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European Technical Assessment

ETA 11/0229
of 06/ 06/ 2019

English translation prepared by IETcc. Original version in Spanish language

General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) Nº305/2011:	Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)
Trade name of the construction product	**VERMIPLASTER®** **MP 75 L FIRE** **JETGIPS FIRE**
Product family to which the construction product belongs	Rendering intended for Fire Resisting Application of building elements
Manufacturer	**KNAUF Gips KG** Am Bahnhof 7, 97346 Iphofen. Germany
Manufacturing plant(s)	Carretera. de Incar, km 2.8, 18130 Escúzar (Granada). Spain Mladoboleslavská 949, 19700 Praha 9 (Kbely). Czech Republic Karagedik Ahiboz Serpmeler Mevkii No. 236, 06833 Gölbassi (Ankara). Turkey Knaufstraße 1, 06536 Südharz, Germany Localita Treschi, 50050 Gambassi Terme. Italy
This European Technical Assessment contains	16 pages including 1 Annex, which form an integral part of this assessment. Annex 2. Contain confidential information and is not included in the ETA when that assessment is publicly available
This European Technical Assessment is issued in accordance with regulation (EU) Nº 305/2011, on the basis of	EAD 350140-00-1106. Renderings and rendering kits intended for fire resisting applications
This version replaces	ETA 11/0229 issued on 17/17/2018

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SPECIFIC PARTS OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of the product

The VERMIPLASTER®/ MP 75 L FIRE / JETGIPS FIRE product is a mortar of fine granule based in calcium sulphate. This product is lightened with expansive minerals and formulated with several additives to improve the application and its performances. The application is performed by spray; the product powder is mixed with water in appropriated machines, or manually. Once the mortar is hardened, conforms a continuous rendering completely bonded to the support (concrete, steel with and without primer, galvanized steel and sheet of galvanized steel).

The thickness of the applied product ranges from 6 mm to 36 mm, with a consumption of 6,5-7 kg/m^2/cm thickness.

The final assembly contains a rendering, several primers (base epoxy, alkyd and silicate zinc) when it is applied on steel supports (optional).

According to EAD 350140-00-1106, this ETA is assessed under use conditions: Option 3.

2 Specification of the intended use in accordance with the applicable EAD

The intended use of this product is the rendering of indoor building load-bearing constructive elements to increase the fire resistance in case of fire, keeping the resistance, integrity and insulation (REI) of the building elements until the fire extinction or the building evacuation.

This Product fulfils the Essential Requirements nº 2 (Safety in case of fire), nº 3 (Hygiene, health and the environment) and nº 4 (Safety in use) of the European Regulation 305/2011.

This product has a category of use related to environmental conditions:

- **Type Y** (included Z1, Z2): Renderings intended for internal and semi-exposed conditions (semi exposed conditions include temperatures below 0°C, but not exposed to rain and limited exposure to UV).

Use category related to the element(s) intended to be protected:

- Type 3: Fire Protective Products to protect load-bearing concrete elements.
- Type 4: Fire Protective Products to protect load-bearing steel elements. Beams and columns with 3 and 4 exposed faces. With a section factor of <540 m^{-1}. Temperature ranges from 350ºC to 550ºC. R15, R30, R60, R90, R120.
- Type 5: Fire Protective Products to protect flat concrete profiled sheet composite elements.
- Type 10. Further intended uses, related to fire compartmentalisation or protection of fire performance, not covered by above Types.

The provisions made in this European Technical Assessment (ETA) are based on an assumed intended working life of the system of 25 years, provided that the product is subject to appropriate use and maintenance in accordance with Chapter 5. The indication given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are only to be regarded as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

"Assumed intended working life" means that, when an assessment following the EAD provisions is made, and when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the Essential Requirements.

***Application on site*.** The suitability of use of this product can only be assumed if this is applied according to the manufacturer's instructions, which are part of the MTD to this ETA placed at IETcc.

Particularly, it is recommended to consider.

- The application has to carried out by skilled labor,
- It can only be used the components of the Product indicated in this ETA,
- It is necessary to control the thickness of the applied product during application,
- The support to protect must be clean, dry and without dust or grease in order not to affect the adherence of VERMIPLASTER® / MP 75 L FIRE / JETGIPS FIRE mortar.
- The recommended mixing water (water/cement) is 0,7 to 0,9 so for a VERMIPLASTER® / MP75 L FIRE / JETGIPS FIRE sacks is necessary 15 ± 2 L of water.

- The application must be performed by spray, mixing the product with water in the projection machine, or manually. Usually the powder is mixed with water in usual mixing machines. The water flow of the machine must be regulated until achieving a mass/paste/plasticity that covers uniformly and does not fell down. In order to achieve a uniform finishing of VERMIPLASTER®/ MP75 L FIRE / JETGIPS FIRE it should be used nozzles from 10 to 12 mm.
- The adherence test in situ should be at least 80% of the values enclosed in this ETA.
- The density of the applied rendering on site will not vary more than 760 kg/m^3 ± 15%. If it was more than 15%, it would be needed to carry out adherence tests.
- The hardened product will not present cracks, according to the test performed in this evaluation.
- Before, the installation of VERMIPLASTER® / MP 75 L FIRE / JETGIPS FIRE, it is recommended to read its security card.

Requirements to use primers on different supports and its compatibility with its rendering

- The alkyd, epoxy and silicate zinc primers are compatible with VERMIPLASTER®/ MP75 L FIRE/ JETGIPS FIRE, however, the application of VERMIPLASTER®/ MP75 L FIRE / JETGIPS FIRE can be carried out directly on clean steel because it does not cause directly any corrosion on steel. Adherence can vary from one primer to another, depending on the primer quality and the finishing state of the surface**.** Oily primers and those which give off pigments are not recommended.
- For concrete, galvanized steel sheet, and galvanized steel supports, the use of primer is not necessary.
- The ETA-Guideline is not designed to cover the application of rendering over any existing coating (*e.g.* 'old' existing paint) or rendering. It is therefore assumed that:
    - any existing coating or rendering must be completely removed before the application.
    - if it could not be removed, it must be consult with the manufacturer.

Circumstances in which the rendering needs reinforcements. Although it has not been evaluated in this ETA, in cases where the mechanical resistance needs to be improved, it is recommended to place a mesh. In cases that the state of the surface does not assure an adequate adherence, please check it with the manufacturer.

Finishing of the final aspect of the rendering. Any repairing required may be performed manually by using a trowel, etc, Its finishing is rough but, if desired; it can be smoothed using a trowel or any other brickwork tool intended for this use.

Application limitations due to certain environments

- The recommended environmental temperature of the product to be applied will be between 5ºC and 40ºC and it will be not admitted support temperatures upper to 45ºC. In other conditions it will need to follow the manufacturer's instructions.
- During the application and drying time, the product has to be protected against the water rain.
- Curing and drying must not be exposed to strong winds during projection to avoid a rapid dry.

Incompatibility with other Fire protection materials. For these special cases, it is needed to check it with the manufacturer.

Recommendations of use, maintenance and repair. It is recommended to carry out regularly control inspections to check the state of the product (damages, cracks, cleanliness, etc). The repair procedure will be carried out by complete disposal of the damaged product, preparation of the support (cleanliness) and new application of VERMIPLASTER®/ MP75 L FIRE / JETGIPS FIRE sprayed or manually if the reparation size is small (< 1000 cm^2). When the area to repair is significant, it is recommending to use a mesh fixed to the support shall be used.

Further application details are laid down in the MTD place at IETcc.

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

The assessment of the fitness of the VERMIPLASTER®/ MP75 L FIRE / JETGIPS FIRE for the intended use regard to the Essential Requirements nº 2, 3 and 4 was performed in compliance with the "Guideline for European Technical Approval of Fire Protective Products, EAD 350140-00-1106 "Renderings and Rendering Kits Intended for Fire Resisting Applications".

3.1 Characteristics of Product "VERMIPLASTER®/ MP75 L FIRE /JETGIPS FIRE"[1]

3.1.1 ER. 2 *Safety in case of fire*

Reaction to fire. Classification A1 according to EN 13501-1. Product does not require to be tested because of its composition.

Fire resistance. The tests were performed according to the standards ENV 13381-3:2004, 13381-4:2005, ENV 13381-5:2005 and EN 13501-2 (annex I).

Support	Thickness of the product	Classification
Walls and slab of concrete	10,6 to 20,2 mm	REI 30 at REI 240
Beam and columns of concrete	6,9 to 18,5 mm	R 30 at R 180
Flat concrete profiled sheet composite	11,4 to 24,0 mm	REI 30 at REI 120
Steel	6,0 to 36,0 mm	R 15 at R 120

3.1.2 ER. 3 *Hygiene, health and environment*

Content, emission and/or release of dangerous substances. According to the manufacturer's declaration taking account of EOTA TR 034, the product installed does not contain and release any dangerous substance.

The semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) were not determined in accordance with EN 16515.

Resistance to water vapour (EN 12086). $\mu = 8$ (thickness 1 cm)

3.1.3 ER. 4 *Safety in use. See* Serviceability aspect.

3.1.4 A*spects of durability.*

Resistance to deterioration caused by high humidity[2] (4 weeks at 32ºC, 95%HR)

Support	Adherence (MPa)	Thermal efficiency	Visual aspect
Concrete	≤ 20%	----------	Correct
Steel	≤ 20%	≤ 15%	Correct

Resistance to deterioration caused by heat and cold[2] (5 cycles)

Support	Adherence (MPa)	Thermal efficiency	Visual aspect
Concrete	≤ 20%	----------	Correct
Steel	≤ 20%	≤ 15%	Correct

Resistance to deterioration caused by freezing and thawing[2] (25 cycles)

Support	Adherence (MPa)	Thermal efficiency	Visual aspect
Concrete	≤ 20%	----------	Correct
Steel	≤ 20%	≤ 15%	Correct

Resistance to corrosion of a steel substrate by the rendering (240h, 23ºC at 60% and at 95% HR). The thickness of the sample was 6 mm and the obtained weight lost was of 4,1 10^{-5} g/mm^2 and 5,1 10^{-5} g/mm^2 at 60% and 90% HR conditions respectively.

3.1.5 Serviceability aspects

Resistance to functional failure from hard body impact load – 0,5 kg steel ball (TR 001, modified according to EAD 350140-00-1106)

Thickness (mm)	Print (mm)		Aspect
	3J	10J	
25	22	32	non cracks, non-delamination
10	23	31	non cracks, non-delamination

Resistance to functional failure from soft body impact load – 50 kg bag (TR 001, modified according to EAD 350140-00-1106). The product was applied on concrete support and an impact of 500 J does not produce cracks loss of delaminating, nor loss of adherence.

[1] These tests are valid for hardened density of applied rendering between 760 ± 15% kg/m^3.
[2] Adherence and thermal efficiency values alter ageing, must not be inferior to 80% (variation ≤ 20% and 85% (variation ≤ 15%) respectively from initial value.

Flexural performance. NPA

Air erosion. NPA

Adherence (EGOLF SM/5).

Support	Thickness	Adherence (MPa)
Concrete	25 mm	≥ 0.1
	10 mm	
	6 mm	
Steel	36 mm	≥ 0.1
	25 mm	
	6 mm	
Steel + Epoxy primer	36 mm	≥ 0.1
	25 mm	
	6 mm	
Steel + Alkyd primer	36 mm	≥ 0.1
	25 mm	
	6 mm	
Steel + Silicate Zinc primer	36 mm	≥ 0.1
	25 mm	
	6 mm	
Galvanized steel	25 mm	≥ 0.1
	10 mm	
Sheet galvanized steel	25 mm	≥ 0.05
	10 mm	

Thermal efficiency and aspect with the different primers

Support	Thermal efficiency	Visual aspect
Steel + Epoxy primer	≤ 15%[3]	Correct
Steel + Alkyd primer	≤ 15%	Correct
Steel + Silicate Zinc primer	≤ 15%	Correct
Galvanized steel	≤ 15%	Correct

3.2 Identification of components

The characteristics of the components of this product show the following values, which are within the respective requirements and tolerances stated in the Manufacture Technical Dossier (MTD).

Properties	VERMIPLASTER / MP 75 L FIRE / JETGIPS FIRE
Binder content	45-55
TG / ATD	IETcc
Water mixing ratio (%)	70-90
Colour of applied material	white to beige
Density (kg/m^3) Powder Paste (EN 1015-6) Hardened (EN 1015-10)	 500-600 1000-1300 650-875
Dry extract 45ºC, (% weight residue)	> 99
Ash content 550ºC, (% weight residue)	> 95
Flexural strength (EN 1015-11) (MPa)	> 0,7
Compressive strength (EN 1015-11) (MPa)	> 1,4

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

System of attestation of conformity. The European Commission according to mandate Construct 98/311, Annex 3 (taking into account decision 1999/454/EC of the Commission) on the procedure of attestation of conformity for the procedure of attestation of conformity (Annex III of EU Regulation 305/2011) has laid down for this type of material:

Product	Intended uses	Level or Classes	System
VERMIPLASTER MP 75 L FIRE JETGIPS FIRE	Rendering intended for Fire Resisting Application of building elements	Any	1

[3] Variation of the test time respect to the same sample un-primed steel sheet

The system 1 provides:

Tasks for the manufacturer: factory production control and further testing of samples taken at the factory by the manufacturer in accordance with the "Control Plan".

Tasks for the approved body: initial type-testing of the product, initial inspection of factory and of factory production control and two annual surveillances, assessment and approval of factory production control of the manufacturer.

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

The ETA is issued for these products on the basis of agreed data/information, deposited at IETcc, which identifies the product that has been assessed and judged. It is the manufacturer's responsibility to make sure that all those who use the kit are appropriately informed of specific conditions according to sections 1, 2, 4 and 5 including the annexes of this ETA. Changes of the product´s components or their production process, which could result in this deposited data/information being incorrect should be notified to the IETcc before the changes are introduced. IETcc will decide whether or not such changes affect the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

5.1 Tasks for the manufacturer

Factory production control. The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this ETA.

The manufacturer may only use components stated in the technical documentation of this ETA including Control Plan. The incoming raw materials are subjected to verifications by the manufacturer before acceptance.

The factory production control shall be in accordance with the Control Plan(4) which is part of the Technical Documentation of this ETA. The Control Plan has been agreed between the manufacturer and the IETcc and is laid down in the context of the factory production control system operated by the manufacturer and deposited at the IETcc. The results of factory production control shall be recorded and evaluated in accordance with the provisions of the Control Plan.

The documentation shall be kept for at least five years. In the next table are enclosed the controls and the minimum frequency performed by the manufacturer.

Property	Frequency
Raw Material	Batch
Bulk density of the components	Batch
Bulk density of dry product	Batch
Bulk density of paste product	Batch
Consistence	Batch
Bulk density of hardened	Monthly
Adherence	Monthly
Insulation efficiency	Monthly

Further information concerning tests, frequencies and tolerances are included in the test's plan, which is part of the MTD to this ETA placed at IETcc.

Other tasks of manufacturer. The manufacturer shall, on the basis of a contract, involve a body which is notified for the tasks referred to in section 4 in order to undertake the actions laid down in this clause. For this purpose, the control plan shall be handed over by the manufacturer to the notified bodies involved.

The manufacturer shall make a declaration of conformity, stating that this product is in conformity with the provisions of this ETA.

(4) The control plan is a confidential part of this European Technical Assessment and only handed over to the notified body involved in the procedure of attestation of conformity.

5.2 Tasks for the Notified body

Initial type-testing of the product. The initial type-testing have been carried out by the IETcc to issue this ETA which corresponds to chapter 5 of the Guideline for European Technical Approval of Fire Protective Products, EAD 350140-00-1106 “Renderings and Rendering Kits Intended for Fire Resisting Applications”.

The initial type-testing of this ETA have been carried out by the IETcc on samples from the current production. The IETcc has assessed the results of these tests in accordance with chapter 6 of this ETA –Guideline, as part of the ETA issuing procedure.

Initial inspection of factory and production control. The IETcc has checked that, in accordance with the MTD, factory conditions and production control allow the manufacturer to ensure the consistency and homogeneity of the manufactured product and its traceability, in order to assure the final characteristics of the product.

Continuous surveillance, assessment and approval of Factory Production Control. The Notified body shall visit the factory at least once a year. Surveillance of the manufacturing process shall include:

- Inspection of the documentation of factory production control, to ensure continuing compliance with the provisions of the ETA,
- Identification of changes by comparing data obtained during the initial inspection or during the last visit.

In cases where the provisions of the European Technical Approval and its “Control Plan” are no longer fulfilled the certification body (IETcc) shall withdraw the certificate of conformity.

Issued in Madrid on 6 june 2019
by

Instituto de Ciencias de la Construcción Eduardo Torroja

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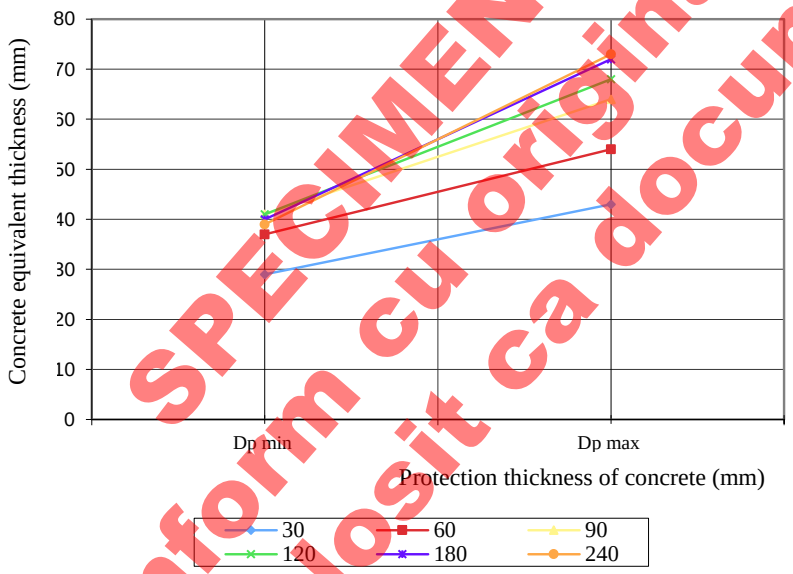
Director IETcc-CSIC

Annex I. Fire resistance tests

Concrete slabs and walls. According to the standard of reference ENV 13381:3-2004, during the course of the test were not detected temperatures on the exposed side higher than 50% of the mean temperature of this side, consequently, the loss of stickability of the protection product was not registered.

Final equivalent thickness of concrete obtained according to isothermal curves of the Eurocode 2 (ENV 1992-1-2:1995. Design of concrete structures. Part 1-2 General Rules. Structural Fire Design) for the concrete, dated in December 1996 is:

	Time (min)					
	30	**60**	**90**	**120**	**180**	**240**
d_{pmin} = 10,61 mm Total Average thickness applied	29	37	41	41	40	39
d_{pmax} = 20,18 mm Total Average thickness applied	43	54	64	68	72	73
	Values of equivalent thicknesses of concrete in mm					

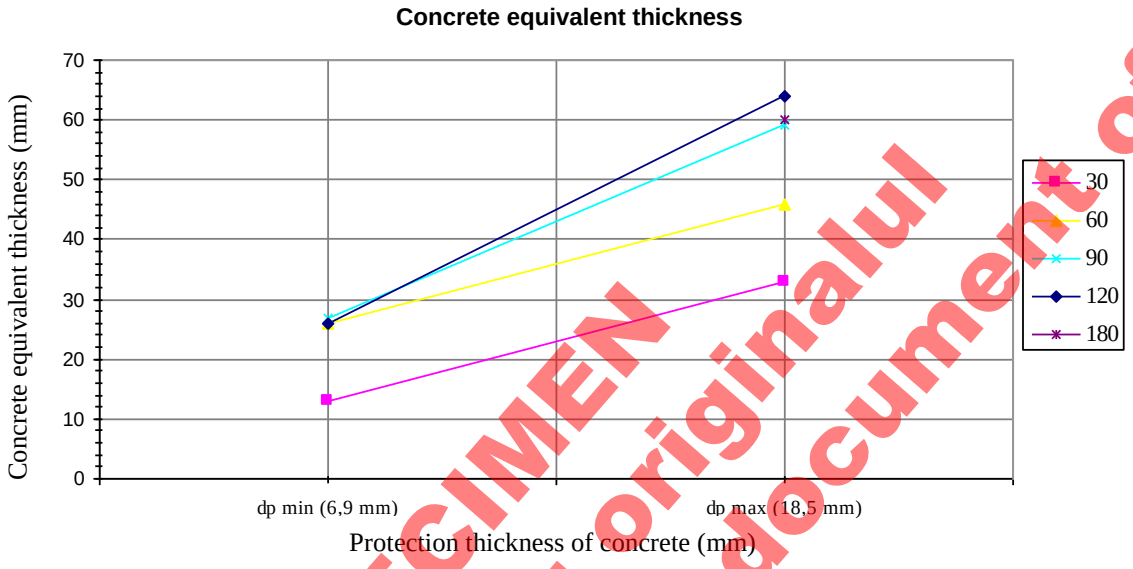


The limits of applicability of the results of the assessment obtained are the next:

- Results valid only for slabs and walls of concrete with fire exposure from one side.
- Result applicable to densities of concrete within the range 1908,25 kg/m^3 to 2662,25 kg/m^3. (Densities of concrete tested 2245 kg/m^3 and 2315 kg/m^3).
- Result applicable to concrete members with strength equal to or superior of the tested ones (28,8 N/mm^2 at 28 days).
- Results applicable to slabs of thickness equal to or superior of 120 mm.
- Results valid for application system of coating as the tested one and framework as the tested one.

Concrete columns and beams. Final equivalent thickness of concrete obtained according to the graphic from the document"*FSGN455. Fire protective product on concrete beams. Detailed conditions for evaluating the equivalent thickness of concrete*", of February 2009 has been:

	Time (min)				
	30	**60**	**90**	**120**	**180**
d_{pmin} = 6,9 mm Total average thickness applied	13	26	27	26	---
d_{pmax} = 18,5 mm Total average thickness applied	33	46	59	64	60
Values of equivalent thicknesses of concrete in mm					



The limits on the application of the results obtained are the following:

- Results valid only for concrete beams and columns in horizontal as well as vertical position, exposed on more than one side.
- Result applicable to densities of concrete within the range of 2025 kg/m^3 to 2740 kg/m^3.
- Result applicable to concretes with fracture stresses under compression which are equal to or higher than the tested ones. 36,4 N/mm^2 at 28 days.
- Results applicable to beams with the width in their base equal to a higher than 150 mm.

Flat concrete profiled sheet composite. Minimum protection thickness of VERMIPLASTER® /MP 75 L FIRE mortar for the resistance (REI). Critical temperature of flat concrete profiled sheet composite 350 ºC.

Total thickness flat concrete profiled sheet composite (cm)	**Minimum Thickness of applied (mm)** **Classification of REI**			
	REI 30	REI 60	REI 90	REI 120
10	11	15	19	24
11	11	15	19	24
12	11	15	19	24
13	11	15	19	24
14	11	15	19	24
15	11	15	19	24
16	11	15	19	24
17	11	15	19	24
18	11	15	19	24
19	11	15	19	24
20	11	15	19	24
21	11	15	19	24
22	11	15	19	24
23	11	15	19	24
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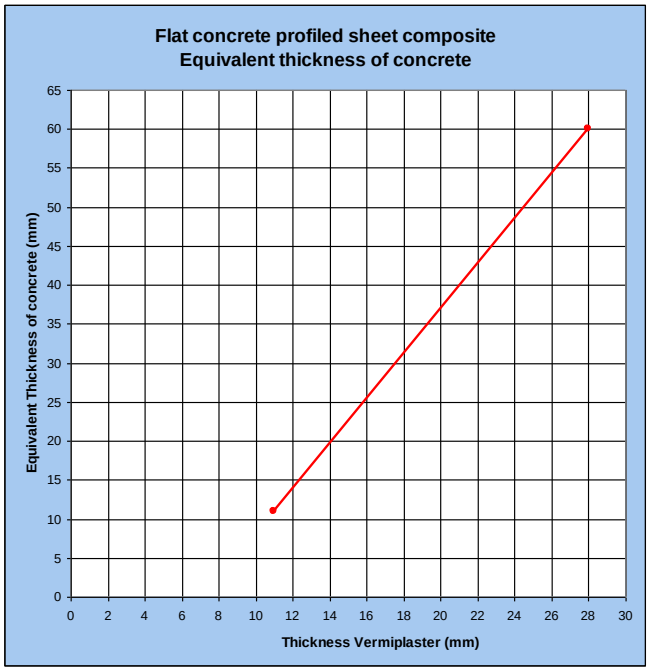
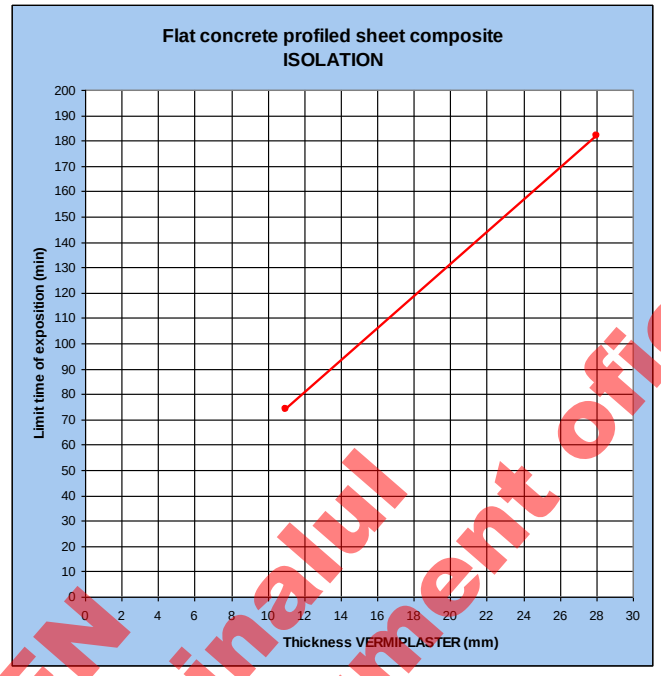
28	11	15	19	24





In case only integrity and isolation is required (EI), check with the manufacturer.

The application limitations of the results obtained are the following:

- The test results, according to the performance of the fire protection system in accordance with this method, can be applied to slabs composed of concrete/steel with profiled steel sheet which may or may not contain framework steel bars for the purpose of load resistance.
- The results of the assessment are applicable to the mixed slabs of concrete/steel with exposition to fire next to the steel and in accordance with the following:
  - The sheet's thickness is superior or equal to 0,75 mm.
  - The width of the rib (lp_1), to which the fire protection material is directly fixed, should not be superior to 1.5 times as much the width of the specimen tested. Thus, $lp_1 \leq 135$ mm.
  - The height of the rib (h_2) should not be superior to 1,5 times as much the height of the specimen tested, that is, $h_2 \leq 88,5$ mm.
- The equivalent thickness of concrete for a given thickness of the fire protection system is applicable within the corresponding Limiting Exposure Time (according to graphic).
- The results of the assessment are valid solely for slabs composed of concrete/sheet made with trapezoidal profiled steel sheet.
- The results of the assessment can only be applied to slabs made of concrete/sheet whose concrete's density is comprised between 0,85 and 1,15 times as much the thickness of the concrete tested, that is: [2014 – 2726] kg/m^3.
- The results of the assessment are applicable to concrete elements whose concrete's strength is equal or greater to the resistance of the concrete tested, that is: 33,8 MPa within 28 days.
- The results of the assessment are applicable to all of those concrete elements whose concrete has been made of siliceous aggregates.
- The results of the assessment can only be applied to slabs made of concrete/steel where the effective thickness of the slab is equal or superior to the slab tested. (80,3 mm).
- The results of the assessment can only be applied to fire protection systems where the fixation system used is equal to the one used in the system tested.
- The results of the assessment can only be applied to protections of single layer.

Beams and Columns of steel with 3 or 4 exposed faces

Section factor (m^{-1})	Minimum thickness (mm) of product to R-15 (mm)				
	Critical temperature (ºC) of the steel below				
	350	400	450	500	550
60	6	6	6	6	6
70	6	6	6	6	6
80	6	6	6	6	6
90	6	6	6	6	6
100	6	6	6	6	6
110	6	6	6	6	6
120	6	6	6	6	6
130	6	6	6	6	6
140	6	6	6	6	6
150	6	6	6	6	6
160	6	6	6	6	6
170	6	6	6	6	6
180	6	6	6	6	6
190	6	6	6	6	6
200	6	6	6	6	6
210	6	6	6	6	6
220	6	6	6	6	6
230	6	6	6	6	6
240	6	6	6	6	6
250	6	6	6	6	6
260	6	6	6	6	6
270	6	6	6	6	6
280	6	6	6	6	6
290	6	6	6	6	6
300	6	6	6	6	6
310	6	6	6	6	6
320	6	6	6	6	6
330	6	6	6	6	6
340	7	7	6	6	6
350	9	8	6	6	6
360	9	8	6	6	6
370	10	8	6	6	6
380	10	8	7	6	6
390	10	8	7	6	6
400	10	8	7	6	6
410	10	8	7	6	6
420	10	9	7	6	6
430	10	9	7	6	6
440	10	9	7	6	6
450	10	9	7	6	6
460	10	9	8	6	6
470	11	9	8	6	6
480	11	9	8	6	6
490	11	9	8	7	6
500	11	9	8	7	6
510	11	9	8	7	6
520	11	9	8	7	6
530	11	9	8	7	6
540	11	10	8	7	6

Beams and Columns of steel with 3 or 4 exposed faces

Section factor (m^{-1})	Minimum thickness (mm) of product to R-30 (mm)				
	Critical temperature (°C) of the steel below				
	350	400	450	500	550
60	*7*	*6*	*6*	*6*	6
70	*7*	*6*	*6*	*6*	6
80	7	6	6	6	6
90	7	7	6	6	6
100	8	7	6	6	6
110	8	7	6	6	6
120	8	7	7	6	6
130	8	8	7	6	6
140	9	8	7	6	6
150	9	8	7	6	6
160	9	8	7	7	6
170	9	8	7	7	6
180	9	8	8	7	6
190	9	9	8	7	6
200	10	9	8	7	6
210	10	9	8	7	7
220	10	9	8	7	7
230	10	9	8	7	7
240	10	9	8	8	7
250	10	9	8	8	7
260	10	9	8	8	7
270	10	9	9	8	7
280	10	9	9	8	7
290	10	9	9	8	7
300	10	10	9	8	7
310	10	10	9	8	7
320	10	*10*	*9*	*8*	8
330	*11*	*11*	*10*	*8*	8
340	*12*	*12*	*11*	*9*	8
350	14	13	12	10	9
360	14	13	12	11	9
370	14	13	12	11	9
380	14	13	12	11	10
390	15	13	12	11	10
400	15	13	12	11	10
410	15	14	12	11	10
420	15	14	12	11	10
430	15	14	13	11	10
440	15	14	13	11	10
450	16	14	13	12	10
460	16	14	13	12	11
470	16	14	13	12	11
480	16	14	13	12	11
490	16	14	13	12	11
500	16	14	13	12	11
510	16	14	13	12	11
520	16	14	13	12	11
530	16	15	13	12	11
540	16	15	14	12	11

Beams and Columns of steel with 3 or 4 exposed faces

Section factor (m^{-1})	Minimum thickness (mm) of product to R-60 (mm)				
	Critical temperature (ºC) of the steel below				
	350	400	450	500	550
60	*11*	*10*	*9*	*8*	7
70	*12*	*10*	*9*	*8*	8
80	12	11	10	9	9
90	13	12	11	10	9
100	14	12	11	10	10
110	14	13	12	11	10
120	15	13	12	11	11
130	15	14	13	12	11
140	15	14	13	12	11
150	16	14	13	12	12
160	16	15	14	13	12
170	16	15	14	13	12
180	17	15	14	13	13
190	17	16	15	14	13
200	17	16	15	14	13
210	17	16	15	14	13
220	17	16	15	14	14
230	18	16	15	14	14
240	18	17	16	15	14
250	18	17	16	15	14
260	18	17	16	15	14
270	18	17	16	15	14
280	18	17	16	15	14
290	18	17	16	16	15
300	19	18	17	16	15
310	19	18	17	16	15
320	*19*	*18*	*17*	*16*	15
330	*21*	*19*	*17*	*16*	15
340	*23*	*21*	*19*	*17*	16
350	25	23	21	19	18
360	25	23	21	20	18
370	25	23	22	20	18
380	25	24	22	20	19
390	26	24	22	20	19
400	26	24	22	21	19
410	26	24	22	21	19
420	26	24	22	21	19
430	26	24	23	21	19
440	26	24	23	21	20
450	26	25	23	22	20
460	26	25	23	22	20
470	27	25	24	22	20
480	27	25	24	22	20
490	27	25	24	22	21
500	27	25	24	22	21
510	27	25	24	22	21
520	27	25	24	23	21
530	27	26	24	23	21
540	27	26	24	23	21

Beams and Columns of steel with 3 or 4 exposed faces

Section factor (m^{-1})	Minimum thickness (mm) of product to R-90 (mm)				
	Critical temperature (ºC) of the steel below				
	350	400	450	500	550
60	*16*	*14*	*13*	*12*	11
70	*17*	*15*	*13*	*12*	11
80	18	16	15	13	12
90	19	17	15	14	13
100	19	18	16	15	14
110	20	19	17	16	15
120	21	19	18	16	15
130	21	20	18	17	16
140	22	20	19	18	16
150	23	21	20	18	17
160	23	21	20	19	18
170	23	22	20	19	18
180	24	22	21	20	18
190	24	23	21	20	18
200	24	23	22	20	19
210	25	23	22	21	19
220	25	24	22	21	20
230	25	24	23	21	20
240	26	24	23	22	20
250	26	24	23	22	21
260	26	25	23	22	21
270	26	25	24	23	21
280	26	25	24	23	22
290	27	25	24	23	22
300	27	26	24	23	22
310	27	26	25	24	22
320	*27*	*26*	*25*	*24*	23
330	*28*	*27*	*26*	*25*	23
340	*30*	*29*	*27*	*26*	24
350	32	31	29	28	26
360	32	31	29	28	27
370	33	31	30	28	27
380	33	31	30	28	27
390	33	31	30	28	27
400	33	31	30	29	27
410	33	32	30	29	27
420	33	32	30	29	28
430	33	32	30	29	28
440	33	32	30	29	28
450	33	32	31	29	28
460	33	32	31	29	28
470	33	32	31	30	28
480	33	32	31	30	28
490	33	32	31	30	28
500	33	32	31	30	28
510	34	32	31	30	29
520	34	32	31	30	29
530	34	32	31	30	29
540	34	33	31	30	29

Beams and Columns of steel with 3 or 4 exposed faces

Section factor (m^{-1})	Minimum thickness (mm) of product to R-120 (mm)				
	Critical temperature (ºC) of the steel below				
	350	400	450	500	550
60	*21*	*19*	*17*	*15*	14
70	*22*	*19*	*18*	*16*	15
80	23	21	19	18	16
90	24	22	20	19	17
100	25	23	21	20	18
110	26	23	22	21	19
120	27	24	23	22	20
130	28	25	24	23	21
140	29	26	25	23	22
150	29	27	26	24	23
160	30	27	26	25	23
170	30	28	27	25	24
180	*31*	29	28	26	25
190	*31*	29	28	27	25
200	*32*	30	29	27	26
210	*34*	*30*	29	28	26
220	36	*31*	29	28	27
230	•	*31*	30	28	27
240	•	*31*	30	29	28
250	•	*32*	31	29	28
260	•	*32*	31	30	28
270	•	34	31	30	29
280	•	36	32	30	29
290	•	•	32	31	29
300	•	•	32	31	30
310	•	•	33	31	30
320	•	•	35	*31*	30
330	•	•	35	*32*	31
340	•	•	35	*33*	32
350	•	•	35	34	33
360	•	•	36	34	33
370	•	•	•	34	33
380	•	•	•	34	33
390	•	•	•	35	33
400	•	•	•	35	33
410	•	•	•	35	33
420	•	•	•	35	34
430	•	•	•	35	34
440	•	•	•	35	34
450	•	•	•	35	34
460	•	•	•	36	34
470	•	•	•	•	34
480	•	•	•	•	34
490	•	•	•	•	34
500	•	•	•	•	34
510	•	•	•	•	35
520	•	•	•	•	35
530	•	•	•	•	35
540	•	•	•	•	35

The evaluation results within which the product can be used are:

- Section Factor up to 540 m^{-1}
- Protection thicknesses assessed between 6 mm and 36 mm.
- Critical temperature up to 550 ºC

In the same way, the evaluation results are only applicable to:

- "I" and "H" section profiles
- Results from analysis of I or H-sections are directly applicable to angles, channels and T-sections for the same section factor, whether used as individual elements or as bracing.
- Those profiles of different type of section to the previous ones must be assessed expressly, according to the indications shown on ANNEX B of the ENV 13381-4:2005.
- Other grades of steel in accordance to EN 10025 and EN 10113
- Columns and beams with 3 or 4 faces exposed.