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Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-12/0324

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*	NOVATHERM 4FRe
Zulassungsinhaber *Holder of approval*	PROTEGA AB Verkstadsgatan 6B 231 66 Trelleborg SCHWEDEN
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Reaktive Brandschutzbeschichtung auf Stahlbauteilen *Reactive coatings for fire protection of steel elements*
Geltungsdauer: *Validity:* vom *from* / bis *to*	12 June 2013 3 September 2017
Herstellwerk *Manufacturing plant*	PROTEGA AB Verkstadsgatan 6B 231 66 TRELLEBORG SCHWEDEN

Diese Zulassung umfasst *This Approval contains*	39 Seiten einschließlich 1 Anhang *39 pages including 1 annex*
Diese Zulassung ersetzt *This Approval replaces*	ETA-12/0324 mit Geltungsdauer vom 28.03.2013 bis 03.09.2017 *ETA-12/0324 with validity from 28.03.2013 to 03.09.2017*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by Article 2 of the law of 8 November 2011[5];*
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- Guideline for European technical approval of "Fire Protective Products - Part 2: Reactive Coatings for Fire Protection of Steel Elements", ETAG 018-02.

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.

3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.

4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2011*, p. 2178
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

This European technical approval applies to the reactive coating for fire protection "NOVATHERM FRe". "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 ETAG 018-2 the ETA is issued for the product under end use conditions (Option 2).

1.2 Intended use

1.2.1 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[7], excluding S185 to achieve a fire resistance duration in accordance with EN 13501-2[8].

"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.

1.2.2 Use category

Depending on the use category in accordance with ETAG 018, part 2, section 2.2.2 the following types have been approved.

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

8 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

Primer		Reactive coating	Topcoat
			Typ Z_2
Alkydresin-primers	"Metallgrund" "Novagrund 40"	"NOVATHERM 4FRe"	"Decklack 300D" [9]

For the carrying out with primer "Novagrund 40" and topcoat "Decklack 300D" 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 ETAG 018 part 2, clause 5.7.2.1 for the use category Type Z_2.

1.2.3 Working life

The provisions made in this European technical approval are based on an assumed working life of the reactive coating for fire protection "NOVATHERM 4FRe" of 10 years; provided that the conditions laid down in sections 4.2, 5.1 and 5.2 for installation, packaging, transport, storage, use, as well as for use, maintenance and repair are met. 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.

2. Characteristics of product and methods of verification

2.1 Mechanical resistance and stability

Not relevant.

2.2 Safety in case of fire

2.2.1 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[10].

2.2.2 Fire resistance

The fire resistance classes were determined according to EN 13501-2[8] corresponding to ENV 13381-4[12] and EN 13381-8[11] and shall be gathered from Annex 1.

2.2.3 Smouldering fire exposure

The verification under exposure to the smouldering fire curve according to ENV 13381-4[12] has been furnished in the context of the approval tests.

2.3 Hygiene, Health and the Environment

2.3.1 Air and water permeability

Not relevant.

[9] For all shades of this top coat

[10] 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

[11] 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

[12] 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

2.3.2 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 approval, 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.

2.4 Safety in use (Mechanical resistance and stability)

Not relevant.

2.5 Protection against noise

Not relevant.

2.6 Energy, economy and heat retention

Not relevant.

2.7 Aspects of serviceability, durability and identification

2.7.1 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 ETAG 018, part 2, section 5.7.2.2. The approved use categories shall be taken from section 1.2.2 of this ETAG.

2.8 Identification

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

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 1999/454/EG of the European Commission[13] system 1 of the attestation of conformity applies.

Additionally according to the Decision 2001/596/EC of the European Commission[14] system 1 of the attestation of conformity is to be used in relation to the reaction-to-fire performance.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

(a) Tasks for the manufacturer:

(1) factory production control;

(2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;

[13] Official Journal of the European Communities L 178/52 of 14.07.1999
[14] Official Journal of the European Communities L 209/33 of 2.8.2001

(b) Tasks for the approved body:

(3) initial type–testing of the product;

(4) initial inspection of factory and of factory production control;

(5) continuous surveillance, assessment and approval of factory production control.

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer of the reactive coating "NOVATHERM 4FRe", of the primer "Metallgrund" and "Novagrund 40" and the topcoat "Deckanstrich D300" shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this European technical approval.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control that applies. The documentation to be carried out by the manufacturer and the applicable procedures shall be appropriate to the product and manufacturing process. The factory production control shall ensure the conformity of the product to an appropriate level. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations

b) the effective implementation of these procedures and instructions

c) the recording of these procedures and their results

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the factory production control to rectify the cause of non-conformity

e) it shall be ensured that both the Approval Body and the Approved (certification) bodies are advised before the product, its components or the manufacturing process, is changed in a significant way

f) it shall be ensured that personnel involved in the production processes and the quality control procedures are adequately qualified and trained to carry out the required tasks

g) the regular maintenance of all testing and measuring equipment and the documentation of up to date calibration records

h) the maintenance of records to ensure every container of coating material produced is clearly labelled with the batch number, which allows traceability to the point of its production.

The manufacturer may only use initial and constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the "control plan" of this European technical approval. The results of factory production control shall be recorded and evaluated in accordance with the provisions of the "control plan".

Reactive coating

Property	**Paragraph, indicating the relevant test method**	**Threshold (if any) and tolerances**	**Minimum frequency of tests**
Incoming material	Declaration of conformity	Manufacturer's declaration	Every delivery
Char depth	e.g. Cylinder test (see TR 024) or similar	Manufacturer's declaration of minimum value[15]	Every batch
Insulating efficiency	Annex A or similar	Manufacturer's declaration	Every 10th batch or at least once per month
Non-volatile content or density	e.g. EN ISO 3251		Every batch
Sag resistance		Manufacturer's specification	Every batch
Viscosity	e.g. EN ISO 3219		Every batch
Raw material[16]	Check the raw material supplier's declared values against the manufacturer's specification in FPC		Every delivery
Curing			Every batch
Pigment dispersion			Every batch

Primer

Raw material I	Check the raw material supplier's declared values against the manufacturer's specification in FPC	Declared values	Every delivery
Viscosity	e.g. EN ISO 3219	Manufacturer's specification	Every batch
Non-volatile content	e.g. EN ISO 3251		Every batch

15 If the test result for the determination of the char depth is not satisfactory then a test of the insulating effect test should be performed.

16 Test results of the supplier shall be checked according to the specification of the raw material's manufacturer.

Topcoat

Raw material	Check the raw material supplier's declared values against the manufacturer's specification in FPC	Manufacturer's specification	Every delivery
Pigment content color			Every batch
Viscosity	e.g. EN ISO 3219		Every batch
Non-volatile content	e.g. ISO 3251		Every batch

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of reactive coatings for fire protection of steel elements in order to undertake the actions laid down in section 3.2.2 For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial type-testing of the product ,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed to the packaging and to the accompanying commercial document, e.g. the EC declaration of conformity. The letters ”CE” shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:the name and address of the producer (legal entity responsible for the manufacture),

- Identification number of the Approved Body,
- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product ,
- the number of the European technical approval,
- ETAG 018, Part 1 and 2

- Identification of the product (trade name: reactive coating "NOVATHERM 4FRe" or primer "Metallgrund" respectively "Novagrund 40" or topcoat "Decklack 300D")

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The European technical approval 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 approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Installation

4.2.1 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.

4.2.2 Primer

An alkyd-resign primer as specified by the manufacturer shall be used, see clause 1.2.2 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.

4.2.3 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.

4.2.4 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 1.2.2 of this ETA.

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

4.2.5 Structural references

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

5 Indications to the manufacturer

5.1 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.

5.2 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.

Prof. Gunter Hoppe
Head of Department

beglaubigt:
Stopp

Annex 1 – Product performance: 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[12], EN 13381-8[11] 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[12] and for hollow section according EN 13381-8[11]
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 according to section 4.2.2 of this ETA.
5. 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									