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EDUARDO TORROJA**

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European Technical Assessment **ETA 23/ 0098** of 24/ 01/ 2023

English translation prepared by IETcc. Original version in Spanish language

General Part

Technical Assessment Body issuing the European Technical Assessment:

Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)

Trade name of the construction product

PROTECT FIRE

Product family to which the construction product belongs

Fire Protective Reactive coating for structural steel

Manufacturer

Pinturas Adoral, S.L.
Crta. Nacional 301 km 215,7
CP 02630 LA RODA. ALBACETE. Spain

Manufacturing plant(s)

Plant 1.

This European Technical Assessment contains

13 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

European Assessment Document (EAD) nº 350402-00-1106 Reactive coating for Fire Protective of structural steel

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Specific parts

1 Technical description of the product

The PROTECT FIRE product is reactive coating in water dispersion formulated for the fire protection of structural steel elements. The application is performed by spray or brush, and once the reactive coating is hardened, conforms a continuous rendering completely bonded to the support (steel with different kinds of primers). The final assembly contains the following components:

Product	Trade name	Thickness (µm)	Consumption (kg/m ²)	Support	Environmental conditions
PRIMER (solvent based)	EPOXI 2/C	45-65	0,10 - 0,15	steel	-----
	EPOXI 2/C rich in Zinc	45-60	0,20 - 0,26	steel	-----
	ALKIDIC 1/C	60-75	0,19 - 0,24	steel	-----
Reactive coating	PROTECT FIRE	214-1405	0,43 - 3,0	-----	Z2, Z1
Top coat (solvent based) ¹	Acrylic polyurethane 2/C	45 -102	0,10 - 0,20	-----	Y
	Varnish Acrylic 1/C	60-95	0,19 - 0,3	-----	Y

The final assembled system is constituted by one PRIMER + PROTECT FIRE + top coat of the above table only for the environmental conditioned type Y.

According to EAD 350402-00-1106 this ETA is assessed under use conditions: Option 3.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use(s)

The intended use of the PROTECT FIRE coat reactive is the rendering of 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 Basic works requirements n.º 2 (Safety in case of fire), n.º 3 (Hygiene, health and the environment) and n.º 4 (Safety in use) of the of Regulation (EU) No 305/2011.

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

- **Type Y:** Reactive coating system intended for use in internal and semi-exposed conditions. Semi exposed includes temperatures below zero, but no exposure to rain and limited expo-sure to UV (but UV is not assessed). When it is applied with top coat Polyurethane Acrylic de 2/C o varnish Acrylic de 1/C.
- **Type Z1:** Reactive coating system intended for use in internal conditions with humidity equal to or higher than 85 % RH, excluding temperatures below 0 °C. The reactive coating can be applied without top coat or with any one of the system.
- **Type Z2:** Reactive coat intended for internal conditions without high humidity² content, and excluding temperatures below 0 °C, In this case the reactive coat can be applied without top coat or with any top coat of the system.

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

- **Type 4:** Fire Protective Products to protect load-bearing steel elements. Beams and columns of open section and square hollow beams, both with 3 and 4 exposed faces. With a section factor of < 320 m⁻¹. Temperature ranges from 500 °C to 650 °C. R15, R30, R60 and R90.

¹ In Type Y environments, you must always check top coats with the manufacturer.

²These uses do not apply for internal humidity class 5 in accordance with EN ISO 13788.



2.2 Relevant general conditions for the use of the kit

The provisions made in this European Technical Assessment are based on an assumed working life of 10 years from installation in the works, according to EAD 350402-00-1106, provided that the conditions lay down for the installation, packaging, transport and storage as well as appropriate use, maintenance and repair are met. In this respect.

The indications given on the working life cannot be interpreted as a guarantee given neither by the product manufacturer nor by EOTA nor by the Technical Assessment Body issuing this ETA, but are regarded only as a means for choosing the right product in relation to the expected economically reasonable working life of the works.

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 be 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 PROTECT FIRE.
- The application must be performed by spray or brush. All these characteristics are included in the machines technical specifications and instructions of use.
- The hardened product will not present cracks, according to the test performed in this evaluation.
- Before the application of PROTECT FIRE or any primer, it is recommended to read their MSDS.
- Surface preparation: The surface must be blasted to a Sa2½ degree (ISO 8501-1), cleaned and degreased. Roughness must be at least 25-50 microns. The application of the primers must be immediately after surface preparation in order to avoid any contamination.
- The EAD 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 would be necessary to consult the manufacturer.
- Protection materials. In these special cases, it is needed to check it with manufacturer.

Application limitations due to certain environments

- During the application and drying time, the product has to be protected against the water rain. With strong winds, high temperatures and any climate agent that can produce a quick dry of the reactive coating, PROTECT FIRE will be applied in several layers with lower thicknesses each one to reduce the formation of cracks.

Incompatibility with other Fire protection materials

- For these special cases, it is needed to check it with the manufacturer.

Manufacturer's responsibilities. It is responsibility of the manufacturer of the product to ensure that the information of application of the product is communicated correctly to the manufacturer's applicators.

Recommendations of use, maintenance and repair. It is recommended to carry out yearly 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),
- new application of PROTECT FIRE, sprayed or manually according to the reparation size. The material preparation and its application will be performed as indicated above.

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



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

The assessment of the fitness of the PROTECT FIRE for the intended use regard to the Basic works requirements n.º 2, 3 and 4 was performed in compliance with the “European Assessment Document (EAD) n.º 350402-00-1106 Reactive coating for Fire Protective of structural steel.

3.1 Safety in case of fire (BWR 2)

Reaction to fire. According to EN 13501-1. Classification F.

Fire resistance. The tests were performed according to the standards EN 13381-8.

Support	Primer	Reactive coating	Thickness (µm) Reactive coating	Top Coat	Classification
Steel	EPOXI 2/C rich in zinc EPOXI 2/C, ALKIDIC 1/C	PROTECT FIRE	214-1405	-----	R 15 at R 90

3.2 Hygiene, health and environment (BWR 3)

Emission 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) are not determined in accordance with EN 16516.

3.3 Safety and accessibility in use (BWR 4)

Adhesion. Pass.

Durability

Corrosion. Pass. The reactive coat has no adverse effect on the primer and the reactive coating system does not produce corrosion to the substrate.

Compatibility with primers The different primers do not affect the properties of the reactive coating adhesion and thermal efficiency: Pass³.

Behaviour under different environmental conditions.

Reactive coating	Top coat	Environmental conditions	Results ³
PROTECT FIRE	-----	Z2	Apt
	-----	Z1	Apt
	Polyurethane acrylic 2/C	Y	Apt
	Varnish acrylic 1/C	Y	Apt

Resistance to chemical. NPA

3.4 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).

Components	Description	Fingerprint	Colour	Density ⁴	Dry content (105 °C, 1h) (%)
PROTECT FIRE	Reactive coating	IETcc	White	1,40 ± 0,03	71
EPOXI 2/C	Epoxi 2 component	-----	Grey	1,35 -1,40	A: 85 // B:70
Epoxi 2/c rich in Zn	Epoxi 2/c rich in Zn	-----	Grey	2,0 - 2.5	A: 87 // B:48
Alkydic 1/C	Alkydic	-----	Grey	1,25 -1,50	83
Polyurethane acrylic 2/C	Polyurethane acrylic	-----	White	1,21 -1,30	-----
Varnish acrylic 1/C	Acrylic	-----	White	1,10 -1,40	-----

³ The averages time to achievement of critical Steel temperature (t500) determined in the insulation efficiency tests with the different primers and top coats are not less than 85% of the average time t500 (time to reach a steel temperature of 500°C) of the reference system. No single results of exposed specimens were less than 80 % of the mean time t_{500} of the initial test.

⁴ EN ISO 2811, 23°C, HR% 50; kg/l



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

4.1 System of assessment and verification of constancy of performance

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
PROTECT FIRE	Rendering intended for Fire Resisting Application of building elements	Any	1

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 notified 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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan which is deposited at IETcc⁵.

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 Plan⁶ 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	Every delivery
Char depth (expansion ratio)	Batch
Sag resistance	Batch
Insulation efficiency	10 Batch / 1 per month at least
Viscosity	Batch
Incoming material	Every delivery
Curing	Batch
Pigment dispersion (fineness of the grind)	Batch
Non-volatile content	Batch

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.

⁵ 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.

⁶ 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.



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.

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 EAD “Reactive coatings for fire protection of steel elements”. 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 to this EAD.

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, 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 twice 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 Assessment and its “Control Plan” are no longer fulfilled the certification body (IETcc) shall withdraw the certificate of conformity.

Issued in Madrid on 24 May 2022

By

D. Ángel Castillo Talavera
Director

on behalf of Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc – CSIC)



Annex I. Fire resistance tests. This Annex relates to the use of PROTECT FIRE for the fire protection of 'H' or 'I' shaped steel beam and column sections and tubular beam of square section. The precise scope is given in the following tables which show the total dry film thickness of PROTECT FIRE (excluding primer and top coat) required to provide classifications of R15 to R90 for various design temperatures and section factors. The product is approved on the basis of:

- Assessment testing in accordance with the principles of EN 13381-8.
- A design appraisal against this ETA adopting the numerical regression analysis defined in Annex E of EN 13381-8:2013 is used for results R15 and R30.
- A design appraisal against this ETA adopting the graphics methods in Annex E.2 of EN 13381-8:2013 is used for R-60, R-90 and tubular sections.

The data presented in the tables in this annex refers to beams and columns of open section and beams of close section square. The data shown is applicable to steel sections blast cleaned to ISO 8501-1 SA21/2 or equivalent and primed with the compatible primers and top coats listed in this ETA. Based on the test data the total dry film thickness of primer and top coat together should not exceed the maximum tested.

The data applies also to other shaped steel open sections that have re-entrant details such as type "U", "L" and "T". PROTECT FIRE has been exposed to the slowing heating regime defined in Annex A of EN 13381-8 and has satisfied the requirements.

OPEN SECTION BEAMS and COLUMNS

Section factor up to (m ⁻¹)	Beams. Fire Resistance Classification			500 °C
	R15	R30	R60	R90
≤65	214	214	528	747
70	214	214	528	879
75	214	214	528	1011
80	214	214	528	1142
85	214	214	528	1274
90	214	214	528	1405
95	214	214	528	
100	214	214	528	
110	214	214	548	
120	214	214	599	
130	214	214	648	
140	214	214	694	
150	214	214	739	
160	214	214	785	
170	214	214	830	
180	214	214	876	
190	214	214	922	
200	214	214	947	
210	214	214	1063	
220	214	214	1091	
230	214	214	1118	
240	214	214	1146	
250	214	214	1174	
260	214	216	1202	
270	214	368	1230	
280	214	373	1258	
290	214	378	1286	
300	214	383	1314	
310	214	388	1342	
320	214	392	1370	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 500 °C				

Note: The cursive values are extrapolated values.



Section factor up to (m ⁻¹)	Beams. Fire Resistance Classification			550°C
	R15	R30	R60	R90
≤65	214	214	410	486
70	214	214	410	557
75	214	214	410	629
80	214	214	410	700
85	214	214	410	771
90	214	214	410	801
95	214	214	410	801
100	214	214	410	801
110	214	214	428	830
120	214	214	474	903
130	214	214	520	1414
140	214	214	562	
150	214	214	610	
160	214	214	656	
170	214	214	699	
180	214	214	741	
190	214	214	784	
200	214	214	826	
210	214	214	869	
220	214	214	911	
230	214	214	1016	
240	214	214	1043	
250	214	214	1070	
260	214	214	1098	
270	214	214	1125	
280	214	214	1152	
290	214	214	1180	
300	214	214	1207	
310	214	214	1234	
320	214	214	1262	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 550 °C				

Section factor up to (m ⁻¹)	Beams. Fire Resistance Classification			600°C
	R15	R30	R60	R90
≤ 65	214	214	214	486
70	214	214	214	557
75	214	214	214	629
80	214	214	214	700
85	214	214	214	727
90	214	214	214	745
95	214	214	214	764
100	214	214	214	782
110	214	214	214	848
120	214	214	223	944
130	214	214	356	1040
140	214	214	437	1137
150	214	214	467	1233
160	214	214	497	1325
170	214	214	527	1408
180	214	214	557	
190	214	214	587	
200	214	214	617	
210	214	214	673	
220	214	214	769	
230	214	214	865	
240	214	214	926	
250	214	214	984	
260	214	214	1012	
270	214	214	1040	
280	214	214	1068	
290	214	214	1097	
300	214	214	1125	
310	214	214	1153	
320	214	214	1181	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 600 °C				



Section factor up to (m ⁻¹)	Beams. Fire Resistance Classification			650°C
	R15	R30	R60	R90
≤ 65	214	214	214	486
70	214	214	214	557
75	214	214	214	629
80	214	214	214	700
85	214	214	214	705
90	214	214	214	709
95	214	214	214	714
100	214	214	214	718
110	214	214	214	748
120	214	214	214	779
130	214	214	239	815
140	214	214	279	866
150	214	214	319	916
160	214	214	358	967
170	214	214	398	1017
180	214	214	445	1068
190	214	214	504	1118
200	214	214	563	1169
210	214	214	621	1219
220	214	214	680	1270
230	214	214	739	1323
240	214	214	797	1381
250	214	214	856	1438
260	214	214	910	
270	214	214	945	
280	214	214	949	
290	214	214	949	
300	214	214	949	
310	214	214	1013	
320	214	214	1039	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 650 °C				

Section factor up to (m ⁻¹)	Columns. Fire Resistance Classification			500°C
	R15	R30	R60	R90
≤65	221	221	618	747
70	221	221	636	879
75	221	221	654	1011
80	221	221	671	1142
85	221	221	689	1274
90	221	221	707	1405
95	221	221	725	
100	221	226	743	
110	221	238	779	
120	221	249	811	
130	221	260	839	
140	221	270	867	
150	221	279	895	
160	221	289	923	
170	221	297	951	
180	221	306	979	
190	221	314	1007	
200	221	322	1035	
210	221	329	1063	
220	221	336	1091	
230	221	343	1118	
240	221	350	1146	
250	221	356	1174	
260	221	362	1202	
270	221	368	1230	
280	221	374	1258	
290	221	380	1286	
300	221	385	1314	
310	221	390	1342	
320	221	395	1370	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 500 °C				
Columns. Fire Resistance Classification				550°C



Section factor up to (m ⁻¹)	R15	R30	R60	R90
≤65	221	221	547	486
70	221	221	562	557
75	221	221	576	629
80	221	221	591	700
85	221	221	606	771
90	221	221	621	843
95	221	221	635	914
100	221	221	650	986
110	221	221	679	1129
120	221	221	709	1271
130	221	221	738	1414
140	221	221	768	
150	221	221	797	
160	221	221	825	
170	221	221	852	
180	221	221	879	
190	221	221	907	
200	221	221	934	
210	221	221	961	
220	221	221	989	
230	221	221	1016	
240	221	221	1043	
250	221	221	1070	
260	221	221	1098	
270	221	221	1125	
280	221	221	1152	
290	221	221	1180	
300	221	221	1207	
310	221	221	1234	
320	221	221	1262	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 550 °C				

Section factor up to (m ⁻¹)	Columns. Fire Resistance Classification			600°C
	R15	R30	R60	R90
≤ 65	221	221	511	486
70	221	221	520	557
75	221	221	529	629
80	221	221	537	700
85	221	221	546	727
90	221	221	555	745
95	221	221	563	764
100	221	221	572	782
110	221	221	590	848
120	221	221	612	944
130	221	221	641	1040
140	221	221	670	1137
150	221	221	699	1233
160	221	221	728	1325
170	221	221	757	1408
180	221	221	786	
190	221	221	814	
200	221	221	842	
210	221	221	871	
220	221	221	899	
230	221	221	927	
240	221	221	955	
250	221	221	984	
260	221	221	1012	
270	221	221	1040	
280	221	221	1068	
290	221	221	1097	
300	221	221	1125	
310	221	221	1153	
320	221	221	1181	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 600 °C				



Section factor up to (m ⁻¹)	Columns. Fire Resistance Classification			650°C
	R15	R30	R60	R90
≤ 65	221	221	361	486
70	221	221	370	557
75	221	221	379	629
80	221	221	387	700
85	221	221	396	705
90	221	221	404	709
95	221	221	413	714
100	221	221	421	718
110	221	221	438	748
120	221	221	455	779
130	221	221	472	815
140	221	221	489	866
150	221	221	506	916
160	221	221	523	967
170	221	221	540	1017
180	221	221	557	1068
190	221	221	574	1118
200	221	221	591	1169
210	221	221	648	1219
220	221	221	743	1270
230	221	221	810	1323
240	221	221	836	1381
250	221	221	861	1438
260	221	221	886	
270	221	221	912	
280	221	221	937	
290	221	221	962	
300	221	221	988	
310	221	221	1013	
320	221	221	1039	
Minimum thickness (µm) required of the protection to keep the temperature of the support under 650 °C				

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

- Section Factor between 65 m⁻¹ and below or equal to 320 m⁻¹.
- Protection thicknesses assessed between 214 – 1405 microns for steel beams.
- Protection thicknesses assessed between 221 – 1405 microns for steel columns.
- Critical temperature of 500 °C- 650 °C.

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

- “I” H, U and “H” section profiles, angles and T sections.
- Other grades of steel in accordance to EN 10025-1.
- Columns and beams with 3 or 4 faces exposed.
- Beams with a web maximum length of 600 mm for R 60.



CLOSE TUBULAR SECTION SQUARE

Section factor up to (m ⁻¹)	Beams. Fire Resistance Classification			
	R 15			
	500 °C	550 °C	600°C	650°C
≤80	304	304	304	304
85	304	304	304	304
90	304	304	304	304
95	304	304	304	304
100	304	304	304	304
110	304	304	304	304
120	304	304	304	304
130	304	304	304	304
140	304	304	304	304
150	304	304	304	304
160	304	304	304	304
170	304	304	304	304
180	304	304	304	304
190	304	304	304	304
200	304	304	304	304
210	304	304	304	304
220	304	304	304	304
230	304	304	304	304
240	304	304	304	304
250	304	304	304	304
260	310	304	304	304
270	324	304	304	304
280	337	304	304	304
290	350	304	304	304
300	363	304	304	304
310	376	304	304	304
320	381	304	304	304
Minimum thickness (µm) required of the protection to keep the temperature of the support under the critical temperature				

Section factor up to (m ⁻¹)	Beams. Fire Resistance Classification			
	R 30			
	500 °C	550 °C	600°C	650°C
≤80	314	310	304	304
85	332	310	304	304
90	350	310	304	304
95	368	310	304	304
100	386	310	304	304
110	421	323	304	304
120	457	348	304	304
130	493	374	304	304
140	529	399	304	304
150	564	425	304	304
160	600	450	320	304
170	625	475	341	304
180	650	501	361	304
190	674	526	381	304
200	699	552	401	304
210	724	577	422	304
220	749	603	442	304
230	774	638	462	316
240	798	673	482	339
250	823	708	503	362
260	848	743	523	385
270	873	778	543	408
280	898	813	564	432
290	922	848	584	455
300	947	883	606	478
310	959	915	635	501
320	-----	930	646	510
Minimum thickness (µm) required of the protection to keep the temperature of the support under the critical temperature				

Note: The cursive values are extrapolated values



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

- Section Factor between 65 m^{-1} and below or equal to 320 m^{-1} .
- Protection thicknesses assessed between 310 –959 microns for tubular steel beams.
- Critical temperature of $500 \text{ }^{\circ}\text{C}$ – $650 \text{ }^{\circ}\text{C}$.

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

- Rectangular or square tubular section profiles.
- Other grades of steel in accordance to EN 10025-1.
- Beams with 3 or 4 faces exposed.

