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European Technical Assessment

ETA 14/0417 of 04/09/2018

General Part

Technical Assessment Body issuing the European Technical Assessment:
Technical and Test Institute for Construction Prague

Trade name of the construction product:	**Amotherm Steel WB**
Product family to which the construction product belongs:	Product are code: 35 Fire protective products; Reactive coatings for protection of steel elements
Manufacturer:	J.F. AMONN S.r.l. Via Altmann 12 39100 Bolzano, Italy
Manufacturing plant(s):	J.F. AMONN S.r.l. Via Cima i Pra 7 32014 Ponte nelle Alpi (Belluno), Italy AMONN COATINGS GMBH An der Landsebhan 7 2100 Korneuburg, Niederostereich
This European Technical Assessment contains:	33 pages including 3 Annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EAD 350402-00-1106 Reactive coatings for fire protection of steel elements
This version replaces:	ETA 14/0417 issued on 31/10/2016

Specific part

1. Technical description of the product

1.1 General

Amotherm Steel WB is a spray or brush (brush for small areas only) applied water based acrylic fire protective intumescent coating that provides fire resistance to structure steel elements. The reactive coating system consisting of components listed in Table No. 1.1 is intended for the use scenarios related to environmental conditions **Type Z_2**: fire protective coating products/kits intended for internal conditions with humidity lower than 85% RH excluding temperatures below 0 °C, the use scenarios according to EAD 350402-00-1106, Cl. 1.2.3. Either of the top coats specified below can be used in the reactive coating system.

Table No. 1.1: Components of the reactive coating system

Primer	Reactive coating	Topcoat
Amotherm Steel Primer WB (water-based acrylic mono-component)	**Amotherm Steel WB** (water-based mono-component)	**Amotherm Steel Top WB** (any colour of acrylic protective top coat, water-based mono-component) **Amotherm Top WB** (any colour of acrylic protective top coat, water-based mono-component)

In accordance with EAD 350402-00-1106, Cl. 1.2.2, **Amotherm Steel WB** may be considered as a reactive coating kit (Option 2).

Reactive coating kit (primer, reactive coating and top coat) is intended for application on structure steel, grade of steel (S designation) to the standard EN 10025-1[1] (excluding S 185).

[1] EN 10025-1 Hot rolled products of structural steels - Part 1: General technical delivery conditions

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

Amotherm Steel WB is used as reactive coating kit for fire protection of beams and columns made of structural steel to achieve fire resistance duration in accordance with EN 13501-2.

Amotherm Steel WB is intended to protect various sizes of open of **H and I shaped beams and columns** up to fire resistance classification **R90** and for design temperatures range of 350°C to 650°C.
Amotherm Steel WB is intended to protect various sizes of **rectangular or circular hollow columns** up to fire resistance classification **R60** and for design temperatures range of 350°C to 750°C.
Amotherm Steel WB is intended to protect various sizes of **rectangular or circular hollow beams** up to fire resistance classification **R90** and for design temperatures range of 350°C to 750°C.

The detailed field of application regarding fire protection of Amotherm Steel WB is given in Annex 1 and Annex 2 of this ETA. The data for H and I shaped beams and columns are also directly applicable to angles and T-sections for the same selection factor for individual steel elements.

Regarding the environmental conditions, the reactive coating system is intended for the following uses:

- **Amotherm Steel WB** systems with/without topcoat as defined in Table No. 1: use scenario **Type Z_2**.

The use scenarios related to environmental conditions are specified in EAD 350402-00-1106, Cl. 1.2.3:

- Type Z_2: Fire protective coating products/kits intended for internal conditions with humidity lower than 85 % RH excluding temperatures below 0 °C.

The assessment methods included or referred to in EAD 350402-00-1106 have been written based on the manufacturer's request to take into account a working life of the fire protective coating kit Amotherm Steel WB for the intended use of 10 years when installed in the works (provided that the kit is subject to appropriate installation). These provisions are based upon the current state of the art and the available knowledge and experience.

The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the working life referred to above.

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

The essential characteristics of product **Amotherm Steel WB** and methods of verification were carried out in compliance with the EAD 350402-00-1106: Reactive coatings for fire protection of steel elements.

Table No. 3.1: Essential characteristics of the product (kit) and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic and method of verification and assessment	Expression of product performance
Basic Works Requirement 2: Safety in case of fire		
1	**Reaction to fire** (EAD 350402-00-1106, Cl. 2.2.1; Commission Delegated Regulation (EU) 2016/364)	See Cl. 3.1.1 of this ETA: Euroclass **B-s2,d0**
2	**Resistance to fire** (EAD 350402-00-1106, Cl. 2.2.2) - Fire resistance - Slow heating curve	See Cl. 3.1.2 and 3.1.2 of this ETA
Basic Works Requirement 3: Hygiene, health and the environment		
3	**Content, emission and/or release of dangerous substances** (EAD 350402-00-1106, Cl. 2.2.3)	See Cl. 3.2 of this ETA
Basic Works Requirement 4: Safety and accessibility in use		
4	**Adhesion** (EAD 350402-00-1106, Cl. 2.2.4)	See Cl. 3.3.1 of this ETA: the primer and the topcoats indicated in Table 1.1 of this ETA are compatible with the reactive coating
5	**Durability** (EAD 350402-00-1106, Cl. 2.2.5)	See Cl. 3.3.2 of this ETA: Humidity: passed **Type Z_2**: passed Chemical attack: no performance assessed

3.1 Safety in case of fire (BWR 2)

3.1.1 Reaction to fire

The performance of the reactive coating system **Amotherm Steel WB** has been determined according to EN 13501-1+A1:2009[3]:

B – s2, d0

for all the combination given in Table No. 1.1.

3.1.2 Resistance to fire

The resistance to fire performance according to EN 13501-2:2016[4] determined in accordance with test principles defined in EN 13381-8:2013[5]. The test data were reached according to the ENV 13381-4:2002[6] and additional testing was performed according to EN 13381-8:2013 and the assessment was made according to EN 13381-8:2013. The selection of test specimens, that were assessed, complies with the requirements of EN 13381-8: clause 6.6 and EAD 350402-00-1106, Annex F.

The detailed relationship between protection thickness, section factor and fire resistance period of Amotherm Steel WB is given in Annexes of this ETA:
Annex 1 - **H or I shaped columns and beams;**
Annex 2 - **hollow columns and hollow beams.**

3.1.3 Smouldering fire exposure (slow heating curve)

H or I shaped beams and columns: the verification under exposure to the smouldering fire curve according to EN 13381-8:2013, Annex A, has been carried out and the product meets the requirement established in EN 13381-8:2013, Annex A.

Hollow columns and hollow beams: no performance assessed

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[3] EN 13501-1+A1:2009 Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests

[4] EN 13501-2:2016 Fire classification of construction products and building elements - Part 2: Classification using test data from resistance fire tests, excluding ventilation services

[5] EN 13381-8:2013 Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members

[6] ENV 13381-4:2002 Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied protection to steel members

3.2 Hygiene, health and environment (BWR 3)

3.2.1 Content, emission and/or release of dangerous substances

3.2.1.1 SVOC and VOC

For the intended uses covered by the release scenarios IA1 (Product with direct contact to indoor air) and IA2 (Product with indirect contact to indoor air (e.g covered products) but possible impact on indoor air), respectively, semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) were determined in accordance with EN 16516.It was determined for the reactive coating Amotherm Steel WB (without the primer and without the top coats).

Test results after 28 days in the emission test chamber:

Parameter	**Test results after 28 days**
TVOC (Total Volatile Organic Compound)	0.4 mg/m³
Carcinogenic compounds	0.000 mg/m³
R-value (VOC with LCI) (Volatile Organic Compound with Lowest Concentration of Interest)	0
VOC without LCI (Volatile Organic Compound without Lowest Concentration of Interest)	0.0 mg/m³
TSVOC (Total Semi Volatile Organic Compound)	0.0 mg/m³
Formaldehyde	0.000 mg/m³
Parameters of the emission chamber test:	Chamber type: 1m³ – glass chamber B Climatic conditions: 23°C, 50% relative humidity Air exchange: 0.5 h^{-1} Loading factor: 33 m²/m³ Area specific air exchange rate q: 1,51 m³/(m²*h)
Information about the sample:	Reactive coating Amotherm Steel WB (without the primer and the top coats). The sample was applied on a stainless steel tub with a surface area of 0.325 m² in seven layers. The total amount of wet film was 3 430g/m².

3.2.1.2 Testing according to EN ISO 3251[7] and EN ISO 11358-1[8]

The test results are stated in the Table No. 3.2. and Table No. 3.3. It was determined for the reactive coating Amotherm Steel WB (without the primer and without the top coats).

Table No. 3.2: Test result based on EN ISO 3251:

Test method	Test conditions	Result: **average non-volatile matter**
EN ISO 3251:2013	temperature of drying 125°C; time of drying: 60 min	**70,7%**

Table No. 3.3: Test result of TG analysis based on EN ISO 11358-1:

Characteristics measured TG analysis according to EN ISO 11358-1	**Unit**	**Test results**	**Uncertainty** (k=2, probability 95%)
- content of 1st constituent	% (mass percent)	10.4	1.4
- T_{A1}	°C	41.8	2.0
- T_{B1}	°C	86.5	2.2
- T_{C1}	°C	65.0	0.2
- content of 2nd constituent	% (mass percent)	17.7	2.1
- T_{A2}	°C	111.1	3.2
- T_{B2}	°C	146.7	3.9
- T_{C3}	°C	134.6	3.4
- content of 3rd constituent	% (mass percent)	8.0	0.7
- T_{A2}	°C	197.1	3.4
- T_{B2}	°C	265.2	1.9
- T_{C3}	°C	225.9	2.9
- content of 4th constituent	% (mass percent)	21.4	0.5
- T_{A2}	°C	302.3	1.8
- T_{B2}	°C	381.2	4.6
- T_{C3}	°C	354.9	2.9
- content of 5th constituent	% (mass percent)	11.3	0.4
- T_{A2}	°C	467.2	1.8
- T_{B2}	°C	778.3	1.5
- T_{C3}	°C	529.4	12.9
- content of oxidizable constituents (to 900°C)		3.5	0.3
- content of inorganic constituents (at 900°C)		27.5	0.2

See Annex No. 3 of this ETA with TG curve.

[7] EN ISO 3251 Paints, varnishes and plastics - Determination of non-volatile matter content

[8] EN ISO 11358-1 Plastics - Thermogravimetry (TG) of polymers - Part 1: General principles

3.3 Safety and accessibility in use (BWR 4)

3.3.1 Adhesion

The primer and the topcoats indicated in table 1 of this ETA are compatible with the reactive coating. The verifications were made in accordance with 2.2.4 of EAD 350402-00-1106.

3.3.2 Durability

The verifications were made in accordance with 2.2.5 of EAD 350402-00-1106. The adhesion of the primer was tested on uncoated steel.

- Humidity: passed
- Variations of temperature and relative humidity, rain and radiation of the sun: the **Amotherm Steel WB** has been assessed as having passed the requirements for use in internal conditions with humidity lower than 85 % RH, excluding temperatures below 0°C defined in ETAG 018, Part 2 for **Type Z_2** environmental conditions and can be used with or without the following top coats: Amotherm Steel Top WB, Amotherm Top WB.
- Chemical attack: no performance assessed

3.3.3 Means of technical characterisation

The components of reactive coating kit, which are subject to this ETA, were characterised on the basis of EAD 350402-00-1106, Cl. 2.3.5, Table 4. The results are kept in the files of TZUS Prague, branch Brno.

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

According to the European Commission decision 1999/454/EC, the **AVCP system 1** (further described in Annex V to Regulation (EU) No 305/2011) applies:

Table No. 4.1:

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

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

The manufacturer shall perform a permanent internal factory production control based on the control plan. The Control Plan specifies the type, test method, criteria and frequency of tests conducted on the final product.
The control plan for the manufacturer/corner stones (factory production control) is specified in Cl. 3.2 of EAD 350402-00-1106 *Reactive coatings for fire protection of steel elements*. Manufacturer and TZUS Prague, branch Brno have agreed a control plan which is deposited with the TZUS Prague, branch Brno in documentation which accompanies the ETA.

Issued in Prague on 04.09.2018

By
Ing. Mária Schaan
Head of the Technical Assessment Body

Annex 1

Product performance: Fire resistance of **Amotherm Steel WB**

This Annex relates to the use of **Amotherm Steel WB** for the protection of H or I shaped beams (three-sided exposure) and columns (four-sided exposure).

The precise scope is given in Table No. A1.1 – A1.5 (Amotherm Steel WB for columns exposed on 4 sides) and in Table No. A2.1 – A2.5 (Amotherm Steel WB for beams exposed on 3 sides) which shows the total dry film thickness of Amotherm Steel WB (excluding primer and top coat) required to provide classifications of R15 to R90 for various design temperatures and selection factors.

The data for H and I shaped beams and columns are also directly applicable to angles and T-sections for the same selection factor for individual elements.

The assessment method used to assess the relationship between protection thickness, section factor and fire resistance for I- section structural steel beams and columns protected with **Amotherm Steel WB** is EN 13381-8:2013[9], Annex E.2 Graphical Approach.

Reactive coating kit (primer, reactive coating and top coat) is intended for application on structure steel, grade of steel (S designation) to the standard EN 10025-1[10] (excluding S 185).

[9] EN 13381-1:2013 Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members

[10] EN 10025-1:2005 Hot rolled products of structural steels - Part 1: General technical delivery conditions

Table No. A1.1: I- sections - columns exposed on 4 sides

Fire resistance clarification R15 - columns exposed on 4 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
63	0,412	0,412	0,412	0,412	0,412	0,412	0,412
65	0,412	0,412	0,412	0,412	0,412	0,412	0,412
75	0,412	0,412	0,412	0,412	0,412	0,412	0,412
85	0,412	0,412	0,412	0,412	0,412	0,412	0,412
95	0,412	0,412	0,412	0,412	0,412	0,412	0,412
105	0,412	0,412	0,412	0,412	0,412	0,412	0,412
115	0,412	0,412	0,412	0,412	0,412	0,412	0,412
125	0,412	0,412	0,412	0,412	0,412	0,412	0,412
135	0,412	0,412	0,412	0,412	0,412	0,412	0,412
145	0,412	0,412	0,412	0,412	0,412	0,412	0,412
155	0,412	0,412	0,412	0,412	0,412	0,412	0,412
165	0,412	0,412	0,412	0,412	0,412	0,412	0,412
175	0,412	0,412	0,412	0,412	0,412	0,412	0,412
185	0,412	0,412	0,412	0,412	0,412	0,412	0,412
195	0,412	0,412	0,412	0,412	0,412	0,412	0,412
205	0,412	0,412	0,412	0,412	0,412	0,412	0,412
215	0,412	0,412	0,412	0,412	0,412	0,412	0,412
225	0,412	0,412	0,412	0,412	0,412	0,412	0,412
235	0,412	0,412	0,412	0,412	0,412	0,412	0,412
245	0,412	0,412	0,412	0,412	0,412	0,412	0,412
255	0,412	0,412	0,412	0,412	0,412	0,412	0,412
265	0,412	0,412	0,412	0,412	0,412	0,412	0,412
275	0,412	0,412	0,412	0,412	0,412	0,412	0,412
285	0,412	0,412	0,412	0,412	0,412	0,412	0,412
295	0,412	0,412	0,412	0,412	0,412	0,412	0,412
297	0,412	0,412	0,412	0,412	0,412	0,412	0,412

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Table No. A1.2: I- sections - columns exposed on 4 sides

Fire resistance clarification R30 - columns exposed on 4 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
63	0,412	0,412	0,412	0,412	0,412	0,412	0,412
65	0,412	0,412	0,412	0,412	0,412	0,412	0,412
75	0,412	0,412	0,412	0,412	0,412	0,412	0,412
85	0,412	0,412	0,412	0,412	0,412	0,412	0,412
95	0,478	0,412	0,412	0,412	0,412	0,412	0,412
105	0,591	0,412	0,412	0,412	0,412	0,412	0,412
115	0,684	0,412	0,412	0,412	0,412	0,412	0,412
125	0,763	0,414	0,412	0,412	0,412	0,412	0,412
135	0,830	0,506	0,412	0,412	0,412	0,412	0,412
145	0,888	0,585	0,412	0,412	0,412	0,412	0,412
155	0,938	0,654	0,412	0,412	0,412	0,412	0,412
165	1,009	0,715	0,472	0,412	0,412	0,412	0,412
175	1,096	0,769	0,525	0,412	0,412	0,412	0,412
185	1,173	0,817	0,572	0,412	0,412	0,412	0,412
195	1,243	0,860	0,614	0,412	0,412	0,412	0,412
205	1,305	0,898	0,652	0,412	0,412	0,412	0,412
215	1,362	0,934	0,687	0,413	0,412	0,412	0,412
225	1,414	0,971	0,719	0,467	0,412	0,412	0,412
235	1,478	1,026	0,747	0,515	0,412	0,412	0,412
245	1,555	1,077	0,774	0,560	0,442	0,412	0,412
255	1,627	1,125	0,798	0,601	0,486	0,412	0,412
265	1,692	1,168	0,821	0,639	0,527	0,412	0,412
275	1,754	1,209	0,842	0,674	0,566	0,412	0,412
285	1,810	1,246	0,861	0,707	0,601	0,412	0,412
295	1,863	1,281	0,880	0,738	0,634	0,441	0,412
297	1,874	1,288	0,883	0,744	0,641	0,450	0,412

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Table No. A1.3: I- sections - columns exposed on 4 sides

Fire resistance clarification R45 - columns exposed on 4 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
63	0,643	0,503	0,435	0,412	0,412	0,412	0,412
65	0,827	0,626	0,503	0,412	0,412	0,412	0,412
75	0,827	0,626	0,503	0,412	0,412	0,412	0,412
85	0,964	0,762	0,621	0,444	0,412	0,412	0,412
95	1,138	0,869	0,714	0,552	0,412	0,412	0,412
105	1,279	0,955	0,790	0,640	0,427	0,412	0,412
115	1,395	1,080	0,852	0,712	0,517	0,412	0,412
125	1,515	1,189	0,904	0,773	0,593	0,412	0,412
135	1,633	1,281	0,949	0,824	0,657	0,412	0,412
145	1,735	1,361	1,036	0,869	0,712	0,412	0,412
155	1,824	1,430	1,128	0,908	0,761	0,472	0,412
165	1,902	1,521	1,208	0,942	0,803	0,533	0,412
175	1,971	1,607	1,280	0,992	0,841	0,587	0,412
185	2,033	1,684	1,344	1,063	0,874	0,635	0,412
195	2,088	1,753	1,401	1,127	0,904	0,678	0,412
205	--	1,815	1,464	1,185	0,931	0,717	0,450
215	--	1,871	1,551	1,237	0,956	0,753	0,507
225	--	1,923	1,629	1,285	1,004	0,785	0,558
235	--	1,970	1,701	1,329	1,054	0,814	0,605
245	--	2,013	1,768	1,369	1,100	0,841	0,647
255	--	2,053	1,829	1,406	1,142	0,866	0,687
265	--	2,090	1,885	1,440	1,180	0,889	0,724
275	--	--	1,937	1,544	1,216	0,910	0,758
285	--	--	1,986	1,640	1,250	0,930	0,789
295	--	--	2,031	1,731	1,281	0,949	0,819
297	--	--	2,040	1,748	1,287	0,952	0,824

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Note: where a cell shows "–", this indicates that the system as assessed is not suitable for this particular application.

Table No. A1.4: I- sections - columns exposed on 4 sides

Fire resistance clarification R60 - columns exposed on 4 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
63	1,134	0,987	0,724	0,587	0,465	0,412	0,412
65	1,332	1,073	0,835	0,699	0,582	0,412	0,412
75	1,332	1,073	0,835	0,699	0,582	0,458	0,412
85	--	1,238	0,953	0,816	0,700	0,584	0,412
95	--	1,368	1,106	0,909	0,793	0,684	0,482
105	--	--	1,234	1,003	0,869	0,765	0,579
115	--	--	1,340	1,116	0,931	0,832	0,660
125	--	--	1,429	1,211	1,006	0,888	0,727
135	--	--	1,552	1,292	1,092	0,936	0,785
145	--	--	1,665	1,362	1,166	0,993	0,834
155	--	--	1,764	1,423	1,231	1,060	0,877
165	--	--	1,851	1,514	1,288	1,119	0,915
175	--	--	1,928	1,611	1,338	1,171	0,949
185	--	--	1,996	1,698	1,383	1,218	0,995
195	--	--	2,058	1,775	1,423	1,260	1,045
205	--	--	--	1,845	1,497	1,298	1,089
215	--	--	--	1,909	1,593	1,332	1,130
225	--	--	--	1,967	1,680	1,363	1,167
235	--	--	--	2,020	1,760	1,392	1,201
245	--	--	--	2,068	1,834	1,418	1,232
255	--	--	--	--	1,902	1,452	1,261
265	--	--	--	--	1,964	1,573	1,288
275	--	--	--	--	2,022	1,686	1,312
285	--	--	--	--	2,076	1,790	1,335
295	--	--	--	--	--	1,888	1,357
297	--	--	--	--	--	1,906	1,361

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Note: where a cell shows "–", this indicates that the system as assessed is not suitable for this particular application.

Table No. A1.5: I- sections - columns exposed on 4 sides

Fire resistance clarification R90 - columns exposed on 4 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
63	--	--	--	1,045	0,924	0,889	0,712
65	--	--	--	1,262	1,122	1,011	0,831
75	--	--	--	1,262	1,122	1,011	0,831
85	--	--	--	1,409	1,258	1,142	0,952
95	--	--	--	--	1,366	1,246	1,074
105	--	--	--	--	--	1,330	1,175
115	--	--	--	--	--	1,399	1,259
125	--	--	--	--	--	1,488	1,329
135	--	--	--	--	--	1,624	1,389
145	--	--	--	--	--	1,741	1,440
155	--	--	--	--	--	1,843	1,561
165	--	--	--	--	--	1,932	1,667
175	--	--	--	--	--	2,011	1,760
185	--	--	--	--	--	2,082	1,844
195	--	--	--	--	--	--	1,919
205	--	--	--	--	--	--	1,987
215	--	--	--	--	--	--	2,049
225	--	--	--	--	--	--	--
235	--	--	--	--	--	--	--
245	--	--	--	--	--	--	--
255	--	--	--	--	--	--	--
265	--	--	--	--	--	--	--
275	--	--	--	--	--	--	--
285	--	--	--	--	--	--	--
295	--	--	--	--	--	--	--
297	--	--	--	--	--	--	--

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Note: where a cell shows "–", this indicates that the system as assessed is not suitable for this particular application.

Table No. A2.1: I- sections - beams exposed on 3 sides

Fire resistance clarification R15 - beams exposed on 3 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
70	0,390	0,390	0,390	0,390	0,390	0,390	0,390
75	0,390	0,390	0,390	0,390	0,390	0,390	0,390
85	0,390	0,390	0,390	0,390	0,390	0,390	0,390
95	0,390	0,390	0,390	0,390	0,390	0,390	0,390
105	0,390	0,390	0,390	0,390	0,390	0,390	0,390
115	0,390	0,390	0,390	0,390	0,390	0,390	0,390
125	0,390	0,390	0,390	0,390	0,390	0,390	0,390
135	0,390	0,390	0,390	0,390	0,390	0,390	0,390
145	0,390	0,390	0,390	0,390	0,390	0,390	0,390
155	0,390	0,390	0,390	0,390	0,390	0,390	0,390
165	0,390	0,390	0,390	0,390	0,390	0,390	0,390
175	0,390	0,390	0,390	0,390	0,390	0,390	0,390
185	0,390	0,390	0,390	0,390	0,390	0,390	0,390
195	0,390	0,390	0,390	0,390	0,390	0,390	0,390
205	0,390	0,390	0,390	0,390	0,390	0,390	0,390
215	0,390	0,390	0,390	0,390	0,390	0,390	0,390
225	0,390	0,390	0,390	0,390	0,390	0,390	0,390
235	0,390	0,390	0,390	0,390	0,390	0,390	0,390
245	0,390	0,390	0,390	0,390	0,390	0,390	0,390
255	0,390	0,390	0,390	0,390	0,390	0,390	0,390
265	0,390	0,390	0,390	0,390	0,390	0,390	0,390
275	0,390	0,390	0,390	0,390	0,390	0,390	0,390
285	0,390	0,390	0,390	0,390	0,390	0,390	0,390
295	0,390	0,390	0,390	0,390	0,390	0,390	0,390
297	0,390	0,390	0,390	0,390	0,390	0,390	0,390

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Table No. A2.2: I- sections - beams exposed on 3 sides

Fire resistance clarification R30 - beams exposed on 3 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
70	0,390	0,390	0,390	0,390	0,390	0,390	0,390
75	0,390	0,390	0,390	0,390	0,390	0,390	0,390
85	0,390	0,390	0,390	0,390	0,390	0,390	0,390
95	0,478	0,390	0,390	0,390	0,390	0,390	0,390
105	0,591	0,390	0,390	0,390	0,390	0,390	0,390
115	0,684	0,390	0,390	0,390	0,390	0,390	0,390
125	0,763	0,414	0,390	0,390	0,390	0,390	0,390
135	0,830	0,506	0,390	0,390	0,390	0,390	0,390
145	0,888	0,585	0,390	0,390	0,390	0,390	0,390
155	0,938	0,654	0,412	0,390	0,390	0,390	0,390
165	1,009	0,715	0,472	0,390	0,390	0,390	0,390
175	1,096	0,769	0,525	0,390	0,390	0,390	0,390
185	1,173	0,817	0,572	0,390	0,390	0,390	0,390
195	1,243	0,860	0,614	0,390	0,390	0,390	0,390
205	1,305	0,899	0,652	0,390	0,390	0,390	0,390
215	1,362	0,934	0,687	0,413	0,390	0,390	0,390
225	1,414	0,971	0,719	0,467	0,390	0,390	0,390
235	1,478	1,027	0,747	0,515	0,393	0,390	0,390
245	1,555	1,078	0,774	0,560	0,442	0,390	0,390
255	1,627	1,125	0,798	0,601	0,486	0,390	0,390
265	1,692	1,168	0,821	0,639	0,527	0,390	0,390
275	1,754	1,209	0,842	0,674	0,566	0,390	0,390
285	1,810	1,246	0,861	0,707	0,601	0,394	0,390
295	1,863	1,281	0,880	0,738	0,634	0,441	0,390
297	1,874	1,288	0,883	0,744	0,641	0,450	0,390

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Table No. A2.3: I- sections - beams exposed on 3 sides

Fire resistance clarification R45 - beams exposed on 3 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
70	0,745	0,544	0,432	0,390	0,390	0,390	0,390
75	0,827	0,626	0,503	0,390	0,390	0,390	0,390
85	0,964	0,762	0,621	0,445	0,390	0,390	0,390
95	1,138	0,869	0,714	0,553	0,390	0,390	0,390
105	1,279	0,955	0,790	0,640	0,427	0,390	0,390
115	1,395	1,081	0,852	0,712	0,517	0,390	0,390
125	1,515	1,189	0,905	0,773	0,593	0,390	0,390
135	1,633	1,281	0,949	0,825	0,657	0,390	0,390
145	1,735	1,361	1,036	0,869	0,712	0,403	0,390
155	1,824	1,430	1,128	0,908	0,761	0,472	0,390
165	1,902	1,521	1,209	0,942	0,803	0,533	0,390
175	1,971	1,607	1,281	0,992	0,841	0,587	0,390
185	2,033	1,684	1,344	1,064	0,874	0,635	0,390
195	2,088	1,753	1,402	1,128	0,904	0,678	0,390
205	--	1,815	1,465	1,185	0,932	0,717	0,450
215	--	1,872	1,551	1,238	0,956	0,753	0,507
225	--	1,923	1,630	1,285	1,005	0,785	0,558
235	--	1,970	1,702	1,329	1,054	0,814	0,605
245	--	2,014	1,768	1,369	1,100	0,841	0,648
255	--	2,053	1,829	1,406	1,142	0,866	0,687
265	--	2,090	1,866	1,441	1,181	0,889	0,724
275	--	--	1,938	1,545	1,217	0,910	0,758
285	--	--	1,987	1,642	1,250	0,930	0,789
295	--	--	2,032	1,732	1,281	0,949	0,819
297	--	--	2,041	1,749	1,287	0,952	0,824

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).

Note: where a cell shows "–", this indicates that the system as assessed is not suitable for this particular application.

Table No. A2.4: I- sections - beams exposed on 3 sides

Fire resistance clarification R60 - beams exposed on 3 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
70	1,220	0,973	0,764	0,628	0,510	0,390	0,390
75	1,332	1,073	0,835	0,699	0,582	0,458	0,390
85	--	1,238	0,953	0,816	0,700	0,584	0,390
95	--	1,368	1,107	0,909	0,793	0,684	0,482
105	--	--	1,235	1,004	0,869	0,766	0,579
115	--	--	1,340	1,117	0,931	0,832	0,660
125	--	--	1,429	1,212	1,006	0,889	0,727
135	--	--	1,552	1,293	1,092	0,937	0,785
145	--	--	1,666	1,362	1,166	0,993	0,834
155	--	--	1,765	1,423	1,231	1,061	0,878
165	--	--	1,852	1,515	1,288	1,120	0,915
175	--	--	1,928	1,612	1,338	1,172	0,949
185	--	--	1,997	1,699	1,383	1,219	0,995
195	--	--	2,059	1,776	1,424	1,260	1,045
205	--	--	--	1,846	1,498	1,298	1,090
215	--	--	--	1,910	1,594	1,332	1,131
225	--	--	--	1,968	1,682	1,364	1,168
235	--	--	--	2,021	1,762	1,392	1,202
245	--	--	--	2,069	1,835	1,418	1,233
255	--	--	--	--	1,903	1,454	1,261
265	--	--	--	--	1,965	1,575	1,288
275	--	--	--	--	2,023	1,688	1,313
285	--	--	--	--	2,077	1,792	1,336
295	--	--	--	--	--	1,89	1,357
297	--	--	--	--	--	1,908	1,361

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).
Note: where a cell shows "–", this indicates that the system as assessed is not suitable for this particular application.

Table No. A2.5: I- sections - beams exposed on 3 sides

Fire resistance clarification R90 - beams exposed on 3 sides							
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**						
70	--	--	1,395	1,172	1,039	0,933	0,758
75	--	--	--	1,262	1,122	1,011	0,831
85	--	--	--	1,409	1,259	1,143	0,952
95	--	--	--	--	1,367	1,246	1,074
105	--	--	--	--	--	1,330	1,175
115	--	--	--	--	--	1,400	1,259
125	--	--	--	--	--	1,489	1,329
135	--	--	--	--	--	1,625	1,386
145	--	--	--	--	--	1,742	1,441
155	--	--	--	--	--	1,844	1,562
165	--	--	--	--	--	1,933	1,668
175	--	--	--	--	--	2,012	1,762
185	--	--	--	--	--	2,083	1,845
195	--	--	--	--	--	--	1,920
205	--	--	--	--	--	--	1,988
215	--	--	--	--	--	--	2,050
225	--	--	--	--	--	--	2,106
235	--	--	--	--	--	--	--
245	--	--	--	--	--	--	--
255	--	--	--	--	--	--	--
265	--	--	--	--	--	--	--
275	--	--	--	--	--	--	--
285	--	--	--	--	--	--	--
295	--	--	--	--	--	--	--
297	--	--	--	--	--	--	--

The thickness of the fire protection material is for the reactive coating layer only (without primer and topcoat).
Note: where a cell shows "–", this indicates that the system as assessed is not suitable for this particular application.

Annex 2

Product performance: Fire resistance of **Amotherm Steel WB**

This Annex relates to the use of **Amotherm Steel WB** for the protection of rectangular or circular **hollow columns** (four-sided exposure) and rectangular or circular **hollow beams** (three-sided exposure or four-sided exposure).

The precise scope given in Table No. A2.1 – A2.5 for **rectangular or circular hollow columns** (rolled or prefabricated) **exposed from 4 sides** shows the total dry film thickness of Amotherm Steel WB (excluding primer and top coat) required to provide classifications of **R15 to R60** for various design temperatures and selection factors.

The precise scope given in Table No. A2.6 – A2.11 for **rectangular hollow beams** (rolled or prefabricated) **exposed from 3 or 4 sides** shows the total dry film thickness of Amotherm Steel WB (excluding primer and top coat) required to provide classifications of **R15 to R90** for various design temperatures and selection factors.

The assessment was carried out by the use of graphical approach method according Annex E.2, EN 13381-8:2013[11], based on the test package 6A according Table 1, EN 13381-8:2013. The test was carried out as an addition to the test of open sections.

Reactive coating kit (primer, reactive coating and top coat) is intended for application on structure steel, grade of steel (S designation) to the standard EN 10025-1[12].

[11] EN 13381-8:2013 Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members

[12] EN 10025-1:2005 Hot rolled products of structural steels - Part 1: General technical delivery conditions

Table No. A2-1: rectangular or circular hollow columns (rolled or prefabricated)

Fire resistance clarification R15 – hollow section columns (e.g. rectangular and circular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
86	0,392	0,270	0,270	0,270	0,270	0,270	0,270	0,270	0,270
90	0,417	0,270	0,270	0,270	0,270	0,270	0,270	0,270	0,270
95	0,453	0,270	0,270	0,270	0,270	0,270	0,270	0,270	0,270
100	0,488	0,270	0,270	0,270	0,270	0,270	0,270	0,270	0,270
105	0,523	0,294	0,270	0,270	0,270	0,270	0,270	0,270	0,270
110	0,558	0,316	0,270	0,270	0,270	0,270	0,270	0,270	0,270
115	0,594	0,338	0,270	0,270	0,270	0,270	0,270	0,270	0,270
120	0,629	0,360	0,270	0,270	0,270	0,270	0,270	0,270	0,270
125	0,664	0,382	0,270	0,270	0,270	0,270	0,270	0,270	0,270
130	0,699	0,404	0,270	0,270	0,270	0,270	0,270	0,270	0,270
135	0,735	0,427	0,270	0,270	0,270	0,270	0,270	0,270	0,270
140	0,770	0,449	0,270	0,270	0,270	0,270	0,270	0,270	0,270
145	0,805	0,471	0,305	0,270	0,270	0,270	0,270	0,270	0,270
150	0,804	0,493	0,325	0,270	0,270	0,270	0,270	0,270	0,270
155	0,876	0,515	0,345	0,270	0,270	0,270	0,270	0,270	0,270
160	0,911	0,537	0,364	0,270	0,270	0,270	0,270	0,270	0,270
165	0,946	0,559	0,384	0,270	0,270	0,270	0,270	0,270	0,270
170	0,981	0,581	0,404	0,270	0,270	0,270	0,270	0,270	0,270
175	1,016	0,603	0,423	0,270	0,270	0,270	0,270	0,270	0,270
180	1,052	0,625	0,443	0,270	0,270	0,270	0,270	0,270	0,270
185	1,086	0,647	0,463	0,270	0,270	0,270	0,270	0,270	0,270
190	1,110	0,669	0,482	0,294	0,270	0,270	0,270	0,270	0,270
195	1,133	0,691	0,502	0,312	0,270	0,270	0,270	0,270	0,270
200	1,157	0,713	0,522	0,330	0,270	0,270	0,270	0,270	0,270
205	1,181	0,735	0,541	0,348	0,270	0,270	0,270	0,270	0,270
210	1,204	0,757	0,561	0,366	0,270	0,270	0,270	0,270	0,270
215	1,228	0,779	0,581	0,383	0,270	0,270	0,270	0,270	0,270
220	1,252	0,801	0,601	0,401	0,270	0,270	0,270	0,270	0,270
225	1,276	0,823	0,620	0,419	0,270	0,270	0,270	0,270	0,270
230	1,299	0,845	0,640	0,437	0,270	0,270	0,270	0,270	0,270
235	1,323	0,867	0,660	0,455	0,270	0,270	0,270	0,270	0,270
240	1,347	0,889	0,679	0,473	0,270	0,270	0,270	0,270	0,270
245	1,371	0,911	0,699	0,491	0,292	0,270	0,270	0,270	0,270
250	1,394	0,933	0,719	0,509	0,308	0,270	0,270	0,270	0,270
255	1,418	0,956	0,738	0,527	0,324	0,270	0,270	0,270	0,270
260	1,442	0,978	0,758	0,544	0,340	0,270	0,270	0,270	0,270
265	1,465	1,000	0,778	0,562	0,356	0,270	0,270	0,270	0,270
270	1,489	1,022	0,798	0,580	0,372	0,270	0,270	0,270	0,270
275	1,513	1,044	0,817	0,598	0,388	0,270	0,270	0,270	0,270
280	1,537	1,066	0,837	0,616	0,404	0,270	0,270	0,270	0,270
285	1,560	1,090	0,857	0,634	0,420	0,270	0,270	0,270	0,270
290	1,584	1,121	0,876	0,652	0,435	0,295	0,270	0,270	0,270
295	1,608	1,153	0,896	0,670	0,451	0,307	0,270	0,270	0,270
300	1,631	1,184	0,916	0,688	0,467	0,319	0,270	0,270	0,270
305	1,655	1,216	0,935	0,706	0,483	0,331	0,270	0,270	0,270
310	1,679	1,247	0,955	0,723	0,499	0,343	0,270	0,270	0,270
315	1,703	1,278	0,975	0,741	0,515	0,355	0,270	0,270	0,270
320	1,726	1,310	0,994	0,759	0,531	0,367	0,270	0,270	0,270
322	1,736	1,323	1,002	0,766	0,538	0,372	0,270	0,270	0,270

Table No. A2-2: rectangular or circular hollow columns (rolled or prefabricated)

Fire resistance clarification R20 – hollow section columns (e.g. rectangular and circular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
86	0,711	0,448	0,289	0,270	0,270	0,270	0,270	0,270	0,270
90	0,750	0,477	0,308	0,270	0,270	0,270	0,270	0,270	0,270
95	0,803	0,517	0,339	0,270	0,270	0,270	0,270	0,270	0,270
100	0,857	0,557	0,370	0,270	0,270	0,270	0,270	0,270	0,270
105	0,911	0,597	0,400	0,270	0,270	0,270	0,270	0,270	0,270
110	0,964	0,637	0,431	0,306	0,270	0,270	0,270	0,270	0,270
115	1,018	0,677	0,462	0,328	0,270	0,270	0,270	0,270	0,270
120	1,072	0,717	0,493	0,350	0,270	0,270	0,270	0,270	0,270
125	1,115	0,757	0,523	0,372	0,270	0,270	0,270	0,270	0,270
130	1,155	0,798	0,554	0,394	0,270	0,270	0,270	0,270	0,270
135	1,195	0,838	0,585	0,416	0,270	0,270	0,270	0,270	0,270
140	1,235	0,878	0,616	0,438	0,270	0,270	0,270	0,270	0,270
145	1,275	0,918	0,647	0,460	0,309	0,270	0,270	0,270	0,270
150	1,315	0,958	0,677	0,482	0,329	0,270	0,270	0,270	0,270
155	1,355	0,998	0,708	0,504	0,349	0,270	0,270	0,270	0,270
160	1,395	1,038	0,739	0,525	0,370	0,270	0,270	0,270	0,270
165	1,435	1,078	0,770	0,547	0,390	0,270	0,270	0,270	0,270
170	1,475	1,109	0,801	0,569	0,410	0,270	0,270	0,270	0,270
175	1,515	1,138	0,831	0,591	0,430	0,297	0,270	0,270	0,270
180	1,555	1,168	0,862	0,613	0,450	0,315	0,270	0,270	0,270
185	1,595	1,197	0,893	0,635	0,470	0,332	0,270	0,270	0,270
190	1,635	1,227	0,924	0,657	0,490	0,349	0,270	0,270	0,270
195	1,675	1,256	0,954	0,679	0,511	0,367	0,270	0,270	0,270
200	1,716	1,286	0,985	0,701	0,531	0,384	0,270	0,270	0,270
205	1,756	1,315	1,016	0,723	0,551	0,402	0,270	0,270	0,270
210	1,792	1,345	1,047	0,745	0,571	0,419	0,270	0,270	0,270
215	1,822	1,374	1,078	0,766	0,591	0,436	0,294	0,270	0,270
220	1,851	1,404	1,105	0,788	0,611	0,454	0,309	0,270	0,270
225	1,881	1,433	1,133	0,810	0,631	0,471	0,323	0,270	0,270
230	1,911	1,463	1,160	0,832	0,652	0,489	0,338	0,270	0,270
235	1,940	1,492	1,187	0,854	0,672	0,506	0,352	0,270	0,270
240	1,970	1,522	1,214	0,876	0,692	0,523	0,367	0,270	0,270
245	2,000	1,551	1,241	0,898	0,712	0,541	0,381	0,270	0,270
250	2,029	1,581	1,268	0,920	0,732	0,558	0,396	0,270	0,270
255	2,059	1,610	1,295	0,942	0,752	0,576	0,410	0,270	0,270
260	2,089	1,640	1,322	0,964	0,773	0,593	0,425	0,270	0,270
265	2,118	1,669	1,349	0,985	0,793	0,611	0,439	0,270	0,270
270	2,148	1,699	1,376	1,007	0,813	0,628	0,454	0,270	0,270
275	2,178	1,728	1,403	1,029	0,833	0,645	0,469	0,270	0,270
280	2,207	1,757	1,430	1,051	0,853	0,663	0,483	0,270	0,270
285	2,237	1,788	1,458	1,073	0,873	0,680	0,498	0,270	0,270
290	2,266	1,823	1,485	1,102	0,893	0,698	0,512	0,270	0,270
295	2,296	1,858	1,512	1,137	0,914	0,715	0,527	0,297	0,270
300	2,326	1,893	1,539	1,172	0,934	0,732	0,541	0,307	0,270
305	2,355	1,928	1,566	1,207	0,954	0,750	0,556	0,318	0,270
310	2,385	1,963	1,593	1,242	0,974	0,767	0,570	0,328	0,270
315	2,415	1,998	1,620	1,278	0,994	0,785	0,585	0,339	0,270
320	2,444	2,034	1,647	1,313	1,014	0,802	0,599	0,349	0,270
322	2,456	2,048	1,658	1,327	1,022	0,809	0,605	0,353	0,270

Table No. A2-3: rectangular or circular hollow columns (rolled or prefabricated)

Fire resistance clarification R30 – hollow section columns (e.g. rectangular and circular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
86	1,388	1,083	0,783	0,624	0,456	0,315	0,207	0,207	0,270
90	1,452	1,083	0,825	0,659	0,486	0,340	0,207	0,207	0,270
95	1,540	1,151	0,885	0,708	0,528	0,374	0,207	0,207	0,270
100	1,629	1,224	0,945	0,757	0,570	0,408	0,293	0,207	0,270
105	1,717	1,297	1,004	0,806	0,612	0,442	0,321	0,207	0,270
110	1,804	1,370	1,064	0,855	0,654	0,475	0,348	0,207	0,270
115	1,885	1,443	1,119	0,903	0,696	0,509	0,375	0,207	0,270
120	1,966	1,516	1,173	0,952	0,737	0,543	0,403	0,207	0,270
125	2,047	1,589	1,223	1,001	0,779	0,577	0,430	0,207	0,270
130	2,128	1,662	1,279	1,050	0,821	0,611	0,457	0,305	0,270
135	2,209	1,735	1,332	1,098	0,863	0,645	0,485	0,327	0,270
140	2,291	1,800	1,386	1,144	0,905	0,679	0,512	0,349	0,270
145	2,372	1,852	1,439	1,189	0,947	0,713	0,539	0,371	0,270
150	2,453	1,905	1,492	1,235	0,988	0,747	0,567	0,393	0,270
155	2,534	1,957	1,546	1,281	1,030	0,781	0,594	0,415	0,270
160	2,615	2,009	1,599	1,327	1,072	0,815	0,621	0,437	0,270
165	--	2,061	1,652	1,372	1,109	0,849	0,649	0,459	0,270
170	--	2,113	1,706	1,418	1,143	0,883	0,676	0,480	0,304
175	--	2,165	1,759	1,464	1,177	0,916	0,703	0,502	0,320
180	--	2,217	1,804	1,510	1,212	0,950	0,731	0,524	0,337
185	--	2,269	1,842	1,555	1,246	0,984	0,758	0,546	0,353
190	--	2,322	1,880	1,601	1,281	1,018	0,785	0,568	0,370
195	--	2,374	1,918	1,647	1,315	1,052	0,813	0,590	0,386
200	--	2,426	1,956	1,693	1,350	1,086	0,840	0,612	0,403
205	--	2,478	1,994	1,738	1,384	1,118	0,867	0,634	0,420
210	--	2,530	2,032	1,783	1,419	1,150	0,895	0,656	0,436
215	--	2,582	2,070	1,815	1,453	1,182	0,922	0,678	0,453
220	--	2,634	2,108	1,847	1,488	1,214	0,949	0,700	0,469
225	--	2,687	2,146	1,879	1,522	1,246	0,977	0,722	0,486
230	--	--	2,184	1,911	1,557	1,278	1,004	0,744	0,502
235	--	--	2,222	1,943	1,591	1,310	1,031	0,766	0,519
240	--	--	2,260	1,975	1,626	1,342	1,058	0,788	0,535
245	--	--	2,299	2,007	1,660	1,374	1,086	0,809	0,552
250	--	--	2,337	2,038	1,695	1,406	1,119	0,831	0,568
255	--	--	2,375	2,070	1,729	1,438	1,152	0,853	0,585
260	--	--	2,413	2,102	1,764	1,470	1,185	0,875	0,601
265	--	--	2,451	2,134	1,798	1,502	1,218	0,897	0,618
270	--	--	2,489	2,166	1,833	1,533	1,251	0,919	0,634
275	--	--	2,527	2,198	1,868	1,565	1,284	0,941	0,651
280	--	--	2,565	2,230	1,902	1,597	1,317	0,963	0,667
285	--	--	2,603	2,262	1,937	1,629	1,350	0,985	0,684
290	--	--	2,641	2,293	1,971	1,661	1,383	1,007	0,701
295	--	--	2,679	2,325	2,006	1,693	1,416	1,029	0,717
300	--	--	--	2,357	2,041	1,725	1,449	1,051	0,734
305	--	--	--	2,389	2,075	1,757	1,482	1,073	0,750
310	--	--	--	2,421	2,110	1,790	1,514	1,099	0,767
315	--	--	--	2,453	2,144	1,824	1,547	1,130	0,783
320	--	--	--	2,485	2,179	1,858	1,580	1,161	0,800
322	--	--	--	2,497	2,193	1,872	1,594	1,174	0,806

Table No. A2-4: rectangular or circular hollow columns (rolled or prefabricated)

Fire resistance clarification R45 – hollow section columns (e.g. rectangular and circular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
86	--	--	--	1,350	1,083	0,899	0,730	0,538	0,270
90	--	--	--	1,421	1,155	0,947	0,773	0,576	0,315
95	--	--	--	1,520	1,237	1,015	0,833	0,629	0,358
100	--	--	--	1,619	1,319	1,083	0,892	0,683	0,400
105	--	--	--	1,718	1,401	1,154	0,952	0,736	0,443
110	--	--	--	1,811	1,482	1,226	1,011	0,789	0,486
115	--	--	--	1,895	1,564	1,298	1,071	0,843	0,529
120	--	--	--	1,979	1,646	1,369	1,131	0,896	0,571
125	--	--	--	2,062	1,728	1,441	1,192	0,949	0,614
130	--	--	--	2,146	1,803	1,513	1,253	1,003	0,657
135	--	--	--	2,230	1,866	1,584	1,314	1,056	0,700
140	--	--	--	2,314	1,928	1,656	1,375	1,107	0,742
145	--	--	--	2,397	1,991	1,728	1,436	1,156	0,785
150	--	--	--	2,481	2,053	1,794	1,497	1,205	0,828
155	--	--	--	2,565	2,116	1,841	1,558	1,254	0,871
160	--	--	--	2,649	2,178	1,888	1,619	1,303	0,913
165	--	--	--	--	2,241	1,935	1,680	1,352	0,956
170	--	--	--	--	2,303	1,982	1,741	1,401	0,999
175	--	--	--	--	2,366	2,030	1,794	1,450	1,042
180	--	--	--	--	2,428	2,077	1,831	1,499	1,084
185	--	--	--	--	2,491	2,124	1,868	1,548	1,126
190	--	--	--	--	2,553	2,171	1,905	1,597	1,167
195	--	--	--	--	2,616	2,219	1,942	1,646	1,209
200	--	--	--	--	2,678	2,266	1,979	1,695	1,250
205	--	--	--	--	--	2,313	2,016	1,744	1,291
210	--	--	--	--	--	2,360	2,053	1,790	1,333
215	--	--	--	--	--	2,407	2,090	1,823	1,374
220	--	--	--	--	--	2,455	2,127	1,856	1,416
225	--	--	--	--	--	2,502	2,164	1,889	1,457
230	--	--	--	--	--	2,549	2,201	1,922	1,498
235	--	--	--	--	--	2,596	2,238	1,956	1,540
240	--	--	--	--	--	2,643	2,275	1,989	1,581
245	--	--	--	--	--	--	2,312	2,022	1,623
250	--	--	--	--	--	--	2,349	2,055	1,664
255	--	--	--	--	--	--	2,386	2,088	1,706
260	--	--	--	--	--	--	2,423	2,122	1,747
265	--	--	--	--	--	--	2,460	2,155	1,787
270	--	--	--	--	--	--	2,497	2,188	1,820
275	--	--	--	--	--	--	2,534	2,221	1,853
280	--	--	--	--	--	--	2,571	2,254	1,886
285	--	--	--	--	--	--	2,608	2,288	1,919
290	--	--	--	--	--	--	2,645	2,321	1,952
295	--	--	--	--	--	--	2,682	2,354	1,985
300	--	--	--	--	--	--	--	2,387	2,018
305	--	--	--	--	--	--	--	2,420	2,051
310	--	--	--	--	--	--	--	2,454	2,084
315	--	--	--	--	--	--	--	2,487	2,117
320	--	--	--	--	--	--	--	2,520	2,150
322	--	--	--	--	--	--	--	2,533	2,163

Table No. A2-5: rectangular or circular hollow columns (rolled or prefabricated)

Fire resistance clarification R60 – hollow section columns (e.g. rectangular and circular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
86	--	--	--	--	--	1,550	1,302	1,058	0,725
90	--	--	--	--	--	1,631	1,374	1,118	0,774
95	--	--	--	--	--	1,744	1,474	1,202	0,843
100	--	--	--	--	--	1,848	1,574	1,287	0,911
105	--	--	--	--	--	1,947	1,674	1,371	0,980
110	--	--	--	--	--	2,045	1,774	1,455	1,048
115	--	--	--	--	--	2,144	1,857	1,539	1,117
120	--	--	--	--	--	2,243	1,937	1,623	1,185
125	--	--	--	--	--	2,341	2,018	1,707	1,254
130	--	--	--	--	--	2,440	2,099	1,789	1,323
135	--	--	--	--	--	2,539	2,180	1,853	1,391
140	--	--	--	--	--	2,637	2,260	1,918	1,460
145	--	--	--	--	--	--	2,341	1,982	1,529
150	--	--	--	--	--	--	2,422	2,046	1,597
155	--	--	--	--	--	--	2,503	2,110	1,666
160	--	--	--	--	--	--	2,583	2,174	1,753
165	--	--	--	--	--	--	2,664	2,238	1,799
170	--	--	--	--	--	--	--	2,303	1,852
175	--	--	--	--	--	--	--	2,367	1,906
180	--	--	--	--	--	--	--	2,431	1,960
185	--	--	--	--	--	--	--	2,495	2,013
190	--	--	--	--	--	--	--	2,559	2,067
195	--	--	--	--	--	--	--	2,623	2,121
200	--	--	--	--	--	--	--	--	2,174
205	--	--	--	--	--	--	--	--	2,228
210	--	--	--	--	--	--	--	--	2,282
215	--	--	--	--	--	--	--	--	2,335
220	--	--	--	--	--	--	--	--	2,389
225	--	--	--	--	--	--	--	--	2,443
230	--	--	--	--	--	--	--	--	2,496
235	--	--	--	--	--	--	--	--	2,550
240	--	--	--	--	--	--	--	--	2,604
245	--	--	--	--	--	--	--	--	2,657
250	--	--	--	--	--	--	--	--	--
255	--	--	--	--	--	--	--	--	--
260	--	--	--	--	--	--	--	--	--
265	--	--	--	--	--	--	--	--	--
270	--	--	--	--	--	--	--	--	--
275	--	--	--	--	--	--	--	--	--
280	--	--	--	--	--	--	--	--	--
285	--	--	--	--	--	--	--	--	--
290	--	--	--	--	--	--	--	--	--
295	--	--	--	--	--	--	--	--	--
300	--	--	--	--	--	--	--	--	--
305	--	--	--	--	--	--	--	--	--
310	--	--	--	--	--	--	--	--	--
315	--	--	--	--	--	--	--	--	--
320	--	--	--	--	--	--	--	--	--
322	--	--	--	--	--	--	--	--	--

Table No. A2-6: rectangular hollow beams (rolled or prefabricated)

Fire resistance clarification R15 – hollow section beams (e.g. rectangular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
50	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
55	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
60	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
65	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
70	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
75	0,261	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
80	0,282	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
85	0,303	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
90	0,323	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
95	0,344	0,247	0,243	0,243	0,243	0,243	0,243	0,243	0,243
100	0,365	0,264	0,243	0,243	0,243	0,243	0,243	0,243	0,243
105	0,386	0,281	0,243	0,243	0,243	0,243	0,243	0,243	0,243
110	0,407	0,298	0,243	0,243	0,243	0,243	0,243	0,243	0,243
115	0,428	0,315	0,243	0,243	0,243	0,243	0,243	0,243	0,243
120	0,449	0,332	0,243	0,243	0,243	0,243	0,243	0,243	0,243
125	0,469	0,349	0,243	0,243	0,243	0,243	0,243	0,243	0,243
130	0,490	0,366	0,243	0,243	0,243	0,243	0,243	0,243	0,243
135	0,511	0,383	0,249	0,243	0,243	0,243	0,243	0,243	0,243
140	0,532	0,400	0,263	0,243	0,243	0,243	0,243	0,243	0,243
145	0,553	0,417	0,278	0,243	0,243	0,243	0,243	0,243	0,243
150	0,574	0,434	0,292	0,243	0,243	0,243	0,243	0,243	0,243
155	0,595	0,451	0,306	0,243	0,243	0,243	0,243	0,243	0,243
160	0,615	0,468	0,321	0,243	0,243	0,243	0,243	0,243	0,243
165	0,636	0,484	0,335	0,244	0,243	0,243	0,243	0,243	0,243
170	0,657	0,501	0,349	0,256	0,243	0,243	0,243	0,243	0,243
175	0,678	0,518	0,364	0,268	0,243	0,243	0,243	0,243	0,243
180	0,699	0,535	0,378	0,280	0,243	0,243	0,243	0,243	0,243
185	0,720	0,552	0,393	0,292	0,243	0,243	0,243	0,243	0,243
190	0,741	0,569	0,407	0,303	0,243	0,243	0,243	0,243	0,243
195	0,762	0,586	0,421	0,315	0,243	0,243	0,243	0,243	0,243
200	0,782	0,603	0,436	0,327	0,243	0,243	0,243	0,243	0,243
205	0,803	0,620	0,450	0,339	0,251	0,243	0,243	0,243	0,243
210	0,824	0,637	0,465	0,351	0,260	0,243	0,243	0,243	0,243
215	0,845	0,654	0,479	0,363	0,270	0,243	0,243	0,243	0,243
220	0,866	0,671	0,493	0,375	0,279	0,243	0,243	0,243	0,243
225	0,887	0,688	0,508	0,386	0,289	0,243	0,243	0,243	0,243
230	0,908	0,705	0,522	0,398	0,299	0,243	0,243	0,243	0,243
235	0,928	0,722	0,537	0,410	0,308	0,243	0,243	0,243	0,243
240	0,949	0,739	0,551	0,422	0,318	0,243	0,243	0,243	0,243
245	0,970	0,756	0,565	0,434	0,328	0,243	0,243	0,243	0,243
247	0,979	0,763	0,571	0,439	0,331	0,243	0,243	0,243	0,243

Table No. A2-7: rectangular hollow beams (rolled or prefabricated)

Fire resistance clarification R20 – hollow section beams (e.g. rectangular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
50	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
55	2,666	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
60	0,302	0,243	0,243	0,243	0,243	0,243	0,243	0,243	0,243
65	0,337	0,248	0,243	0,243	0,243	0,243	0,243	0,243	0,243
70	0,373	0,270	0,243	0,243	0,243	0,243	0,243	0,243	0,243
75	0,408	0,293	0,243	0,243	0,243	0,243	0,243	0,243	0,243
80	0,443	0,316	0,243	0,243	0,243	0,243	0,243	0,243	0,243
85	0,479	0,338	0,251	0,243	0,243	0,243	0,243	0,243	0,243
90	0,514	0,361	0,270	0,243	0,243	0,243	0,243	0,243	0,243
95	0,550	0,383	0,289	0,243	0,243	0,243	0,243	0,243	0,243
100	0,585	0,406	0,308	0,243	0,243	0,243	0,243	0,243	0,243
105	0,621	0,429	0,326	0,254	0,243	0,243	0,243	0,243	0,243
110	0,656	0,451	0,345	0,270	0,243	0,243	0,243	0,243	0,243
115	0,692	0,474	0,364	0,286	0,243	0,243	0,243	0,243	0,243
120	0,727	0,497	0,383	0,302	0,243	0,243	0,243	0,243	0,243
125	0,763	0,519	0,401	0,317	0,243	0,243	0,243	0,243	0,243
130	0,798	0,542	0,420	0,333	0,243	0,243	0,243	0,243	0,243
135	0,833	0,565	0,439	0,349	0,255	0,243	0,243	0,243	0,243
140	0,869	0,587	0,458	0,365	0,268	0,243	0,243	0,243	0,243
145	0,904	0,610	0,476	0,381	0,282	0,243	0,243	0,243	0,243
150	0,940	0,632	0,495	0,397	0,296	0,243	0,243	0,243	0,243
155	0,975	0,655	0,514	0,412	0,309	0,243	0,243	0,243	0,243
160	1,011	0,678	0,533	0,428	0,323	0,243	0,243	0,243	0,243
165	1,046	0,700	0,551	0,444	0,337	0,253	0,243	0,243	0,243
170	1,086	0,723	0,570	0,460	0,351	0,264	0,243	0,243	0,243
175	1,128	0,746	0,589	0,476	0,364	0,276	0,243	0,243	0,243
180	1,171	0,768	0,608	0,491	0,378	0,288	0,243	0,243	0,243
185	1,213	0,791	0,626	0,507	0,392	0,299	0,243	0,243	0,243
190	1,256	0,814	0,645	0,523	0,406	0,311	0,243	0,243	0,243
195	1,298	0,836	0,664	0,539	0,419	0,323	0,243	0,243	0,243
200	1,341	0,859	0,683	0,555	0,433	0,335	0,243	0,243	0,243
205	1,383	0,881	0,702	0,570	0,447	0,346	0,243	0,243	0,243
210	1,426	0,904	0,720	0,586	0,461	0,358	0,248	0,243	0,243
215	1,468	0,927	0,739	0,602	0,474	0,370	0,257	0,243	0,243
220	1,510	0,949	0,758	0,618	0,488	0,381	0,267	0,243	0,243
225	1,553	0,972	0,777	0,634	0,502	0,393	0,276	0,243	0,243
230	1,595	0,995	0,795	0,650	0,515	0,405	0,285	0,243	0,243
235	1,638	1,017	0,814	0,665	0,529	0,416	0,294	0,243	0,243
240	1,680	1,040	0,833	0,681	0,543	0,428	0,304	0,243	0,243
245	1,723	1,068	0,852	0,697	0,557	0,440	0,313	0,243	0,243
247	1,740	1,093	0,859	0,703	0,562	0,445	0,317	0,243	0,243

Table No. A2-8: rectangular hollow beams (rolled or prefabricated)

Fire resistance clarification R30 – hollow section beams (e.g. rectangular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
50	0,596	0,403	0,243	0,243	0,243	0,243	0,243	0,243	0,243
55	0,672	0,457	0,295	0,244	0,243	0,243	0,243	0,243	0,243
60	0,748	0,512	0,333	0,268	0,243	0,243	0,243	0,243	0,243
65	0,825	0,567	0,371	0,291	0,243	0,243	0,243	0,243	0,243
70	0,902	0,623	0,409	0,315	0,260	0,243	0,243	0,243	0,243
75	0,979	0,678	0,446	0,339	0,281	0,243	0,243	0,243	0,243
80	1,055	0,733	0,484	0,363	0,302	0,246	0,243	0,243	0,243
85	1,134	0,789	0,522	0,386	0,322	0,265	0,243	0,243	0,243
90	1,214	0,844	0,560	0,410	0,343	0,283	0,243	0,243	0,243
95	1,293	0,899	0,597	0,434	0,364	0,302	0,243	0,243	0,243
100	1,372	0,954	0,635	0,458	0,385	0,321	0,243	0,243	0,243
105	1,451	1,010	0,673	0,482	0,405	0,339	0,257	0,243	0,243
110	1,531	1,065	0,711	0,505	0,426	0,358	0,274	0,243	0,243
115	1,610	1,123	0,749	0,529	0,447	0,377	0,290	0,243	0,243
120	1,689	1,180	0,786	0,553	0,468	0,395	0,307	0,243	0,243
125	1,756	1,238	0,824	0,577	0,489	0,414	0,323	0,243	0,243
130	1,810	1,295	0,862	0,600	0,509	0,432	0,339	0,253	0,243
135	1,865	1,352	0,900	0,624	0,530	0,451	0,356	0,267	0,243
140	1,919	1,410	0,937	0,648	0,551	0,470	0,372	0,280	0,243
145	1,973	1,467	0,975	0,672	0,572	0,488	0,388	0,294	0,243
150	2,028	1,525	1,013	0,695	0,593	0,507	0,405	0,308	0,243
155	2,082	1,582	1,051	0,719	0,613	0,525	0,421	0,322	0,243
160	2,136	1,640	1,096	0,743	0,634	0,544	0,438	0,335	0,243
165	2,190	1,697	1,143	0,767	0,655	0,563	0,454	0,349	0,243
170	2,245	1,748	1,190	0,790	0,676	0,581	0,470	0,363	0,243
175	2,299	1,789	1,237	0,814	0,696	0,600	0,487	0,377	0,243
180	2,353	1,831	1,285	0,838	0,717	0,618	0,503	0,390	0,243
185	2,408	1,872	1,332	0,862	0,738	0,637	0,519	0,404	0,243
190	2,462	1,914	1,379	0,885	0,759	0,656	0,536	0,418	0,243
195	2,516	1,956	1,426	0,909	0,780	0,674	0,552	0,432	0,243
200	2,570	1,997	1,474	0,933	0,800	0,693	0,569	0,445	0,243
205	2,625	2,039	1,521	0,957	0,821	0,712	0,585	0,459	0,243
210	--	2,080	1,568	0,980	0,842	0,730	0,601	0,473	0,243
215	--	2,122	1,615	1,004	0,863	0,749	0,618	0,487	0,243
220	--	2,164	1,663	1,028	0,883	0,767	0,634	0,500	0,249
225	--	2,205	1,710	1,052	0,904	0,786	0,650	0,514	0,259
230	--	2,247	1,768	1,101	0,925	0,805	0,667	0,528	0,270
235	--	2,289	1,833	1,163	0,946	0,823	0,683	0,542	0,280
240	--	2,330	1,898	1,225	0,967	0,842	0,700	0,555	0,291
245	--	2,372	1,962	1,287	0,987	0,860	0,716	0,569	0,301
247	--	2,388	1,988	1,312	0,996	0,868	0,723	0,574	0,305

Table No. A2-9: rectangular hollow beams (rolled or prefabricated)

Fire resistance clarification R45 – hollow section beams (e.g. rectangular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
50	--	0,912	0,696	0,548	0,421	0,302	0,243	0,243	0,243
55	--	1,016	0,776	0,610	0,471	0,344	0,252	0,243	0,243
60	--	1,129	0,859	0,674	0,523	0,387	0,284	0,243	0,243
65	--	1,246	0,941	0,738	0,575	0,430	0,316	0,249	0,243
70	--	1,363	1,023	0,801	0,626	0,473	0,347	0,273	0,243
75	--	1,479	1,113	0,865	0,678	0,516	0,379	0,297	0,243
80	--	1,596	1,209	0,929	0,730	0,559	0,411	0,321	0,243
85	--	1,713	1,304	0,993	0,781	0,602	0,443	0,345	0,243
90	--	1,797	1,400	1,056	0,833	0,645	0,474	0,369	0,243
95	--	1,876	1,496	1,118	0,884	0,688	0,506	0,393	0,248
100	--	1,955	1,592	1,180	0,936	0,732	0,538	0,417	0,269
105	--	2,034	1,688	1,242	0,988	0,775	0,570	0,441	0,289
110	--	2,113	1,770	1,304	1,039	0,818	0,601	0,465	0,310
115	--	2,192	1,841	1,365	1,089	0,861	0,633	0,489	0,331
120	--	2,271	1,912	1,427	1,137	0,904	0,665	0,513	0,351
125	--	2,350	1,983	1,489	1,185	0,947	0,697	0,537	0,372
130	--	2,429	2,054	1,551	1,233	0,990	0,729	0,561	0,392
135	--	2,507	2,125	1,612	1,281	1,033	0,760	0,586	0,413
140	--	2,586	2,196	1,674	1,330	1,074	0,792	0,610	0,434
145	--	--	2,267	1,737	1,378	1,110	0,824	0,634	0,454
150	--	--	2,338	1,809	1,426	1,147	0,856	0,658	0,475
155	--	--	2,409	1,880	1,474	1,184	0,887	0,682	0,495
160	--	--	2,481	1,952	1,522	1,221	0,919	0,706	0,516
165	--	--	2,552	2,023	1,570	1,258	0,951	0,730	0,537
170	--	--	2,623	2,095	1,618	1,294	0,983	0,754	0,557
175	--	--	--	2,166	1,666	1,331	1,014	0,778	0,578
180	--	--	--	2,238	1,715	1,368	1,046	0,802	0,598
185	--	--	--	2,309	1,780	1,405	1,086	0,826	0,619
190	--	--	--	2,381	1,852	1,442	1,132	0,850	0,640
195	--	--	--	2,452	1,925	1,478	1,178	0,874	0,660
200	--	--	--	2,524	1,998	1,515	1,224	0,898	0,681
205	--	--	--	2,595	2,070	1,552	1,270	0,922	0,701
210	--	--	--	--	2,143	1,589	1,316	0,947	0,722
215	--	--	--	--	2,215	1,626	1,362	0,971	0,743
220	--	--	--	--	2,288	1,662	1,408	0,995	0,763
225	--	--	--	--	2,361	1,699	1,454	1,019	0,784
230	--	--	--	--	2,433	1,750	1,500	1,043	0,805
235	--	--	--	--	2,506	1,862	1,546	1,078	0,825
240	--	--	--	--	2,578	1,974	1,592	1,139	0,846
245	--	--	--	--	2,651	2,086	1,638	1,200	0,866
247	--	--	--	--	--	2,131	1,657	1,224	0,875

Table No. A2-10: rectangular hollow beams (rolled or prefabricated)

Fire resistance clarification R60 – hollow section beams (e.g. rectangular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
50	--	--	1,151	0,937	0,787	0,656	0,505	0,350	0,243
55	--	--	1,294	1,037	0,873	0,733	0,571	0,407	0,243
60	--	--	1,441	1,143	0,962	0,811	0,639	0,466	0,257
65	--	--	1,587	1,249	1,050	0,890	0,707	0,525	0,299
70	--	--	1,733	1,355	1,137	0,968	0,774	0,583	0,341
75	--	--	1,852	1,462	1,223	1,046	0,842	0,624	0,383
80	--	--	1,970	1,568	1,310	1,116	0,910	0,701	0,425
85	--	--	2,089	1,675	1,396	1,185	0,978	0,760	0,467
90	--	--	2,207	1,785	1,483	1,253	1,046	0,818	0,508
95	--	--	2,326	1,899	1,569	1,321	1,106	0,877	0,550
100	--	--	2,444	2,013	1,656	1,389	1,164	0,936	0,592
105	--	--	2,563	2,127	1,744	1,458	1,222	0,995	0,634
110	--	--	--	2,241	1,842	1,526	1,281	1,053	0,676
115	--	--	--	2,355	1,940	1,594	1,339	1,103	0,718
120	--	--	--	2,469	2,038	1,662	1,397	1,152	0,759
125	--	--	--	2,583	2,135	1,731	1,456	1,201	0,801
130	--	--	--	--	2,233	1,817	1,514	1,249	0,843
135	--	--	--	--	2,331	1,903	1,572	1,298	0,885
140	--	--	--	--	2,429	1,989	1,631	1,347	0,927
145	--	--	--	--	2,526	2,075	1,689	1,395	0,969
150	--	--	--	--	2,624	2,161	1,752	1,444	1,010
155	--	--	--	--	--	2,247	1,826	1,493	1,052
160	--	--	--	--	--	2,333	1,900	1,542	1,117
165	--	--	--	--	--	2,419	1,973	1,590	1,187
170	--	--	--	--	--	2,505	2,047	1,639	1,257
175	--	--	--	--	--	2,591	2,121	1,688	1,327
180	--	--	--	--	--	--	2,194	1,739	1,397
185	--	--	--	--	--	--	2,268	1,467	1,467
190	--	--	--	--	--	--	2,342	1,537	1,537
195	--	--	--	--	--	--	2,416	1,607	1,607
200	--	--	--	--	--	--	2,489	1,677	1,677
205	--	--	--	--	--	--	2,563	1,743	1,743
210	--	--	--	--	--	--	2,637	1,799	1,799
215	--	--	--	--	--	--	--	1,854	1,854
220	--	--	--	--	--	--	--	2,282	1,910
225	--	--	--	--	--	--	--	2,349	1,966
230	--	--	--	--	--	--	--	2,417	2,022
235	--	--	--	--	--	--	--	2,485	2,077
240	--	--	--	--	--	--	--	2,553	2,133
245	--	--	--	--	--	--	--	2,620	2,189
247	--	--	--	--	--	--	--	2,648	2,211

Table No. A2-11: rectangular hollow beams (rolled or prefabricated)

Fire resistance clarification R90 – hollow section beams (e.g. rectangular)									
Design Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**
Section factor A/V [m^{-1}]	**Thickness of the fire protection material to maintain temperature below design temperature [mm]**								
50	--	--	--	--	--	--	--	1,007	0,750
55	--	--	--	--	--	--	--	1,116	0,862
60	--	--	--	--	--	--	--	1,219	0,975
65	--	--	--	--	--	--	--	1,321	1,085
70	--	--	--	--	--	--	--	1,423	1,185
75	--	--	--	--	--	--	--	1,526	1,284
80	--	--	--	--	--	--	--	1,628	1,383
85	--	--	--	--	--	--	--	1,731	1,483
90	--	--	--	--	--	--	--	1,870	1,582
95	--	--	--	--	--	--	--	2,009	1,682
100	--	--	--	--	--	--	--	2,147	1,788
105	--	--	--	--	--	--	--	2,286	1,901
110	--	--	--	--	--	--	--	2,425	2,014
115	--	--	--	--	--	--	--	2,564	2,128
120	--	--	--	--	--	--	--	--	2,241
125	--	--	--	--	--	--	--	--	2,354
130	--	--	--	--	--	--	--	--	2,467
135	--	--	--	--	--	--	--	--	2,580
140	--	--	--	--	--	--	--	--	--
145	--	--	--	--	--	--	--	--	--
150	--	--	--	--	--	--	--	--	--
155	--	--	--	--	--	--	--	--	--
160	--	--	--	--	--	--	--	--	--
165	--	--	--	--	--	--	--	--	--
170	--	--	--	--	--	--	--	--	--
175	--	--	--	--	--	--	--	--	--
180	--	--	--	--	--	--	--	--	--
185	--	--	--	--	--	--	--	--	--
190	--	--	--	--	--	--	--	--	--
195	--	--	--	--	--	--	--	--	--
200	--	--	--	--	--	--	--	--	--
205	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--
215	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--
225	--	--	--	--	--	--	--	--	--
230	--	--	--	--	--	--	--	--	--
235	--	--	--	--	--	--	--	--	--
240	--	--	--	--	--	--	--	--	--
245	--	--	--	--	--	--	--	--	--
247	--	--	--	--	--	--	--	--	--

Annex 3

Product performance: Thermogravimetry according to EN ISO 11358-1 of reactive coating **Amotherm Steel WB**

TG curve of reactive coating Amotherm Steel WB: