Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment ETA-12/0324 of 22 January 2018

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General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	NOVATHERM 4FRe
Product family to which the construction product belongs	Reactive coatings for fire protection of steel elements
Manufacturer	PROTEGA AB Verkstadsgatan 6B 231 66 Trelleborg SCHWEDEN
Manufacturing plant	PROTEGA AB Verkstadsgatan 6B 231 66 TRELLEBORG SCHWEDEN
This European Technical Assessment contains	36 pages including 1 annex 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
This version replaces	ETA-12/0324 issued on 12 June 2013

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Specific part

1 Technical description of the product

This European technical assessment applies to the reactive coating for fire protection "NOVATHERM 4FRe". "NOVATHERM 4FRe" is a water based dispersion and can be applied by spraying. The reactive coating system for fire protection consists of the primer, the reactive coating and of the topcoat. In the case of fire reactive coatings for fire protection act by temperature stress and thus develop a heat-insulating effect. The reactive component, on which the mode of operation of the reactive coating for fire protection is based, is an intumescent material.

In conformity with EAD 350402-00-1106 the ETA is issued for the product under end use conditions (Option 2).

2 Specification of the intended use in accordance with the applicable European Assessment Document

2.1 Field of application

"NOVATHERM 4FRe" serves for the use as reactive coating system (sheathing) necessary on beams and columns made of structural steel (marking 'S') in accordance with EN 10025[1], excluding S185 to achieve a fire resistance duration in accordance with EN 13501-2[2].

"NOVATHERM 4FRe" may be applied in accordance with Annex 1 to the following fields.

- Fire resistance:
  - Open sections (H and I): R30-IncSlow, R45-IncSlow, R60-IncSlow, R75-IncSlow, R90-IncSlow
  - Rectangular hollow sections: R 15-IncSlow, R 30-IncSlow, R 45-IncSlow, R 60-IncSlow, R 75-IncSlow, R 90-IncSlow
  - Circular hollow sections: R 15-IncSlow, R 30-IncSlow, R 45-IncSlow, R 60-IncSlow, R 75-IncSlow, R 90-IncSlow
- A/V factor and/or V/A factor: 49 m^{-1} up 340 m^{-1} / 0,0204 m up 0,0029 m
- Design temperatures: 350 °C up to 750 °C

The application of "NOVATHERM 4FRe" on steel tension members made of structural steel in accordance with EN 10025 is not regulated by this ETA.

The application on zinc-coated substrates has been verified.

[1] EN 10025:part1 to 6:2004-2005 Hot rolled products of structural steels implemented

[2] EN 13501-2:2007-10 Fire classification of construction products and building elements Part 2: Classification using data from fire resistance tests, excluding ventilation services

2.2 Use category

Depending on the use category in accordance with EAD 350402-00-1106, clause 1.2.3 the following types have been approved.

Primer		Reactive coating	Topcoat
Alkydresin primers	"Novagrund 40"	"NOVATHERM 4FRe"	Typ Z_2 "Topcoat W" [3]

For the carrying out with primer "Novagrund 40" and topcoat "Topcoat W" the applicability of the reactive coating system has been verified on zinc coated substrates with a thickness of the zinc coating of up to 150 µm according to EAD 350402-00-1106, clause 2.2.5.1 for the use category Type Z_2.

The performances given in Section 3 are only valid if the reactive coating "NOVATHERM 4FRe" is used in compliance with the specifications and conditions given in Annex 1.

The European technical assessment is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the assessment and consequently the validity of the CE marking on the basis of the assessment and if so whether further assessment or alterations to the European technical assessment shall be necessary.

2.3 Working life

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the reactive coating "NOVATHERM 4FRe" of at least 10 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

[3] For all shades of this top coat

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

3.1 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	In the assembly with primer, reactive coating and topcoat the reactive coating system corresponds to the reaction-to-fire class E according to EN 13501-1[4].
Fire resistance	The fire resistance classes were determined according to EN 13501-2[8] corresponding to ENV 13381-4[12] and EN 13381-8[5] and shall be gathered from Annex 1.
Smouldering fire exposure	The verification under exposure to the smouldering fire curve according to ENV 13381-4[6] has been furnished in the context of the approval tests.

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Air and water permeability	Not relevant
Release of dangerous substances	The formulations for all components of the reactive coating have been deposited at the DIBt. The related dangerous substances have been evaluated by verification of the formulation taking into account the use of the reactive coating and the release scenarios resulting from there. Changes in the formulation may only be effected with approval of the DIBt. Note: In addition to the specific clauses relating to dangerous substances contained in this European technical assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.3 General aspects

The primers and the topcoat indicated in section 1.2.2 of this ETA are compatible with the reactive coating "NOVATHERM 4FRe". The verifications were made in accordance with EAD 350402-00-1106, clause 2.2.5.2. The approved use categories shall be taken from section 2.2 of this ETA.

The formulation for "NOVATHERM 4FRe" has been deposited at the DIBt. In addition density and Non-Volatiles measures have also been determined.

4	EN 13501-1:2007-02+A1:2009	Fire classification of construction products and building elements Part 1: Classification using data from reaction to fire tests
5	EN 13381-8:2010-09	Test methods for determining the contribution to the fire resistance of structural members – Part 8: Applied reactive protection to steel members
6	ENV 13381-4:2002-07	Test methods for determining the contribution to the fire resistance of structural members – Part 4: Applied protection to steel members

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

According to Decision of the Commission of 22 June 1999 (1999/454/EC, ABl. L 178 of 14.07.1999), as amended by Decision of the Commission of 8 January 2001 (2001/596/EG, ABl. L 209/33 of 02.08.2001), the system 1 of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) applies.

Additionally according to the Decision 2001/596/EC of the European Commission system 3 of the assessment and verification of constancy of performance is to be used in relation to the reaction-to-fire performance class "E" according to EN 13501-1.

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 22 January 2018 by Deutsches Institut für Bautechnik

Prof. Gunter Hoppe
Head of Department

beglaubigt:
Dreyer

Annex 1

Handling, Application

The manufacturer shall provide an installation guide for his product.

The installation guide shall give information about.

- List of suitable substrates
- Preparation of the surface of the construction (e.g. cleanliness, required preparation grade of the surface, e.g. Sa 2 ½)
- Method of application (e.g. spraying)
- Environmental conditions (e.g. the temperature and humidity conditions before, during and after application)
- Necessary application wet film thickness in relation to the dry film thickness
- Required minimum dry film thickness of the reactive coating according to annex 1 of the ETA
- Period of time between the application of each component and the single layers, taking into account the exposure conditions
- Curing time of the system
- Approved topcoats
- Equipment parameters

This ETA is issued on the assumption that the application of "NOVATHERM 4FRe" occurs in accordance with the manufacturer's instructions.

Primer

An alkyd-resign primer as specified by the manufacturer shall be used, see clause 2.2 of this ETA.

The primer shall be applied on surface prepared steel. The surface of the steel shall be free of dust, grease and other pollutants. The preparation grade of surface shall be in accordance with the technical data sheets. The primer shall cover the surface of the steel completely. The required dry film thickness according to the manufacturer's declaration shall be respected, it is approx 50 µm - 100 µm.

Primer applied on the steel sections at the factory, where relevant, which does not comply with the requirements of the ETA holder shall be removed before.

Reactive coating

The reactive coating shall be compatible with the primer and the topcoat (optional) and shall not exceed the allowable expiration date.

The dry film thickness of the reactive coating "NOVATHERM 4FRe" (without primer and topcoat) shall have at least the values required in Annex 1.

Topcoat

If a topcoat is used it shall be compatible with the reactive coating. During the tests carried out for the approval procedure the topcoat has been found to be compatible according to section 2.2 of this ETA.

The required dry film thickness according to the manufacturer's declaration shall be respected, it is approx 50 µm - 100 µm.

Structural references

The steel members coated with "NOVATHERM 4FRe" should not have claddings or other sheathings which could prevent the reactive coating from foaming.

Packaging, transport and storage

In the accompanying document or on the tanks the manufacturer shall give information as to transport and storage.

At least the following shall be indicated: storage temperature, type of storage (container, tank, etc.), required data related to minimum and maximum temperature for transport and storage. In case of combustible components or other potentially dangerous substances the instructions shall contain indications about limitations and/or conditions for handling, transport and storage.

Use, maintenance, repair

The assessment of the fitness for use is based on the assumption that necessary maintenance and repair if required is carried out in accordance with the manufacturer's instructions during the assumed intended working life.

The top coat offers an additional protection and serves the color design, therefore it shall always be kept in a proper state.

Fire resistance

1. This Annex relates to the use of "NOVATHERM 4FRe" for safety in case of fire of open sections (H and I), rectangular hollow sections and circular hollow sections for steel beams or steel columns. The proper field of application is given in Tables 1 to 12 which show the minimum dry thickness of the layer (without primer and topcoat) required for achieving the classification "R" in case of different design temperatures and profile factors. The tables are applicable to assemblies with or without topcoat.
2. The product has been approved on the basis of:
   a. The approval test on the basis of ENV 13381-4[6], EN 13381-8[5] and ETAG 018, Part 1 and 2
   b. The design of the minimum dry film thickness of the layer according to Annex H of ENV 13381-4[6] and for hollow section according EN 13381-8[5]
3. The data for beams are related to a three-sided fire exposure and for columns to a four-sided fire exposure.
4. The layer thicknesses given are applicable to steel sections with a surface prepared as described in Annex 1 clause "Primer" in this ETA.

The thicknesses given for open H- and I-sections also apply to steel sections of other shapes, e.g. U-, L- and T-sections under consideration of the same A/V value.

Annex 1, Table 1, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 30 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	0,487	0,405	0,405	0,405	0,405	0,405	0,405	0,405	
70	0,0143	0,551	0,405	0,405	0,405	0,405	0,405	0,405	0,405	
75	0,0133	0,594	0,429	0,405	0,405	0,405	0,405	0,405	0,405	
80	0,0125	0,636	0,466	0,405	0,405	0,405	0,405	0,405	0,405	
85	0,0118	0,675	0,501	0,405	0,405	0,405	0,405	0,405	0,405	
90	0,0111	0,713	0,535	0,405	0,405	0,405	0,405	0,405	0,405	
95	0,0105	0,750	0,568	0,407	0,405	0,405	0,405	0,405	0,405	
100	0,0100	0,785	0,599	0,434	0,405	0,405	0,405	0,405	0,405	
105	0,0095	0,819	0,629	0,461	0,405	0,405	0,405	0,405	0,405	
110	0,0091	0,851	0,659	0,487	0,405	0,405	0,405	0,405	0,405	
115	0,0087	0,882	0,687	0,512	0,405	0,405	0,405	0,405	0,405	
120	0,0083	0,912	0,714	0,536	0,405	0,405	0,405	0,405	0,405	
125	0,0080	0,941	0,740	0,560	0,405	0,405	0,405	0,405	0,405	
130	0,0077	0,969	0,766	0,583	0,417	0,405	0,405	0,405	0,405	
135	0,0074	0,995	0,790	0,605	0,436	0,405	0,405	0,405	0,405	
140	0,0071	1,021	0,814	0,626	0,455	0,405	0,405	0,405	0,405	
145	0,0069	1,046	0,837	0,647	0,474	0,405	0,405	0,405	0,405	
150	0,0067	1,070	0,859	0,667	0,491	0,405	0,405	0,405	0,405	
155	0,0065	1,094	0,881	0,687	0,509	0,405	0,405	0,405	0,405	
160	0,0063	1,116	0,902	0,706	0,526	0,405	0,405	0,405	0,405	
165	0,0061	1,138	0,922	0,725	0,542	0,405	0,405	0,405	0,405	
170	0,0059	1,159	0,942	0,743	0,559	0,405	0,405	0,405	0,405	
175	0,0057	1,180	0,961	0,760	0,574	0,405	0,405	0,405	0,405	
180	0,0056	1,200	0,980	0,777	0,590	0,415	0,405	0,405	0,405	
185	0,0054	1,219	0,998	0,794	0,605	0,428	0,405	0,405	0,405	
190	0,0053	1,238	1,016	0,810	0,619	0,441	0,405	0,405	0,405	
195	0,0051	1,256	1,033	0,826	0,633	0,454	0,405	0,405	0,405	
200	0,0050	1,274	1,050	0,841	0,647	0,466	0,405	0,405	0,405	
205	0,0049	1,291	1,066	0,856	0,661	0,478	0,405	0,405	0,405	
210	0,0048	1,308	1,082	0,871	0,674	0,490	0,405	0,405	0,405	
215	0,0047	1,324	1,097	0,885	0,687	0,501	0,405	0,405	0,405	
220	0,0045	1,340	1,112	0,899	0,700	0,512	0,405	0,405	0,405	
225	0,0044	1,355	1,127	0,913	0,712	0,523	0,405	0,405	0,405	
230	0,0043	1,370	1,141	0,926	0,724	0,534	0,405	0,405	0,405	
235	0,0043	1,385	1,155	0,939	0,736	0,544	0,405	0,405	0,405	
240	0,0042	1,399	1,169	0,952	0,748	0,555	0,405	0,405	0,405	
245	0,0041	1,413	1,182	0,964	0,759	0,565	0,405	0,405	0,405	
250	0,0040	1,426	1,195	0,976	0,770	0,575	0,405	0,405	0,405	
255	0,0039	1,439	1,207	0,988	0,781	0,584	0,405	0,405	0,405	
260	0,0038	1,452	1,220	1,000	0,792	0,594	0,406	0,405	0,405	
265	0,0038	1,465	1,232	1,011	0,802	0,603	0,414	0,405	0,405	
270	0,0037	1,477	1,244	1,022	0,812	0,612	0,422	0,405	0,405	
275	0,0036	1,489	1,255	1,033	0,822	0,621	0,430	0,405	0,405	
280	0,0036	1,501	1,266	1,044	0,832	0,630	0,437	0,405	0,405	
285	0,0035	1,512	1,277	1,054	0,842	0,639	0,445	0,405	0,405	
290	0,0034	1,523	1,288	1,064	0,851	0,647	0,452	0,405	0,405	
295	0,0034	1,534	1,299	1,074	0,860	0,655	0,459	0,405	0,405	
300	0,0033	1,545	1,309	1,084	0,869	0,664	0,466	0,405	0,405	

Annex 1, Table 1, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 30 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
305	0,0033	1,555	1,319	1,094	0,878	0,672	0,473	0,405	0,405	
310	0,0032	1,565	1,329	1,103	0,887	0,679	0,480	0,405	0,405	
315	0,0032	1,575	1,339	1,112	0,895	0,687	0,487	0,405	0,405	
320	0,0031	1,585	1,348	1,122	0,904	0,695	0,494	0,405	0,405	
325	0,0031	1,594	1,358	1,130	0,912	0,702	0,500	0,405	0,405	
330	0,0030	1,604	1,367	1,139	0,920	0,709	0,507	0,405	0,405	
335	0,0030	1,613	1,376	1,148	0,928	0,717	0,513	0,405	0,405	
340	0,0029	1,622	1,384	1,156	0,936	0,724	0,519	0,405	0,405	

Annex 1, Table 2, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 45 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	0,899	0,716	0,559	0,422	0,405	0,405	0,405	0,405	
70	0,0143	0,994	0,803	0,637	0,491	0,405	0,405	0,405	0,405	
75	0,0133	1,058	0,861	0,690	0,539	0,405	0,405	0,405	0,405	
80	0,0125	1,120	0,918	0,741	0,585	0,446	0,405	0,405	0,405	
85	0,0118	1,179	0,972	0,790	0,629	0,486	0,405	0,405	0,405	
90	0,0111	1,235	1,024	0,837	0,672	0,524	0,405	0,405	0,405	
95	0,0105	1,289	1,074	0,883	0,714	0,562	0,425	0,405	0,405	
100	0,0100	1,341	1,122	0,928	0,754	0,598	0,457	0,405	0,405	
105	0,0095	1,391	1,168	0,970	0,793	0,633	0,489	0,405	0,405	
110	0,0091	1,439	1,213	1,012	0,831	0,668	0,520	0,405	0,405	
115	0,0087	1,485	1,257	1,052	0,868	0,701	0,550	0,411	0,405	
120	0,0083	1,530	1,298	1,091	0,903	0,734	0,579	0,437	0,405	
125	0,0080	1,573	1,339	1,128	0,938	0,765	0,607	0,463	0,405	
130	0,0077	1,614	1,378	1,165	0,972	0,796	0,635	0,487	0,405	
135	0,0074	1,654	1,416	1,200	1,004	0,826	0,662	0,512	0,405	
140	0,0071	1,692	1,452	1,234	1,036	0,855	0,689	0,535	0,405	
145	0,0069	1,729	1,487	1,268	1,067	0,883	0,714	0,558	0,414	
150	0,0067	1,765	1,522	1,300	1,097	0,911	0,740	0,581	0,434	
155	0,0065	1,800	1,555	1,332	1,127	0,938	0,764	0,603	0,454	
160	0,0063	1,833	1,587	1,362	1,155	0,965	0,788	0,625	0,473	
165	0,0061	1,866	1,619	1,392	1,183	0,990	0,812	0,646	0,492	
170	0,0059	1,897	1,649	1,421	1,210	1,015	0,835	0,667	0,510	
175	0,0057	1,928	1,678	1,449	1,237	1,040	0,857	0,687	0,528	
180	0,0056	1,957	1,707	1,476	1,262	1,064	0,879	0,707	0,546	
185	0,0054	1,986	1,735	1,503	1,288	1,087	0,901	0,727	0,563	
190	0,0053	2,014	1,762	1,529	1,312	1,110	0,922	0,746	0,581	
195	0,0051	2,041	1,788	1,554	1,336	1,133	0,943	0,765	0,597	
200	0,0050	2,067	1,814	1,579	1,359	1,155	0,963	0,783	0,614	
205	0,0049	2,093	1,839	1,603	1,382	1,176	0,983	0,801	0,630	
210	0,0048	2,117	1,863	1,626	1,404	1,197	1,002	0,819	0,646	
215	0,0047	2,141	1,887	1,649	1,426	1,217	1,021	0,836	0,662	
220	0,0045	2,165	1,910	1,671	1,448	1,237	1,040	0,853	0,677	
225	0,0044	2,188	1,932	1,693	1,468	1,257	1,058	0,870	0,692	
230	0,0043	2,210	1,954	1,714	1,489	1,276	1,076	0,886	0,707	
235	0,0043	2,232	1,976	1,735	1,509	1,295	1,093	0,902	0,721	
240	0,0042		1,996	1,755	1,528	1,313	1,110	0,918	0,736	
245	0,0041		2,017	1,775	1,547	1,331	1,127	0,934	0,750	
250	0,0040		2,037	1,795	1,566	1,349	1,144	0,949	0,763	
255	0,0039		2,056	1,814	1,584	1,366	1,160	0,964	0,777	
260	0,0038		2,075	1,832	1,602	1,383	1,176	0,978	0,790	
265	0,0038		2,094	1,850	1,619	1,400	1,192	0,993	0,804	
270	0,0037		2,112	1,868	1,637	1,417	1,207	1,007	0,816	
275	0,0036		2,129	1,885	1,653	1,433	1,222	1,021	0,829	
280	0,0036		2,147	1,902	1,670	1,448	1,237	1,035	0,842	
285	0,0035		2,164	1,919	1,686	1,464	1,251	1,048	0,854	
290	0,0034		2,180	1,935	1,702	1,479	1,266	1,062	0,866	
295	0,0034		2,196	1,951	1,717	1,494	1,280	1,075	0,878	
300	0,0033		2,212	1,967	1,733	1,508	1,293	1,087	0,890	

Annex 1, Table 2, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 45 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
305	0,0033		2,228	1,982	1,748	1,523	1,307	1,100	0,901	
310	0,0032			1,997	1,762	1,537	1,320	1,112	0,913	
315	0,0032			2,012	1,777	1,551	1,333	1,125	0,924	
320	0,0031			2,027	1,791	1,564	1,346	1,137	0,935	
325	0,0031			2,041	1,805	1,577	1,359	1,149	0,946	
330	0,0030			2,055	1,818	1,591	1,371	1,160	0,957	
335	0,0030			2,068	1,832	1,604	1,384	1,172	0,967	
340	0,0029			2,082	1,845	1,616	1,396	1,183	0,977	

Annex 1, Table 3, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 60 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	1,311	1,098	0,914	0,754	0,614	0,490	0,405	0,405	
70	0,0143	1,437	1,214	1,021	0,852	0,702	0,570	0,451	0,405	
75	0,0133	1,522	1,293	1,094	0,918	0,763	0,625	0,500	0,405	
80	0,0125	1,604	1,369	1,164	0,983	0,822	0,678	0,549	0,432	
85	0,0118	1,682	1,442	1,232	1,045	0,879	0,731	0,596	0,475	
90	0,0111	1,757	1,512	1,297	1,106	0,935	0,781	0,643	0,517	
95	0,0105	1,829	1,580	1,360	1,164	0,989	0,831	0,688	0,557	
100	0,0100	1,898	1,645	1,421	1,221	1,041	0,879	0,732	0,597	
105	0,0095	1,964	1,708	1,480	1,276	1,092	0,926	0,774	0,636	
110	0,0091	2,028	1,768	1,537	1,329	1,141	0,971	0,816	0,674	
115	0,0087	2,089	1,826	1,592	1,381	1,189	1,016	0,857	0,712	
120	0,0083	2,148	1,883	1,645	1,431	1,236	1,059	0,897	0,748	
125	0,0080	2,204	1,937	1,697	1,479	1,282	1,101	0,936	0,784	
130	0,0077		1,990	1,747	1,527	1,326	1,143	0,974	0,819	
135	0,0074		2,041	1,796	1,573	1,369	1,183	1,011	0,853	
140	0,0071		2,090	1,843	1,617	1,411	1,222	1,048	0,887	
145	0,0069		2,138	1,889	1,661	1,452	1,261	1,083	0,919	
150	0,0067		2,184	1,933	1,703	1,492	1,298	1,118	0,952	
155	0,0065		2,229	1,976	1,745	1,531	1,335	1,152	0,983	
160	0,0063			2,018	1,785	1,569	1,370	1,186	1,014	
165	0,0061			2,059	1,824	1,607	1,405	1,218	1,044	
170	0,0059			2,099	1,862	1,643	1,439	1,250	1,074	
175	0,0057			2,137	1,899	1,678	1,473	1,282	1,103	
180	0,0056			2,175	1,935	1,713	1,506	1,312	1,132	
185	0,0054			2,212	1,971	1,746	1,538	1,342	1,160	
190	0,0053				2,005	1,779	1,569	1,372	1,187	
195	0,0051				2,039	1,812	1,599	1,401	1,214	
200	0,0050				2,071	1,843	1,629	1,429	1,241	
205	0,0049				2,104	1,874	1,659	1,457	1,267	
210	0,0048				2,135	1,904	1,688	1,484	1,292	
215	0,0047				2,165	1,934	1,716	1,511	1,317	
220	0,0045				2,195	1,963	1,743	1,537	1,342	
225	0,0044				2,225	1,991	1,771	1,563	1,366	
230	0,0043					2,019	1,797	1,588	1,390	
235	0,0043					2,046	1,823	1,613	1,413	
240	0,0042					2,072	1,849	1,637	1,436	
245	0,0041					2,098	1,874	1,661	1,458	
250	0,0040					2,124	1,898	1,684	1,481	
255	0,0039					2,149	1,922	1,707	1,502	
260	0,0038					2,173	1,946	1,730	1,524	
265	0,0038					2,197	1,969	1,752	1,545	
270	0,0037					2,221	1,992	1,774	1,566	
275	0,0036						2,014	1,795	1,586	
280	0,0036						2,036	1,816	1,606	
285	0,0035						2,058	1,837	1,626	
290	0,0034						2,079	1,858	1,645	
295	0,0034						2,100	1,878	1,665	
300	0,0033						2,120	1,897	1,683	

Annex 1, Table 3, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 60 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
305	0,0033						2,141	1,917	1,702	
310	0,0032						2,160	1,936	1,720	
315	0,0032						2,180	1,955	1,738	
320	0,0031						2,199	1,973	1,756	
325	0,0031						2,218	1,991	1,773	
330	0,0030						2,236	2,009	1,791	
335	0,0030							2,027	1,807	
340	0,0029							2,044	1,824	

Annex 1, Table 4, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 75 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	1,723	1,479	1,269	1,087	0,926	0,784	0,657	0,543	
70	0,0143	1,880	1,626	1,405	1,212	1,042	0,890	0,754	0,632	
75	0,0133	1,986	1,725	1,498	1,298	1,121	0,963	0,822	0,694	
80	0,0125	2,088	1,821	1,587	1,381	1,198	1,034	0,887	0,754	
85	0,0118	2,186	1,913	1,673	1,461	1,273	1,104	0,951	0,813	
90	0,0111		2,001	1,756	1,539	1,345	1,171	1,013	0,870	
95	0,0105		2,086	1,836	1,614	1,416	1,236	1,074	0,927	
100	0,0100		2,168	1,914	1,687	1,484	1,300	1,134	0,982	
105	0,0095			1,989	1,758	1,550	1,362	1,191	1,035	
110	0,0091			2,061	1,827	1,615	1,423	1,248	1,088	
115	0,0087			2,132	1,893	1,678	1,482	1,303	1,139	
120	0,0083			2,200	1,958	1,739	1,539	1,357	1,189	
125	0,0080				2,021	1,798	1,596	1,410	1,239	
130	0,0077				2,082	1,856	1,650	1,461	1,287	
135	0,0074				2,141	1,913	1,704	1,511	1,334	
140	0,0071				2,199	1,968	1,756	1,560	1,380	
145	0,0069					2,021	1,807	1,609	1,425	
150	0,0067					2,074	1,856	1,656	1,469	
155	0,0065					2,124	1,905	1,702	1,513	
160	0,0063					2,174	1,952	1,747	1,555	
165	0,0061					2,223	1,999	1,791	1,597	
170	0,0059						2,044	1,834	1,638	
175	0,0057						2,088	1,876	1,678	
180	0,0056						2,132	1,918	1,717	
185	0,0054						2,174	1,958	1,756	
190	0,0053						2,216	1,998	1,794	
195	0,0051							2,037	1,831	
200	0,0050							2,075	1,867	
205	0,0049							2,112	1,903	
210	0,0048							2,149	1,938	
215	0,0047							2,185	1,973	
220	0,0045							2,221	2,007	
225	0,0044								2,040	
230	0,0043								2,073	
235	0,0043								2,105	
240	0,0042								2,136	
245	0,0041								2,167	
250	0,0040								2,198	
255	0,0039								2,228	
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									

Annex 1, Table 5, Beams, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 90 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	2,135	1,861	1,625	1,419	1,238	1,078	0,935	0,807	
70	0,0143		2,037	1,789	1,572	1,381	1,210	1,058	0,921	
75	0,0133		2,157	1,902	1,678	1,479	1,302	1,143	0,999	
80	0,0125			2,010	1,779	1,574	1,390	1,225	1,076	
85	0,0118			2,115	1,878	1,666	1,477	1,306	1,151	
90	0,0111			2,216	1,973	1,756	1,561	1,384	1,224	
95	0,0105				2,065	1,843	1,642	1,461	1,296	
100	0,0100				2,154	1,927	1,722	1,536	1,366	
105	0,0095					2,009	1,799	1,608	1,434	
110	0,0091					2,089	1,875	1,680	1,501	
115	0,0087					2,166	1,948	1,749	1,566	
120	0,0083						2,020	1,817	1,630	
125	0,0080						2,090	1,883	1,693	
130	0,0077						2,158	1,948	1,754	
135	0,0074						2,224	2,011	1,814	
140	0,0071							2,073	1,873	
145	0,0069							2,134	1,931	
150	0,0067							2,193	1,987	
155	0,0065								2,042	
160	0,0063								2,097	
165	0,0061								2,150	
170	0,0059								2,202	
175	0,0057									
180	0,0056									
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									

Annex 1, Table 6: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 30 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	0,487	0,405	0,405	0,405	0,405	0,405	0,405	0,405	
70	0,0143	0,551	0,405	0,405	0,405	0,405	0,405	0,405	0,405	
75	0,0133	0,594	0,429	0,405	0,405	0,405	0,405	0,405	0,405	
80	0,0125	0,636	0,466	0,405	0,405	0,405	0,405	0,405	0,405	
85	0,0118	0,675	0,501	0,405	0,405	0,405	0,405	0,405	0,405	
90	0,0111	0,713	0,535	0,405	0,405	0,405	0,405	0,405	0,405	
95	0,0105	0,750	0,568	0,407	0,405	0,405	0,405	0,405	0,405	
100	0,0100	0,785	0,599	0,434	0,405	0,405	0,405	0,405	0,405	
105	0,0095	0,819	0,629	0,461	0,405	0,405	0,405	0,405	0,405	
110	0,0091	0,851	0,659	0,487	0,405	0,405	0,405	0,405	0,405	
115	0,0087	0,882	0,687	0,512	0,405	0,405	0,405	0,405	0,405	
120	0,0083	0,912	0,714	0,536	0,405	0,405	0,405	0,405	0,405	
125	0,0080	0,941	0,740	0,560	0,405	0,405	0,405	0,405	0,405	
130	0,0077	0,969	0,766	0,583	0,417	0,405	0,405	0,405	0,405	
135	0,0074	0,995	0,790	0,605	0,436	0,405	0,405	0,405	0,405	
140	0,0071	1,021	0,814	0,626	0,455	0,405	0,405	0,405	0,405	
145	0,0069	1,046	0,837	0,647	0,474	0,405	0,405	0,405	0,405	
150	0,0067	1,070	0,859	0,667	0,491	0,405	0,405	0,405	0,405	
155	0,0065	1,094	0,881	0,687	0,509	0,405	0,405	0,405	0,405	
160	0,0063	1,116	0,902	0,706	0,526	0,405	0,405	0,405	0,405	
165	0,0061	1,138	0,922	0,725	0,542	0,405	0,405	0,405	0,405	
170	0,0059	1,159	0,942	0,743	0,559	0,405	0,405	0,405	0,405	
175	0,0057	1,180	0,961	0,760	0,574	0,405	0,405	0,405	0,405	
180	0,0056	1,200	0,980	0,777	0,590	0,415	0,405	0,405	0,405	
185	0,0054	1,219	0,998	0,794	0,605	0,428	0,405	0,405	0,405	
190	0,0053	1,238	1,016	0,810	0,619	0,441	0,405	0,405	0,405	
195	0,0051	1,256	1,033	0,826	0,633	0,454	0,405	0,405	0,405	
200	0,0050	1,274	1,050	0,841	0,647	0,466	0,405	0,405	0,405	
205	0,0049	1,291	1,066	0,856	0,661	0,478	0,405	0,405	0,405	
210	0,0048	1,308	1,082	0,871	0,674	0,490	0,405	0,405	0,405	
215	0,0047	1,324	1,097	0,885	0,687	0,501	0,405	0,405	0,405	
220	0,0045	1,340	1,112	0,899	0,700	0,512	0,405	0,405	0,405	
225	0,0044	1,355	1,127	0,913	0,712	0,523	0,405	0,405	0,405	
230	0,0043	1,370	1,141	0,926	0,724	0,534	0,405	0,405	0,405	
235	0,0043	1,385	1,155	0,939	0,736	0,544	0,405	0,405	0,405	
240	0,0042	1,399	1,169	0,952	0,748	0,555	0,405	0,405	0,405	
245	0,0041	1,413	1,182	0,964	0,759	0,565	0,405	0,405	0,405	
250	0,0040	1,426	1,195	0,976	0,770	0,575	0,405	0,405	0,405	
255	0,0039	1,439	1,207	0,988	0,781	0,584	0,405	0,405	0,405	
260	0,0038	1,452	1,220	1,000	0,792	0,594	0,406	0,405	0,405	
265	0,0038	1,465	1,232	1,011	0,802	0,603	0,414	0,405	0,405	
270	0,0037	1,477	1,244	1,022	0,812	0,612	0,422	0,405	0,405	
275	0,0036	1,489	1,255	1,033	0,822	0,621	0,430	0,405	0,405	
280	0,0036	1,501	1,266	1,044	0,832	0,630	0,437	0,405	0,405	
285	0,0035	1,512	1,277	1,054	0,842	0,639	0,445	0,405	0,405	
290	0,0034	1,523	1,288	1,064	0,851	0,647	0,452	0,405	0,405	
295	0,0034	1,534	1,299	1,074	0,860	0,655	0,459	0,405	0,405	
300	0,0033	1,545	1,309	1,084	0,869	0,664	0,466	0,405	0,405	

Annex 1, Table 6: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 30 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	M	Minimum thickness required – DFT in mm (without primer and topcoat)								
305	0,0033	1,555	1,319	1,094	0,878	0,672	0,473	0,405	0,405	
310	0,0032	1,565	1,329	1,103	0,887	0,679	0,480	0,405	0,405	
315	0,0032	1,575	1,339	1,112	0,895	0,687	0,487	0,405	0,405	
320	0,0031	1,585	1,348	1,122	0,904	0,695	0,494	0,405	0,405	
325	0,0031	1,594	1,358	1,130	0,912	0,702	0,500	0,405	0,405	
330	0,0030	1,604	1,367	1,139	0,920	0,709	0,507	0,405	0,405	
335	0,0030	1,613	1,376	1,148	0,928	0,717	0,513	0,405	0,405	
340	0,0029	1,622	1,384	1,156	0,936	0,724	0,519	0,405	0,405	

Annex 1, Table 7: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 45 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	0,899	0,716	0,559	0,422	0,405	0,405	0,405	0,405	
70	0,0143	0,994	0,803	0,637	0,491	0,405	0,405	0,405	0,405	
75	0,0133	1,058	0,861	0,690	0,539	0,405	0,405	0,405	0,405	
80	0,0125	1,120	0,918	0,741	0,585	0,446	0,405	0,405	0,405	
85	0,0118	1,179	0,972	0,790	0,629	0,486	0,405	0,405	0,405	
90	0,0111	1,235	1,024	0,837	0,672	0,524	0,405	0,405	0,405	
95	0,0105	1,289	1,074	0,883	0,714	0,562	0,425	0,405	0,405	
100	0,0100	1,341	1,122	0,928	0,754	0,598	0,457	0,405	0,405	
105	0,0095	1,391	1,168	0,970	0,793	0,633	0,489	0,405	0,405	
110	0,0091	1,439	1,213	1,012	0,831	0,668	0,520	0,405	0,405	
115	0,0087	1,485	1,257	1,052	0,868	0,701	0,550	0,411	0,405	
120	0,0083	1,530	1,298	1,091	0,903	0,734	0,579	0,437	0,405	
125	0,0080	1,573	1,339	1,128	0,938	0,765	0,607	0,463	0,405	
130	0,0077	1,614	1,378	1,165	0,972	0,796	0,635	0,487	0,405	
135	0,0074	1,654	1,416	1,200	1,004	0,826	0,662	0,512	0,405	
140	0,0071	1,692	1,452	1,234	1,036	0,855	0,689	0,535	0,405	
145	0,0069		1,487	1,268	1,067	0,883	0,714	0,558	0,414	
150	0,0067		1,522	1,300	1,097	0,911	0,740	0,581	0,434	
155	0,0065		1,555	1,332	1,127	0,938	0,764	0,603	0,454	
160	0,0063		1,587	1,362	1,155	0,965	0,788	0,625	0,473	
165	0,0061		1,619	1,392	1,183	0,990	0,812	0,646	0,492	
170	0,0059		1,649	1,421	1,210	1,015	0,835	0,667	0,510	
175	0,0057		1,678	1,449	1,237	1,040	0,857	0,687	0,528	
180	0,0056		1,707	1,476	1,262	1,064	0,879	0,707	0,546	
185	0,0054			1,503	1,288	1,087	0,901	0,727	0,563	
190	0,0053			1,529	1,312	1,110	0,922	0,746	0,581	
195	0,0051			1,554	1,336	1,133	0,943	0,765	0,597	
200	0,0050			1,579	1,359	1,155	0,963	0,783	0,614	
205	0,0049			1,603	1,382	1,176	0,983	0,801	0,630	
210	0,0048			1,626	1,404	1,197	1,002	0,819	0,646	
215	0,0047			1,649	1,426	1,217	1,021	0,836	0,662	
220	0,0045			1,671	1,448	1,237	1,040	0,853	0,677	
225	0,0044			1,693	1,468	1,257	1,058	0,870	0,692	
230	0,0043			1,714	1,489	1,276	1,076	0,886	0,707	
235	0,0043				1,509	1,295	1,093	0,902	0,721	
240	0,0042				1,528	1,313	1,110	0,918	0,736	
245	0,0041				1,547	1,331	1,127	0,934	0,750	
250	0,0040				1,566	1,349	1,144	0,949	0,763	
255	0,0039				1,584	1,366	1,160	0,964	0,777	
260	0,0038				1,602	1,383	1,176	0,978	0,790	
265	0,0038				1,619	1,400	1,192	0,993	0,804	
270	0,0037				1,637	1,417	1,207	1,007	0,816	
275	0,0036				1,653	1,433	1,222	1,021	0,829	
280	0,0036				1,670	1,448	1,237	1,035	0,842	
285	0,0035				1,686	1,464	1,251	1,048	0,854	
290	0,0034				1,702	1,479	1,266	1,062	0,866	
295	0,0034				1,717	1,494	1,280	1,075	0,878	
300	0,0033					1,508	1,293	1,087	0,890	

Annex 1, Table 7: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 45 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
305	0,0033					1,523	1,307	1,100	0,901	
310	0,0032					1,537	1,320	1,112	0,913	
315	0,0032					1,551	1,333	1,125	0,924	
320	0,0031					1,564	1,346	1,137	0,935	
325	0,0031					1,577	1,359	1,149	0,946	
330	0,0030					1,591	1,371	1,160	0,957	
335	0,0030					1,604	1,384	1,172	0,967	
340	0,0029					1,616	1,396	1,183	0,977	

Annex 1, Table 8: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 60 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	1,311	1,098	0,914	0,754	0,614	0,490	0,405	0,405	
70	0,0143	1,437	1,214	1,021	0,852	0,702	0,570	0,451	0,405	
75	0,0133	1,522	1,293	1,094	0,918	0,763	0,625	0,500	0,405	
80	0,0125	1,604	1,369	1,164	0,983	0,822	0,678	0,549	0,432	
85	0,0118	1,682	1,442	1,232	1,045	0,879	0,731	0,596	0,475	
90	0,0111		1,512	1,297	1,106	0,935	0,781	0,643	0,517	
95	0,0105		1,580	1,360	1,164	0,989	0,831	0,688	0,557	
100	0,0100		1,645	1,421	1,221	1,041	0,879	0,732	0,597	
105	0,0095		1,708	1,480	1,276	1,092	0,926	0,774	0,636	
110	0,0091			1,537	1,329	1,141	0,971	0,816	0,674	
115	0,0087			1,592	1,381	1,189	1,016	0,857	0,712	
120	0,0083			1,645	1,431	1,236	1,059	0,897	0,748	
125	0,0080			1,697	1,479	1,282	1,101	0,936	0,784	
130	0,0077				1,527	1,326	1,143	0,974	0,819	
135	0,0074				1,573	1,369	1,183	1,011	0,853	
140	0,0071				1,617	1,411	1,222	1,048	0,887	
145	0,0069				1,661	1,452	1,261	1,083	0,919	
150	0,0067				1,703	1,492	1,298	1,118	0,952	
155	0,0065					1,531	1,335	1,152	0,983	
160	0,0063					1,569	1,370	1,186	1,014	
165	0,0061					1,607	1,405	1,218	1,044	
170	0,0059					1,643	1,439	1,250	1,074	
175	0,0057					1,678	1,473	1,282	1,103	
180	0,0056					1,713	1,506	1,312	1,132	
185	0,0054						1,538	1,342	1,160	
190	0,0053						1,569	1,372	1,187	
195	0,0051						1,599	1,401	1,214	
200	0,0050						1,629	1,429	1,241	
205	0,0049						1,659	1,457	1,267	
210	0,0048						1,688	1,484	1,292	
215	0,0047						1,716	1,511	1,317	
220	0,0045							1,537	1,342	
225	0,0044							1,563	1,366	
230	0,0043							1,588	1,390	
235	0,0043							1,613	1,413	
240	0,0042							1,637	1,436	
245	0,0041							1,661	1,458	
250	0,0040							1,684	1,481	
255	0,0039							1,707	1,502	
260	0,0038								1,524	
265	0,0038								1,545	
270	0,0037								1,566	
275	0,0036								1,586	
280	0,0036								1,606	
285	0,0035								1,626	
290	0,0034								1,645	
295	0,0034								1,665	
300	0,0033								1,683	

Annex 1, Table 8: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 60 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
305	0,0033								1,702	
310	0,0032								1,720	
315	0,0032									
320	0,0031									
325	0,0031									
330	0,0030									
335	0,0030									
340	0,0029									

Annex 1, Table 9: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 75 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159	1,723	1,479	1,269	1,087	0,926	0,784	0,657	0,543	
70	0,0143		1,626	1,405	1,212	1,042	0,890	0,754	0,632	
75	0,0133			1,498	1,298	1,121	0,963	0,822	0,694	
80	0,0125			1,587	1,381	1,198	1,034	0,887	0,754	
85	0,0118			1,673	1,461	1,273	1,104	0,951	0,813	
90	0,0111				1,539	1,345	1,171	1,013	0,870	
95	0,0105				1,614	1,416	1,236	1,074	0,927	
100	0,0100				1,687	1,484	1,300	1,134	0,982	
105	0,0095					1,550	1,362	1,191	1,035	
110	0,0091					1,615	1,423	1,248	1,088	
115	0,0087					1,678	1,482	1,303	1,139	
120	0,0083						1,539	1,357	1,189	
125	0,0080						1,596	1,410	1,239	
130	0,0077						1,650	1,461	1,287	
135	0,0074						1,704	1,511	1,334	
140	0,0071							1,560	1,380	
145	0,0069							1,609	1,425	
150	0,0067							1,656	1,469	
155	0,0065							1,702	1,513	
160	0,0063								1,555	
165	0,0061								1,597	
170	0,0059								1,638	
175	0,0057								1,678	
180	0,0056								1,717	
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									

Annex 1, Table 10: columns, open sections (H and I Profile)

NOVATHERM 4FRe		**Fire Resistance 90 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
63	0,0159			1,625	1,419	1,238	1,078	0,935	0,807	
70	0,0143				1,572	1,381	1,210	1,058	0,921	
75	0,0133				1,678	1,479	1,302	1,143	0,999	
80	0,0125					1,574	1,390	1,225	1,076	
85	0,0118					1,666	1,477	1,306	1,151	
90	0,0111						1,561	1,384	1,224	
95	0,0105						1,642	1,461	1,296	
100	0,0100						1,722	1,536	1,366	
105	0,0095							1,608	1,434	
110	0,0091							1,680	1,501	
115	0,0087								1,566	
120	0,0083								1,630	
125	0,0080								1,693	
130	0,0077									
135	0,0074									
140	0,0071									
145	0,0069									
150	0,0067									
155	0,0065									
160	0,0063									
165	0,0061									
170	0,0059									
175	0,0057									
180	0,0056									
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									

Annex 1, Table 11: columns, rectangular hollow sections

NOVATHERM 4FRe		**Fire Resistance 15 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
49	0,0204	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
50	0,0200	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
55	0,0182	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
60	0,0167	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
65	0,0154	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
70	0,0143	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
75	0,0133	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
80	0,0125	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
85	0,0118	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
90	0,0111	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
95	0,0105	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
100	0,0100	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
105	0,0095	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
110	0,0091	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
115	0,0087	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
120	0,0083	0,395	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
125	0,0080	0,422	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
130	0,0077	0,449	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
135	0,0074	0,477	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
140	0,0071	0,504	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
145	0,0069	0,532	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
150	0,0067	0,559	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
155	0,0065	0,587	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
160	0,0063	0,615	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
165	0,0061	0,643	0,379	0,371	0,371	0,371	0,371	0,371	0,371	0,371
170	0,0059	0,671	0,399	0,371	0,371	0,371	0,371	0,371	0,371	0,371
175	0,0057	0,699	0,420	0,371	0,371	0,371	0,371	0,371	0,371	0,371
180	0,0056	0,727	0,441	0,371	0,371	0,371	0,371	0,371	0,371	0,371
185	0,0054	0,755	0,462	0,371	0,371	0,371	0,371	0,371	0,371	0,371
190	0,0053	0,784	0,483	0,371	0,371	0,371	0,371	0,371	0,371	0,371
195	0,0051	0,812	0,505	0,371	0,371	0,371	0,371	0,371	0,371	0,371
200	0,0050	0,841	0,526	0,371	0,371	0,371	0,371	0,371	0,371	0,371
205	0,0049	0,870	0,548	0,371	0,371	0,371	0,371	0,371	0,371	0,371
210	0,0048	0,898	0,570	0,371	0,371	0,371	0,371	0,371	0,371	0,371
215	0,0047	0,927	0,592	0,371	0,371	0,371	0,371	0,371	0,371	0,371
220	0,0045	0,956	0,614	0,371	0,371	0,371	0,371	0,371	0,371	0,371
225	0,0044	0,985	0,637	0,371	0,371	0,371	0,371	0,371	0,371	0,371
230	0,0043	1,015	0,659	0,371	0,371	0,371	0,371	0,371	0,371	0,371
235	0,0043	1,044	0,682	0,386	0,371	0,371	0,371	0,371	0,371	0,371
240	0,0042	1,073	0,705	0,402	0,371	0,371	0,371	0,371	0,371	0,371
245	0,0041	1,103	0,728	0,419	0,371	0,371	0,371	0,371	0,371	0,371
250	0,0040	1,132	0,751	0,435	0,371	0,371	0,371	0,371	0,371	0,371
255	0,0039	1,162	0,774	0,452	0,371	0,371	0,371	0,371	0,371	0,371
260	0,0038	1,192	0,798	0,470	0,371	0,371	0,371	0,371	0,371	0,371
265	0,0038	1,222	0,822	0,487	0,371	0,371	0,371	0,371	0,371	0,371
270	0,0037	1,252	0,846	0,505	0,371	0,371	0,371	0,371	0,371	0,371
273	0,0037	1,270	0,860	0,515	0,371	0,371	0,371	0,371	0,371	0,371

Annex 1, Table 12: columns, rectangular hollow sections

NOVATHERM 4FRe		Fire Resistance 30 minutes								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
49	0,0204	0,406	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
50	0,0200	0,419	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
55	0,0182	0,485	0,371	0,371	0,371	0,371	0,371	0,371	0,371	0,371
60	0,0167	0,551	0,399	0,371	0,371	0,371	0,371	0,371	0,371	0,371
65	0,0154	0,618	0,453	0,371	0,371	0,371	0,371	0,371	0,371	0,371
70	0,0143	0,685	0,508	0,379	0,371	0,371	0,371	0,371	0,371	0,371
75	0,0133	0,752	0,564	0,425	0,371	0,371	0,371	0,371	0,371	0,371
80	0,0125	0,819	0,619	0,472	0,371	0,371	0,371	0,371	0,371	0,371
85	0,0118	0,887	0,675	0,519	0,384	0,371	0,371	0,371	0,371	0,371
90	0,0111	0,955	0,731	0,566	0,424	0,371	0,371	0,371	0,371	0,371
95	0,0105	1,023	0,788	0,614	0,464	0,371	0,371	0,371	0,371	0,371
100	0,0100	1,091	0,845	0,663	0,504	0,371	0,371	0,371	0,371	0,371
105	0,0095	1,159	0,903	0,711	0,545	0,378	0,371	0,371	0,371	0,371
110	0,0091	1,228	0,961	0,761	0,586	0,411	0,371	0,371	0,371	0,371
115	0,0087	1,297	1,019	0,811	0,628	0,444	0,371	0,371	0,371	0,371
120	0,0083	1,366	1,078	0,861	0,670	0,478	0,371	0,371	0,371	0,371
125	0,0080	1,435	1,137	0,912	0,713	0,512	0,371	0,371	0,371	0,371
130	0,0077	1,505	1,197	0,963	0,756	0,547	0,373	0,371	0,371	0,371
135	0,0074	1,574	1,257	1,015	0,800	0,582	0,400	0,371	0,371	0,371
140	0,0071	1,645	1,317	1,067	0,844	0,617	0,428	0,371	0,371	0,371
145	0,0069	1,715	1,378	1,120	0,889	0,653	0,457	0,371	0,371	0,371
150	0,0067		1,439	1,173	0,935	0,690	0,486	0,371	0,371	0,371
155	0,0065		1,501	1,227	0,981	0,727	0,515	0,371	0,371	0,371
160	0,0063		1,563	1,282	1,028	0,765	0,545	0,371	0,371	0,371
165	0,0061		1,626	1,337	1,075	0,803	0,575	0,371	0,371	0,371
170	0,0059		1,689	1,392	1,123	0,842	0,606	0,388	0,371	0,371
175	0,0057		1,752	1,448	1,171	0,881	0,637	0,411	0,371	0,371
180	0,0056			1,505	1,220	0,921	0,669	0,435	0,371	0,371
185	0,0054			1,563	1,270	0,962	0,702	0,460	0,371	0,371
190	0,0053			1,620	1,320	1,003	0,735	0,484	0,371	0,371
195	0,0051			1,679	1,371	1,045	0,768	0,510	0,371	0,371
200	0,0050			1,738	1,423	1,087	0,802	0,535	0,371	0,371
205	0,0049				1,475	1,131	0,837	0,562	0,371	0,371
210	0,0048				1,529	1,174	0,872	0,588	0,371	0,371
215	0,0047				1,582	1,219	0,908	0,616	0,371	0,371
220	0,0045				1,637	1,264	0,945	0,643	0,375	0,371
225	0,0044				1,692	1,310	0,982	0,672	0,395	0,371
230	0,0043				1,748	1,357	1,020	0,701	0,415	0,371
235	0,0043					1,405	1,059	0,730	0,436	0,371
240	0,0042					1,453	1,098	0,760	0,458	0,371
245	0,0041					1,502	1,138	0,791	0,479	0,371
250	0,0040					1,552	1,179	0,823	0,502	0,371
255	0,0039					1,603	1,221	0,855	0,524	0,371
260	0,0038					1,654	1,263	0,887	0,548	0,371
265	0,0038					1,707	1,307	0,921	0,572	0,371
270	0,0037					1,760	1,351	0,955	0,596	0,371
273	0,0037						1,378	0,976	0,611	0,371

Annex 1, Table 13: columns, rectangular hollow sections

NOVATHERM 4FRe		**Fire Resistance 45 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
49	0,0204	0,793	0,622	0,499	0,394	0,371	0,371	0,371	0,371	0,371
50	0,0200	0,814	0,640	0,514	0,407	0,371	0,371	0,371	0,371	0,371
55	0,0182	0,921	0,730	0,592	0,474	0,371	0,371	0,371	0,371	0,371
60	0,0167	1,028	0,820	0,670	0,541	0,413	0,371	0,371	0,371	0,371
65	0,0154	1,135	0,912	0,749	0,610	0,470	0,371	0,371	0,371	0,371
70	0,0143	1,242	1,003	0,829	0,679	0,528	0,406	0,371	0,371	0,371
75	0,0133	1,350	1,096	0,909	0,748	0,587	0,455	0,371	0,371	0,371
80	0,0125	1,458	1,189	0,991	0,819	0,646	0,505	0,377	0,371	0,371
85	0,0118	1,567	1,282	1,073	0,890	0,706	0,556	0,419	0,371	0,371
90	0,0111	1,676	1,377	1,156	0,963	0,767	0,607	0,462	0,371	0,371
95	0,0105		1,472	1,239	1,036	0,829	0,660	0,506	0,373	0,371
100	0,0100		1,567	1,324	1,110	0,892	0,713	0,550	0,409	0,371
105	0,0095		1,663	1,409	1,185	0,955	0,767	0,595	0,446	0,371
110	0,0091		1,760	1,495	1,260	1,019	0,821	0,640	0,484	0,371
115	0,0087			1,582	1,337	1,085	0,877	0,687	0,522	0,373
120	0,0083			1,670	1,414	1,151	0,933	0,734	0,561	0,405
125	0,0080			1,758	1,493	1,218	0,990	0,782	0,600	0,436
130	0,0077				1,572	1,286	1,049	0,830	0,641	0,469
135	0,0074				1,653	1,355	1,108	0,880	0,682	0,502
140	0,0071				1,734	1,425	1,168	0,930	0,723	0,536
145	0,0069					1,496	1,228	0,981	0,766	0,570
150	0,0067					1,568	1,290	1,033	0,809	0,605
155	0,0065					1,641	1,353	1,086	0,853	0,641
160	0,0063					1,715	1,417	1,140	0,898	0,677
165	0,0061						1,482	1,195	0,944	0,714
170	0,0059						1,548	1,251	0,991	0,752
175	0,0057						1,615	1,308	1,038	0,791
180	0,0056						1,684	1,366	1,087	0,831
185	0,0054						1,753	1,425	1,136	0,871
190	0,0053							1,485	1,187	0,912
195	0,0051							1,547	1,238	0,954
200	0,0050							1,609	1,291	0,997
205	0,0049							1,673	1,344	1,041
210	0,0048							1,738	1,399	1,086
215	0,0047								1,455	1,132
220	0,0045								1,512	1,179
225	0,0044								1,571	1,227
230	0,0043								1,630	1,276
235	0,0043								1,691	1,327
240	0,0042								1,753	1,378
245	0,0041									1,431
250	0,0040									1,485
255	0,0039									1,540
260	0,0038									1,597
265	0,0038									1,655
270	0,0037									1,715
273	0,0037									1,752

Annex 1, Table 14: columns, rectangular hollow sections

NOVATHERM 4FRe		**Fire Resistance 60 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
49	0,0204	1,180	0,964	0,808	0,674	0,540	0,432	0,371	0,371	0,371
50	0,0200	1,210	0,989	0,830	0,693	0,556	0,446	0,371	0,371	0,371
55	0,0182	1,356	1,115	0,940	0,790	0,640	0,518	0,408	0,371	0,371
60	0,0167	1,504	1,242	1,052	0,888	0,724	0,590	0,470	0,371	0,371
65	0,0154	1,651	1,370	1,165	0,988	0,809	0,664	0,532	0,420	0,371
70	0,0143		1,498	1,279	1,088	0,895	0,738	0,596	0,474	0,371
75	0,0133		1,628	1,394	1,190	0,983	0,814	0,661	0,530	0,412
80	0,0125		1,758	1,510	1,292	1,071	0,891	0,727	0,586	0,460
85	0,0118			1,627	1,396	1,161	0,969	0,794	0,643	0,508
90	0,0111			1,745	1,502	1,252	1,048	0,862	0,701	0,557
95	0,0105				1,608	1,344	1,128	0,931	0,761	0,607
100	0,0100				1,715	1,437	1,209	1,001	0,821	0,659
105	0,0095					1,532	1,292	1,072	0,882	0,711
110	0,0091					1,628	1,376	1,144	0,944	0,763
115	0,0087					1,725	1,461	1,218	1,008	0,817
120	0,0083						1,547	1,293	1,072	0,872
125	0,0080						1,635	1,369	1,138	0,928
130	0,0077						1,724	1,446	1,204	0,985
135	0,0074							1,525	1,272	1,043
140	0,0071							1,605	1,342	1,102
145	0,0069							1,686	1,412	1,163
150	0,0067								1,484	1,224
155	0,0065								1,557	1,287
160	0,0063								1,631	1,351
165	0,0061								1,707	1,416
170	0,0059									1,482
175	0,0057									1,550
180	0,0056									1,620
185	0,0054									1,690
190	0,0053									1,763
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
273	0,0037									

Annex 1, Table 15: columns, rectangular hollow sections

NOVATHERM 4FRe		**Fire Resistance 75 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
49	0,0204	1,568	1,305	1,116	0,954	0,790	0,658	0,539	0,437	0,371
50	0,0200	1,605	1,338	1,145	0,979	0,812	0,677	0,555	0,451	0,371
55	0,0182		1,500	1,289	1,107	0,923	0,774	0,639	0,524	0,421
60	0,0167		1,663	1,434	1,236	1,034	0,871	0,724	0,598	0,484
65	0,0154			1,581	1,366	1,148	0,971	0,810	0,672	0,549
70	0,0143			1,729	1,498	1,262	1,071	0,898	0,749	0,615
75	0,0133				1,631	1,379	1,173	0,986	0,826	0,682
80	0,0125				1,766	1,496	1,277	1,077	0,905	0,750
85	0,0118					1,616	1,382	1,168	0,984	0,819
90	0,0111					1,737	1,488	1,261	1,066	0,890
95	0,0105						1,596	1,356	1,148	0,961
100	0,0100						1,706	1,452	1,232	1,034
105	0,0095							1,550	1,318	1,109
110	0,0091							1,649	1,405	1,184
115	0,0087							1,750	1,493	1,261
120	0,0083								1,583	1,340
125	0,0080								1,675	1,420
130	0,0077									1,501
135	0,0074									1,584
140	0,0071									1,669
145	0,0069									1,755
150	0,0067									
155	0,0065									
160	0,0063									
165	0,0061									
170	0,0059									
175	0,0057									
180	0,0056									
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
273	0,0037									

Annex 1, Table 16: columns, rectangular hollow sections

NOVATHERM 4FRe		**Fire Resistance 90 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
49	0,0204		1,647	1,425	1,234	1,041	0,884	0,743	0,622	0,515
50	0,0200		1,687	1,460	1,265	1,068	0,908	0,764	0,641	0,531
55	0,0182			1,637	1,423	1,206	1,030	0,870	0,734	0,612
60	0,0167				1,583	1,345	1,153	0,978	0,829	0,695
65	0,0154				1,744	1,487	1,278	1,088	0,925	0,779
70	0,0143					1,630	1,404	1,199	1,023	0,865
75	0,0133						1,532	1,312	1,122	0,952
80	0,0125						1,663	1,426	1,223	1,040
85	0,0118							1,543	1,326	1,130
90	0,0111							1,661	1,430	1,222
95	0,0105								1,536	1,315
100	0,0100								1,644	1,410
105	0,0095								1,754	1,507
110	0,0091									1,605
115	0,0087									1,706
120	0,0083									
125	0,0080									
130	0,0077									
135	0,0074									
140	0,0071									
145	0,0069									
150	0,0067									
155	0,0065									
160	0,0063									
165	0,0061									
170	0,0059									
175	0,0057									
180	0,0056									
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
273	0,0037									

Annex 1, Table 17: columns, circular hollow sections

NOVATHERM 4FRe		Fire Resistance 15 minutes								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
50	0,0200	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
55	0,0182	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
60	0,0167	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
65	0,0154	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
70	0,0143	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
75	0,0133	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
80	0,0125	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
85	0,0118	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
90	0,0111	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
95	0,0105	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
100	0,0100	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
105	0,0095	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
110	0,0091	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
115	0,0087	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
120	0,0083	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
125	0,0080	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
130	0,0077	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
135	0,0074	0,463	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
140	0,0071	0,493	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
145	0,0069	0,523	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
150	0,0067	0,552	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
155	0,0065	0,579	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
160	0,0063	0,606	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
165	0,0061	0,633	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
170	0,0059	0,658	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
175	0,0057	0,683	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
180	0,0056	0,707	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
185	0,0054	0,730	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
190	0,0053	0,753	0,445	0,431	0,431	0,431	0,431	0,431	0,431	0,431
195	0,0051	0,775	0,464	0,431	0,431	0,431	0,431	0,431	0,431	0,431
200	0,0050	0,796	0,483	0,431	0,431	0,431	0,431	0,431	0,431	0,431
205	0,0049	0,817	0,501	0,431	0,431	0,431	0,431	0,431	0,431	0,431
210	0,0048	0,837	0,519	0,431	0,431	0,431	0,431	0,431	0,431	0,431
215	0,0047	0,857	0,537	0,431	0,431	0,431	0,431	0,431	0,431	0,431
220	0,0045	0,876	0,554	0,431	0,431	0,431	0,431	0,431	0,431	0,431
225	0,0044	0,895	0,571	0,431	0,431	0,431	0,431	0,431	0,431	0,431
230	0,0043	0,914	0,587	0,431	0,431	0,431	0,431	0,431	0,431	0,431
235	0,0043	0,932	0,603	0,431	0,431	0,431	0,431	0,431	0,431	0,431
240	0,0042	0,949	0,619	0,431	0,431	0,431	0,431	0,431	0,431	0,431
245	0,0041	0,966	0,634	0,431	0,431	0,431	0,431	0,431	0,431	0,431
250	0,0040	0,983	0,649	0,431	0,431	0,431	0,431	0,431	0,431	0,431
255	0,0039	0,999	0,664	0,431	0,431	0,431	0,431	0,431	0,431	0,431
260	0,0038	1,015	0,679	0,431	0,431	0,431	0,431	0,431	0,431	0,431
265	0,0038	1,030	0,693	0,431	0,431	0,431	0,431	0,431	0,431	0,431
270	0,0037	1,046	0,707	0,440	0,431	0,431	0,431	0,431	0,431	0,431
275	0,0036	1,060	0,721	0,452	0,431	0,431	0,431	0,431	0,431	0,431
280	0,0036	1,075	0,734	0,464	0,431	0,431	0,431	0,431	0,431	0,431
285	0,0035	1,089	0,747	0,475	0,431	0,431	0,431	0,431	0,431	0,431
290	0,0034	1,103	0,760	0,487	0,431	0,431	0,431	0,431	0,431	0,431
295	0,0034	1,116	0,773	0,498	0,431	0,431	0,431	0,431	0,431	0,431
300	0,0033	1,130	0,785	0,509	0,431	0,431	0,431	0,431	0,431	0,431
305	0,0033	1,143	0,798	0,520	0,431	0,431	0,431	0,431	0,431	0,431
310	0,0032	1,156	0,810	0,531	0,431	0,431	0,431	0,431	0,431	0,431
315	0,0032	1,168	0,821	0,542	0,431	0,431	0,431	0,431	0,431	0,431
320	0,0031	1,180	0,833	0,552	0,431	0,431	0,431	0,431	0,431	0,431

Annex 1, Table 18: columns, circular hollow sections

NOVATHERM 4FRe		Fire Resistance 30 minutes								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
50	0,0200	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
55	0,0182	0,527	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
60	0,0167	0,633	0,431	0,431	0,431	0,431	0,431	0,431	0,431	0,431
65	0,0154	0,733	0,476	0,431	0,431	0,431	0,431	0,431	0,431	0,431
70	0,0143	0,830	0,556	0,431	0,431	0,431	0,431	0,431	0,431	0,431
75	0,0133	0,923	0,634	0,448	0,431	0,431	0,431	0,431	0,431	0,431
80	0,0125	1,012	0,709	0,512	0,431	0,431	0,431	0,431	0,431	0,431
85	0,0118	1,097	0,782	0,576	0,431	0,431	0,431	0,431	0,431	0,431
90	0,0111	1,180	0,853	0,637	0,431	0,431	0,431	0,431	0,431	0,431
95	0,0105	1,259	0,921	0,698	0,479	0,431	0,431	0,431	0,431	0,431
100	0,0100	1,335	0,988	0,756	0,529	0,431	0,431	0,431	0,431	0,431
105	0,0095	1,409	1,053	0,814	0,578	0,431	0,431	0,431	0,431	0,431
110	0,0091	1,480	1,116	0,870	0,626	0,431	0,431	0,431	0,431	0,431
115	0,0087	1,548	1,177	0,925	0,673	0,451	0,431	0,431	0,431	0,431
120	0,0083	1,615	1,237	0,979	0,720	0,490	0,431	0,431	0,431	0,431
125	0,0080	1,678	1,295	1,031	0,765	0,528	0,431	0,431	0,431	0,431
130	0,0077	1,740	1,351	1,083	0,810	0,566	0,431	0,431	0,431	0,431
135	0,0074	1,800	1,406	1,133	0,854	0,603	0,431	0,431	0,431	0,431
140	0,0071		1,459	1,182	0,897	0,640	0,431	0,431	0,431	0,431
145	0,0069		1,511	1,230	0,939	0,676	0,453	0,431	0,431	0,431
150	0,0067		1,562	1,278	0,981	0,712	0,483	0,431	0,431	0,431
155	0,0065		1,612	1,324	1,022	0,747	0,513	0,431	0,431	0,431
160	0,0063		1,660	1,369	1,062	0,781	0,542	0,431	0,431	0,431
165	0,0061		1,707	1,413	1,102	0,816	0,571	0,431	0,431	0,431
170	0,0059		1,753	1,457	1,141	0,849	0,599	0,431	0,431	0,431
175	0,0057		1,798	1,499	1,179	0,883	0,628	0,431	0,431	0,431
180	0,0056			1,541	1,216	0,915	0,656	0,431	0,431	0,431
185	0,0054			1,582	1,253	0,948	0,683	0,454	0,431	0,431
190	0,0053			1,622	1,290	0,980	0,711	0,477	0,431	0,431
195	0,0051			1,661	1,326	1,011	0,738	0,500	0,431	0,431
200	0,0050			1,700	1,361	1,042	0,764	0,522	0,431	0,431
205	0,0049			1,738	1,396	1,073	0,791	0,544	0,431	0,431
210	0,0048			1,775	1,430	1,103	0,817	0,567	0,431	0,431
215	0,0047			1,812	1,464	1,133	0,843	0,588	0,431	0,431
220	0,0045				1,497	1,162	0,868	0,610	0,431	0,431
225	0,0044				1,529	1,192	0,894	0,631	0,431	0,431
230	0,0043				1,562	1,220	0,919	0,653	0,431	0,431
235	0,0043				1,593	1,249	0,944	0,674	0,431	0,431
240	0,0042				1,624	1,277	0,968	0,695	0,435	0,431
245	0,0041				1,655	1,304	0,992	0,715	0,452	0,431
250	0,0040				1,685	1,332	1,016	0,736	0,469	0,431
255	0,0039				1,715	1,359	1,040	0,756	0,486	0,431
260	0,0038				1,745	1,385	1,064	0,777	0,502	0,431
265	0,0038				1,774	1,412	1,087	0,797	0,519	0,431
270	0,0037				1,802	1,438	1,110	0,816	0,535	0,431
275	0,0036					1,463	1,133	0,836	0,551	0,431
280	0,0036					1,489	1,155	0,856	0,567	0,431
285	0,0035					1,514	1,178	0,875	0,583	0,431
290	0,0034					1,538	1,200	0,894	0,599	0,431
295	0,0034					1,563	1,222	0,913	0,615	0,431
300	0,0033					1,587	1,243	0,932	0,630	0,431
305	0,0033					1,611	1,265	0,951	0,646	0,431
310	0,0032					1,635	1,286	0,969	0,661	0,431
315	0,0032					1,658	1,307	0,988	0,676	0,431
320	0,0031					1,681	1,328	1,006	0,692	0,431

Annex 1, Table 19: columns, circular hollow sections

NOVATHERM 4FRe		**Fire Resistance 45 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
50	0,0200	1,102	0,794	0,605	0,431	0,431	0,431	0,431	0,431	0,431
55	0,0182	1,264	0,930	0,722	0,526	0,431	0,431	0,431	0,431	0,431
60	0,0167	1,419	1,061	0,836	0,623	0,443	0,431	0,431	0,431	0,431
65	0,0154	1,567	1,187	0,948	0,719	0,524	0,431	0,431	0,431	0,431
70	0,0143	1,710	1,310	1,056	0,812	0,603	0,434	0,431	0,431	0,431
75	0,0133		1,429	1,162	0,903	0,681	0,501	0,431	0,431	0,431
80	0,0125		1,544	1,265	0,993	0,758	0,567	0,431	0,431	0,431
85	0,0118		1,656	1,365	1,080	0,834	0,632	0,466	0,431	0,431
90	0,0111		1,764	1,463	1,167	0,908	0,697	0,522	0,431	0,431
95	0,0105			1,559	1,251	0,982	0,760	0,577	0,431	0,431
100	0,0100			1,653	1,334	1,054	0,823	0,631	0,458	0,431
105	0,0095			1,744	1,415	1,125	0,885	0,685	0,504	0,431
110	0,0091				1,495	1,195	0,946	0,738	0,550	0,431
115	0,0087				1,574	1,264	1,007	0,791	0,595	0,431
120	0,0083				1,651	1,332	1,066	0,843	0,640	0,431
125	0,0080				1,726	1,399	1,126	0,895	0,685	0,451
130	0,0077				1,800	1,465	1,184	0,946	0,729	0,487
135	0,0074					1,530	1,241	0,997	0,773	0,523
140	0,0071					1,594	1,298	1,047	0,817	0,558
145	0,0069					1,658	1,355	1,097	0,860	0,594
150	0,0067					1,720	1,410	1,146	0,903	0,629
155	0,0065					1,781	1,465	1,195	0,945	0,664
160	0,0063						1,519	1,243	0,988	0,699
165	0,0061						1,573	1,291	1,030	0,733
170	0,0059						1,626	1,339	1,071	0,767
175	0,0057						1,679	1,386	1,113	0,801
180	0,0056						1,731	1,432	1,154	0,835
185	0,0054						1,782	1,478	1,194	0,869
190	0,0053							1,524	1,235	0,903
195	0,0051							1,569	1,275	0,936
200	0,0050							1,614	1,314	0,969
205	0,0049							1,659	1,354	1,002
210	0,0048							1,703	1,393	1,035
215	0,0047							1,746	1,432	1,067
220	0,0045							1,790	1,471	1,099
225	0,0044								1,509	1,131
230	0,0043								1,547	1,163
235	0,0043								1,585	1,195
240	0,0042								1,623	1,227
245	0,0041								1,660	1,258
250	0,0040								1,697	1,289
255	0,0039								1,734	1,320
260	0,0038								1,770	1,351
265	0,0038								1,806	1,382
270	0,0037									1,413
275	0,0036									1,443
280	0,0036									1,473
285	0,0035									1,503
290	0,0034									1,533
295	0,0034									1,563
300	0,0033									1,592
305	0,0033									1,622
310	0,0032									1,651
315	0,0032									1,680
320	0,0031									1,709

Annex 1, Table 20: columns, circular hollow sections

NOVATHERM 4FRe		**Fire Resistance 60 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
50	0,0200	1,787	1,369	1,113	0,872	0,669	0,508	0,431	0,431	0,431
55	0,0182		1,552	1,273	1,010	0,788	0,611	0,467	0,431	0,431
60	0,0167		1,728	1,430	1,146	0,905	0,713	0,556	0,431	0,431
65	0,0154			1,582	1,279	1,021	0,813	0,643	0,493	0,431
70	0,0143			1,731	1,409	1,134	0,912	0,730	0,568	0,431
75	0,0133				1,537	1,246	1,010	0,816	0,643	0,454
80	0,0125				1,662	1,355	1,106	0,901	0,717	0,516
85	0,0118				1,785	1,463	1,201	0,985	0,791	0,577
90	0,0111					1,570	1,295	1,068	0,864	0,639
95	0,0105					1,675	1,388	1,150	0,936	0,700
100	0,0100					1,778	1,480	1,232	1,008	0,760
105	0,0095						1,570	1,313	1,079	0,820
110	0,0091						1,660	1,392	1,150	0,880
115	0,0087						1,748	1,472	1,220	0,939
120	0,0083							1,550	1,290	0,998
125	0,0080							1,627	1,359	1,057
130	0,0077							1,704	1,427	1,115
135	0,0074							1,780	1,495	1,173
140	0,0071								1,563	1,231
145	0,0069								1,630	1,288
150	0,0067								1,696	1,345
155	0,0065								1,762	1,402
160	0,0063									1,458
165	0,0061									1,514
170	0,0059									1,569
175	0,0057									1,624
180	0,0056									1,679
185	0,0054									1,734
190	0,0053									1,788
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									
305	0,0033									
310	0,0032									
315	0,0032									
320	0,0031									

Annex 1, Table 21: columns, circular hollow sections

NOVATHERM 4FRe		Fire Resistance 75 minutes								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
50	0,0200			1,620	1,316	1,061	0,858	0,694	0,549	0,431
55	0,0182				1,494	1,216	0,994	0,813	0,654	0,480
60	0,0167				1,668	1,368	1,127	0,931	0,758	0,568
65	0,0154					1,518	1,259	1,048	0,861	0,656
70	0,0143					1,665	1,389	1,164	0,963	0,742
75	0,0133					1,810	1,518	1,278	1,064	0,829
80	0,0125						1,645	1,391	1,164	0,915
85	0,0118						1,770	1,503	1,264	1,000
90	0,0111							1,614	1,363	1,085
95	0,0105							1,724	1,461	1,169
100	0,0100								1,558	1,252
105	0,0095								1,655	1,336
110	0,0091								1,750	1,418
115	0,0087									1,500
120	0,0083									1,582
125	0,0080									1,663
130	0,0077									1,744
135	0,0074									
140	0,0071									
145	0,0069									
150	0,0067									
155	0,0065									
160	0,0063									
165	0,0061									
170	0,0059									
175	0,0057									
180	0,0056									
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									
305	0,0033									
310	0,0032									
315	0,0032									
320	0,0031									

Annex 1, Table 22: columns, circular hollow sections

NOVATHERM 4FRe		**Fire Resistance 90 minutes**								
		Design Temperature θ_D in °C								
A/V	V/A	350	400	450	500	550	600	650	700	750
m^{-1}	m	Minimum thickness required – DFT in mm (without primer and topcoat)								
50	0,0200				1,761	1,453	1,208	1,010	0,836	0,646
55	0,0182					1,643	1,376	1,159	0,968	0,759
60	0,0167						1,542	1,307	1,099	0,871
65	0,0154						1,705	1,453	1,229	0,983
70	0,0143							1,597	1,357	1,094
75	0,0133							1,740	1,485	1,204
80	0,0125								1,612	1,313
85	0,0118								1,737	1,422
90	0,0111									1,530
95	0,0105									1,638
100	0,0100									1,745
105	0,0095									
110	0,0091									
115	0,0087									
120	0,0083									
125	0,0080									
130	0,0077									
135	0,0074									
140	0,0071									
145	0,0069									
150	0,0067									
155	0,0065									
160	0,0063									
165	0,0061									
170	0,0059									
175	0,0057									
180	0,0056									
185	0,0054									
190	0,0053									
195	0,0051									
200	0,0050									
205	0,0049									
210	0,0048									
215	0,0047									
220	0,0045									
225	0,0044									
230	0,0043									
235	0,0043									
240	0,0042									
245	0,0041									
250	0,0040									
255	0,0039									
260	0,0038									
265	0,0038									
270	0,0037									
275	0,0036									
280	0,0036									
285	0,0035									
290	0,0034									
295	0,0034									
300	0,0033									
305	0,0033									
310	0,0032									
315	0,0032									
320	0,0031									