective thickness H_{eff} , the equivalent effective thickness H_e and the equivalent thickness of concrete H_{eq} induced by the protective material Sprayfiber-F applied on trapezoidal profiled steel sheets have been determined according to the provisions of the standard ENV 13381-5, section 13.3, and are given in table A.3.5.

Table A.3.5. Equivalent thickness of concrete.

| Element | Thickness of Sprayfiber-F (mm) | H_{eff} (mm) | H_e (mm) | H_{eq} (mm) | Limiting time for applicability (min) |
|--|--------------------------------|----------------|------------|---------------|---------------------------------------|
| Composite concrete/ trapezoidal profiled steel sheet | 17,3 | 81,2 | 120 | 39 | 120 |
| | 25,4 | 91,2 | 153 | 62 | 184 |

The equivalent thickness of concrete H_{eq} in function of the Sprayfiber-F thickness is given in figure A.3.3.

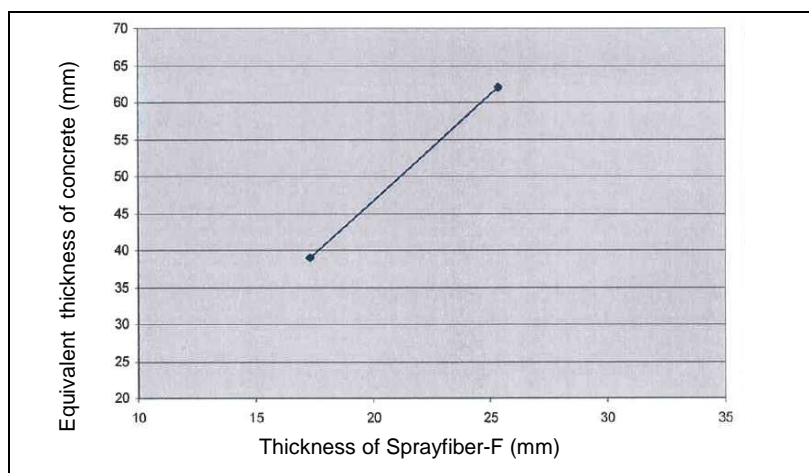


Figure A.3.3. Equivalent effective thickness of concrete H_{eq} in function of the thickness of the protective rendering Sprayfiber-F.

A.3.3.4 Insulation performance

The separating function of the composite concrete/profiled steel sheet elements protected with Sprayfiber-F was maintained during the test in accordance with the criteria established in EN 1363-1.

A.3.3.5 Limiting exposure time

The time for which the stickability of the protective material Sprayfiber-F applied on trapezoidal profiled steel sheets is ensured has been determined according to the provisions of the standard ENV 13381-5, section 13.4, and is given in table A.3.6. No significant detachment of protection occurred.

Table A.3.6. Limiting exposure time of Sprayfiber-F.

| Element | Thickness of Sprayfiber-F (mm) | Limiting exposure time (min) |
|---|---------------------------------------|-------------------------------------|
| Composite concrete/ trapezoidal profiled | 17,3 | 141 |
| galvanised steel sheet | 25,4 | 199 |

ANNEX 4. Specification and assessment of fire protection of load-bearing concrete elements protected by Sprayfiber-F (intended use Type 3)

A.4.1 Classification

The assemblies described in this Annex have been tested and assessed according to ENV 13381-3 and classified in accordance with EN 13501-2.

The maximum duration of the exposure to the standard time-temperature curve defined in EN 1363-1, clause 5.1.1, is 298 minutes depending on the thickness of the Sprayfiber-F applied.

The equivalent thickness of concrete, as well as the insulation and stickability performance are given in section A.4.3.

A.4.2 Installation requirements

The system installation should be carried out in accordance with the provisions in A.1.2.

A.4.2.1 Supporting structure

Sprayfiber-F is applied on concrete slabs or walls with fire exposure from one side only.

Specifications for the components are given in Table A.4.1.

Table A.4.1: Specification of the components.

| Component | Identification | Characteristics | Mounting and fixing |
|------------------------------------|--|--|---|
| Load bearing concrete slab or wall | Concrete strength class 25 N/mm ² Siliceous aggregates | Concrete with the same strength class or better. Density: 2290 kg/m ³ ± 15%. | The concrete contains reinforcing bars for load bearing purposes. Without release agent. |

A.4.2.2 Bonding primer prior to application of Sprayfiber-F

The concrete structures are treated with silicate based bonding primer (e.g. Protibond) before the application of Sprayfiber-F. The bonding primer is applied on all the parts to be protected with Sprayfiber-F with an airless spraying machine. Then, Sprayfiber-F spray material is applied some minutes after the application of bonding primer.

Table A.4.2: Specification of the components.

| Component | Identification | Characteristics | Mounting and fixing |
|----------------|-----------------------|---------------------------------|---|
| Bonding primer | Silicate based primer | Density: 1,50 g/cm ³ | Applied quantity: 100 - 150 g/m ² (liquid) |

A.4.2.3 Fire protective rendering

Sprayfiber-F is applied on the apparent sides of the concrete structures to be protected, by following their shape.

Sprayfiber-F is sprayed in one coat of regular thickness to reach the requested thickness according to this annex. During the application, the thickness of the protective material is regularly controlled with a pin calibre.

Hairline cracks in the dry rendering are not accepted.

Specifications for the components are given in Table A.4.3.

Table A.4.3. Rendering specifications for fire resistance test.

| Component | Identification | Characteristics | Mounting and fixing |
|-----------|----------------|--|---|
| Rendering | Sprayfiber-F | <p>Thicknesses from 9,8 mm to 14,5 mm, according to the assessment rules.</p> <p>Hardened density: 346 kg/m³ ± 15%.</p> | <p>Rendering is kept without finishing after application.</p> <p>Spray applied rendering with:</p> <ul style="list-style-type: none"> - No topcoats or sealing coats - No mechanical fixings - No additives out of dry mix |

A.4.2.4 Bonding properties of Sprayfiber-F on concrete elements

The assessment of the bonding properties of Sprayfiber-F product when applied on concrete structures with bonding primer has been carried out according to EGOLF SM5 procedure.

The indicated values are representative of cohesive failure through the applied thickness of protective sprayed product Sprayfiber-F. These values are guidance values, and they reflect neither a statistical evaluation nor minimum guaranteed values.

Table A.4.4. Tensile bond strength on concrete slabs with normal weight concrete.

| Surface | Thickness of Sprayfiber-F | Mean tensile bond strength | Failure mode |
|---|---------------------------|----------------------------|------------------|
| Concrete slab according EGOLF SM5 with bonding primer | 9,8 mm | 0,015 MPa | Cohesive failure |
| | 14,5 mm | 0,014 MPa | |

A.4.3 Assessment of the fire performance of Sprayfiber-F on concrete elements

A.4.3.1 General

The assessment method used to assess the fire protection performances of product Sprayfiber-F when applied on concrete elements is according to ENV 13381-3.

A.4.3.2 Protection of slabs and walls

The insulation performance of the protective material when applied on slabs is determined in function of:

- The thickness of protective material applied (mm)
- The standard concrete temperature comprised between [150, 450] (°C)

The insulation performance for the minimum protection thickness of 9,8 mm is given in table A.4.5 and for the maximum thickness of 14,5 mm is given in table A.4.6.

Table A.4.5. Depth of concrete for a protection thickness of 9,8 mm.

| Duration of exposure (min) | Concrete temperature | | | | | | |
|----------------------------|----------------------|-------|-------|-------|-------|-------|-------|
| | 150°C | 200°C | 250°C | 300°C | 350°C | 400°C | 450°C |
| | Depth (mm) | | | | | | |
| 30 | 6 | --- | --- | --- | --- | --- | --- |
| 60 | 14 | 8 | 2 | --- | --- | --- | --- |
| 90 | 31 | 16 | 8 | 2 | --- | --- | --- |
| 120 | 45 | 32 | 18 | 9 | 2 | --- | --- |
| 150 | 61 | 42 | 33 | 21 | 10 | 2 | --- |
| 180 | 74 | 56 | 42 | 34 | 23 | 12 | 4 |
| 210 | --- | 69 | 53 | 41 | 34 | 24 | 13 |
| 240 | --- | --- | 65 | 50 | 40 | 32 | 23 |

Table A.4.6. Depth of concrete for a protection thickness of 14,5 mm.

| Duration of exposure (min) | Concrete temperature | | | | | | |
|----------------------------|----------------------|-------|-------|-------|-------|-------|-------|
| | 150°C | 200°C | 250°C | 300°C | 350°C | 400°C | 450°C |
| | Depth (mm) | | | | | | |
| 30 | 4 | --- | --- | --- | --- | --- | --- |
| 60 | 14 | 5 | --- | --- | --- | --- | --- |
| 90 | 39 | 14 | 6 | --- | --- | --- | --- |
| 120 | 54 | 36 | 13 | 6 | --- | --- | --- |
| 150 | 65 | 51 | 32 | 13 | 7 | 1 | --- |
| 180 | 75 | 59 | 48 | 29 | 13 | 7 | 2 |
| 210 | --- | 68 | 55 | 45 | 24 | 12 | 7 |
| 240 | --- | --- | 62 | 52 | 40 | 21 | 11 |

A.4.3.3 Equivalent thickness of concrete

The equivalent thickness of concrete induced by the protective material Sprayfiber-F is determined according to the requirements of Annex C of standard ENV 13381-3 and is given in the table A.4.7.

Table A.4.7. Equivalent thickness of concrete (mm).

| Component | Thickness of Sprayfiber-F (mm) | Duration in minutes | | | | | |
|------------------------------------|--------------------------------|---------------------|----|----|-----|-----|-----|
| | | 30 | 60 | 90 | 120 | 180 | 240 |
| Load bearing concrete slab or wall | 9,8 | 37 | 48 | 53 | 56 | 55 | 52 |
| | 14,5 | 50 | 59 | 68 | 71 | 73 | 72 |

A.4.3.4 Insulation performance

The separating function of the concrete elements protected with Sprayfiber-F was maintained during the entire test in accordance with the criteria established in EN 1363-1.

A.4.3.5 Stickability performance

The stickability of Sprayfiber-F when applied on concrete structures is determined according to requirements of paragraph 13.5 of ENV 13381-3, in function of the thickness.

Stickability criteria for the slab with Sprayfiber-F 9,8 mm:

Between the 1st and the 90th minute the maximum recorded temperatures on the exposed surface of the concrete were more than 50% above the mean value of the recorded temperatures on the exposed surface of the concrete.

No significant detachment of protection.

Stickability criteria for the slab with Sprayfiber-F 14,5 mm:

At no time the maximum recorded temperatures on the exposed surface of the concrete were more than 50% above the mean value of the recorded temperatures on the exposed surface of the concrete.

Significant detachment of protection: 298 min (without failure).