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Authorised and notified according to Article 10 of the 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.

European Organisation for Technical Approvals

EUOPEAN TECHNICAL APPROVAL ETA-11/0045

Trade name:	Interchar 1120
Holder of the approval:	**International Paint Limited** Stoneygate Lane Felling Gateshead NE10 0JY United Kingdom Tel: 0191 469 6111 Fax: 0191 438 3711 Internet: www.akzonobel.com
Generic type and use of construction product(s):	Reactive Coating for the Fire Protection of Structural Steel
Validity from:	**22nd September 2011**
to:	**21st September 2016**
Manufacturing plant(s):	**International Paint** Holmedalen 3, Aspereds Industriomrade 42457 Angered, Sweden
This European Technical Approval contains:	11 pages and 1 Annex, 18 pages in total.

I LEGAL BASES AND GENERAL CONDITIONS

1 This European Technical Approval is issued by Warrington Certification Limited in accordance with:

The Council Directive (89/106/EEC)[1] of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products as amended by Council Directive 93/68/EEC of 22 July 1993[2].

UK implementation of CPD Statutory Instruments 1991, No 1620 Building and Buildings The Construction Products Regulations 1991- made 15 July 1991, laid before Parliament 22 July 1991, coming into force 27 December 1991, and amended by The Construction Products (Amendment) Regulations 1994 (Statutory Instruments 1994, No 3051).

Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC[3]

European Technical Approval Guideline 018 Fire Protective Products Part 1: General and Part 2: Reactive Coatings For Fire Protection of Steel Elements.

2 Warrington Certification Limited is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant(s). Nevertheless, the responsibility for the conformity of the products with the European Technical Approval and for their fitness for their 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.

4 This European Technical Approval may be withdrawn by Warrington Certification Limited pursuant to Article 5.1 of the 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 Warrington Certification Limited. 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 of English. This version should correspond fully to the version used by EOTA for circulation. Translations in other languages have to be designated as such.

[1] Official Journal of the European Communities N° L40, 11 Feb 1989, p 12
[2] Official Journal of the European Communities N° L220, 30 Aug 1993, p 1.
[3] Official Journal of the European Communities N° L17, 20 Jan 1994, p 34.

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 General

Interchar 1120 is a spray or brush applied water borne reactive coating formulated for the fire protection of structural steel elements installed in the following environmental conditions:

Internal use – ETAG 018-2 Type Z2
Internal use with high humidity – ETAG 018-2 Type Z1
Internal use in semi-exposed conditions – ETAG 018-2 Type Y
External use – ETAG 018-2 Type X

1.2 Intended Use

The intended use of Interchar 1120 is to fire protect various sizes of structural steel 'H' or 'I' section beams and columns and hollow columns for fire resistance classifications of R90 and R120 and for design temperatures in the range of 350°C to 750°C.

The intended use is limited to sections without openings in the web. The reactive coating cannot be applied to solid bars or rods, and is not applicable to structural tension members without further evaluation.

1.3 Working life

The provisions made in this ETA are based on an assumed intended working life of the applied coating for the intended use of 10 years, provided that it is subject to appropriate use and maintenance.

The indications given on the intended working life cannot be interpreted as a guarantee given by the producer, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2 Characteristics of the product and methods of verification

The assessment of fitness for use has been made in accordance with ETAG 018-2.

ETAG Clause No.	ETA Clause No.	Characteristic	Assessment of characteristic
5.1		**Mechanical resistance and stability**	Not relevant
5.2	2.1	**Safety in case of fire**	

5.2.1	2.1.1	Resistance to fire	
5.2.2	2.1.2	Reaction to fire	
5.3		**Hygiene, Health and the Environment**	
5.3.2	2.2	- Release of dangerous substances	
5.4	-	**Safety in use**	Not relevant
5.5	-	**Protection against noise**	Not relevant
5.6	-	**Energy, Economy and Heat Retention**	Not relevant
5.7	2.3	**Related aspects of serviceability**	
5.7.2.2	2.3.1 2.3.2 to 2.3.5	- Primer and top coat compatibility - Type Z1 Durability - Type Z2 Durability - Type Y Durability - Type X Durability	
5.7.3 and Annex E	2.3.6	- Identification	

2.1 Safety in case of fire

2.1.1 Resistance to Fire

The resistance to fire performance according to EN 13501-2 determined in accordance with test principles defined in EN 13381-8: 2010 including Annex A (slow heating curve). The test data was analysed adopting the graphical method defined in Annex E of EN 13381-8: 2010. Annex A summarises the results of the analysis.

In accordance with ETAG 018-2 (foreword), Interchar 1120 may be considered as a reactive coating kit that includes one or more primers and/or topcoats (Option 2).

Until the withdrawal of relevant national test and classification standards, CE Marking will cover a finite number of variations in coating thickness subjected to a fire resistance assessment. As time progresses, the performance declaration for fire resistance covered by CE Marking may change and the ETA holder may incorporate the changes in this ETA by amendment or revision.

In the meantime, and taking into account the transitional arrangements for test and classification standards and the corresponding national legislation (see EC Guidance paper J), the ETA holder shall be permitted to maintain and be able to use - on a national basis – the test data for this characteristic, based on relevant national standards, next to the performance declaration covered by the CE Marking based on this ETA.

2.1.2 Reaction to Fire

The fire protection coating in conjunction with the primer type Intercryl 525 and topcoat type Interthane 990 has a performance determined for a reaction to fire classification in accordance with EN 13501-1 of Class E.

2.2 Dangerous substances

According to the manufacturer's declaration, the product specification has been compared with Annex XVII of REACH and the ECHA Candidate List of Substances of Very High Concern to verify that that it does not contain such substances.

2.3 Related Aspects of Serviceability

2.3.1 Interchar 1120 has been assessed as being compatible, in accordance with the test procedures defined in ETAG 018-2 Clause 5.7.2.1 with the following primers and topcoats:

Primers	
Name	**Type**
Intergard 269	Two component epoxy
Intergard 251	Two component epoxy with zinc phosphate
Interprime 306	Single component alkyd
Interzinc 52	Two component zinc rich epoxy

Top Coats	
Name	**Type**
Interthane 990	Two component acrylic polyurethane
Intercryl 525	Single component acrylic
Intersheen 579	Single component modified acrylic

The Intergard 269 primer system has been tested in accordance with the test procedures defined in ETAG 018-2 Clause 5.7.2.1 on galvanised steel substrates and passed the performance requirements for compatibility.

2.3.2 Interchar 1120 has been assessed as having passed the requirements for internal use with high humidity defined in ETAG 018-2 Type Z1 environmental conditions and can be used with and without the following combinations of primers and top coats:

Primer Name	Top Coat Name
Intergard 251	Intercryl 525
Interprime 306	Intersheen 579
	Interthane 990

2.3.3 Interchar 1120 has been assessed as having passed the requirements for internal use defined in ETAG 018-2 Type Z2 environmental conditions and can be used without top coats or with the compatible topcoats with the following primers:

Primer Name	Top Coat Name
Interprime 306	None or compatible
Intergard 251	None or compatible

2.3.4 Interchar 1120 has been assessed as having passed the requirements for external use defined in ETAG 018-2 Type Y environmental conditions and can be used with the following top coats:

Primer Name	Top Coat Name
Intercryl 525	Interthane 990
Intergard 251	Interthane 990
Interprime 306	Interthane 990
Intergard 269 on galvanised	Interthane 990

2.3.5 Interchar 1120 has been assessed as having passed the requirements for external use defined in ETAG 018-2 Type X environmental conditions and can be used with the following top coats:

Primer Name	Top Coat Name
Interzinc 52 Grey Intergard 269	Interthane 990
Intergard 251	Interthane 990
Intergard 269 on galvanised steel	Interthane 990

2.3.6 The reactive product has been subjected to the identification testing in accordance with the methods of identification defined in Table 5.3 of ETAG 018-2 (Infrared spectroscopy, thermogravimetry, density and solids by volume). Similarly appropriate primers and top coats have been subject to the requirements of Table 5.3.

Each reactive product container is identified with the name Interchar 1120 and will be CE marked.

3 Evaluation of Conformity and CE marking

3.1 Attestation of Conformity system

The system of attestation of conformity specified by the European Commission Decision 99/454/EC for fire protective products is system 1 and is detailed as follows:

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

(a) Tasks for the manufacturer

-factory production control

-testing of samples taken at the factory in accordance with a prescribed test plan

(b) Tasks for the Notified body

- initial type-testing of the product
- initial inspection of factory and of factory production control
- 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 Interchar 1120 covered by this European Technical Approval shall document, operate and maintain an adequate factory production control system to enable the achievement of the required product characteristics, hence conformity of the product to this ETA, and the effective operation of the production control system to be checked.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control that applies. The manufacturer's documentation and procedures shall be appropriate to the product and manufacturing process. The factory production control system shall achieve an appropriate level of confidence in the conformity of the product. 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) a procedure to ensure that both the Notified Body and the Certification Body are advised before any significant change to the product, its components or manufacturing process, is made.

f) a procedure to ensure that personnel involved in the production processes and the quality control procedures are qualified and adequately trained to carry out their required tasks.

g) that all testing and measuring equipment is maintained and up to date calibration records are documented.

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

3.2.1.2 Other tasks for the manufacturer

The following tables derived from ETAG 018-2 specify properties that should be controlled and minimum frequencies of control. The test method and threshold have been laid down in the factory production control plan.

Reactive Coating

Property	Property Paragraph (ETAG)	Threshold	Minimum frequency of tests
Incoming material	Declaration of conformity	Manufacturer's declaration	Every delivery
Char depth	Annex G or similar	Manufacturer's declaration of minimum value	Every batch
Insulating efficiency	Annex A or alternative(1)	Manufacturer's declaration (2)	Every 10th batch or at least once per month
Sag resistance		Manufacturer's specification	Every batch

Viscosity	e.g EN ISO 3219		Every batch
Raw materials(3)		Check specification	Every batch
Curing			Every batch
Pigment dispersion			Every batch

(1) agreed with ETA issuing body and manufacturer.
(2) if result of char depth is not sufficient an insulating efficiency test should be carried out.
(3) check test results according specification.

Primer and top coat

Property	Property Paragraph (ETAG)	Threshold	Minimum frequency of tests
Raw materials(1)		Check specification	Every delivery
Viscosity	e.g EN ISO 3219		Every batch
Non-volatile content	e.g ISO 3251		Every batch
Pigment content colour			Every batch

(1) check test results according specification.

3.2.2 Tasks of Notified Body

3.2.2.1. Initial type testing

The approval tests have been conducted on behalf the notified body in accordance ETAG 018, Parts 1 or 2, as relevant, and the notified ETA issuing body has assessed the results of these tests in accordance with the ETAG, as part of the ETA issuing procedure.

These tests shall be used by the certification body for Certificate of Conformity purposes.

3.2.2.2. Assessment of the factory production control system - initial inspection and continuous surveillance

Assessment of the factory production control system is the responsibility of the ETA issuing body.

An initial inspection shall be carried out of the production unit specified in this ETA to demonstrate that the factory production control is in conformity with the ETA.

Subsequently continuous surveillance of factory production control is necessary to ensure continuing conformity with the ETA. It is recommended that surveillance inspections be conducted at least twice a year.

The results of certification of conformity and of the continuous surveillance shall be made available to Warrington Certification Limited. Where the provisions of the ETA are no longer fulfilled, the certificate of conformity shall be withdrawn by the certification body.

3.3 CE marking

The CE conformity marking symbol consists exclusively of the letters "CE" in accordance with Directive 93/68/EEC.

NOTE: The manufacturer, or his authorised representative established in the EEA, is responsible for the affixing of the CE marking symbol.

The CE marking symbol shall be accompanied by the following information:

a) Identification number of the ETA issuing body;

b) The name or identifying mark of the producer;

c) Registered address of the producer;

d) The last two digits of the year in which the marking was first applied;

e) The number of the ETA;

f) Reference to ETAG 018, Parts 1 and 2;

g) Indication of intended use;

The CE marking symbol and items a) to g) above shall accompany the product and shall be included with the application instructions.

Additionally, at least the CE marking symbol and item a) of all this information shall be affixed to the supply containers and optionally on its packaging.

4. ASSUMPTIONS UNDER WHICH THE FITNESS FOR USE OF THE PRODUCT FOR THE INTENDED USE WILL BE ASSESSED

4.1 Manufacturing, transport and storage

Interchar 1120 is manufactured in accordance with the provisions of the ETA using the manufacturing process as identified during the inspection of the factory by Warrington Certification Limited and the approved body and laid down in the technical documentation.

It is assumed that the manufacture of Interchar 1120 fulfils the criteria for stable industrial production. The samples taken in connection with the evaluation of properties shall be representative of the whole production.

4.2 Application

The ETA is issued under the assumption that the application of Interchar 1120 shall be in accordance with the manufacturer's technical literature.

4.3 Maintenance and 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.

ANNEX A - Product Performance: Fire Resistance

1 This Annex relates to the use of Interchar 1120 for the fire protection of 'H' or 'I' shaped steel beam and column sections and hollow column sections. The precise scope is given in Tables 1 to 6 which show the total dry film thickness of Interchar 1120 (excluding primer and top coat) required to provide classifications of R90 and R120 for various design temperatures and section factors.

2. The product is approved on the basis of:

   i) Approval testing in accordance with the principles of EN 13381-8:2010.
   ii) A design appraisal against this ETA adopting the graphical analysis defined in Annex E of EN 13381-8:2010.

3. The data shown is applicable to steel sections blast cleaned to ISO 8501-1 SA$2^1/_2$ or equivalent and primed with the compatible primers and top coats listed in this ETA. Based on the test data the total dry film thickness of primer and top coat together should not exceed 0.2 mm.

4. The data applies also to other shaped steel sections that have re-entrant details such as channels, angles and tees.

5. Interchar 1120 has been exposed to the slowing heating regime defined in Annex A of EN 13381-8: 2010 and has satisfied the requirements.

Table 1: I-Section Beams 90 Minutes									
Section Factor up to m^{-1}	Thickness (mm) Required for a Design Temperature of								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
77	1.959	1.432	1.110	0.907	0.733	0.719	0.719	0.719	0.719
80	2.024	1.475	1.160	0.943	0.760	0.719	0.719	0.719	0.719
85	2.089	1.519	1.210	0.980	0.786	0.734	0.719	0.719	0.719
90	2.154	1.563	1.259	1.016	0.812	0.753	0.719	0.719	0.719
95	2.219	1.607	1.309	1.053	0.839	0.772	0.719	0.719	0.719
100	2.284	1.651	1.359	1.090	0.865	0.790	0.726	0.719	0.719
105	2.349	1.695	1.409	1.126	0.891	0.809	0.745	0.719	0.719
110	2.414	1.739	1.458	1.163	0.917	0.828	0.764	0.719	0.719
115	2.479	1.782	1.508	1.199	0.944	0.846	0.783	0.719	0.719
120	2.544	1.826	1.551	1.236	0.970	0.865	0.802	0.719	0.719
125	2.610	1.870	1.589	1.272	0.996	0.884	0.821	0.734	0.719
130	2.675	1.914	1.628	1.309	1.023	0.903	0.840	0.754	0.719
135	2.740	1.958	1.666	1.345	1.049	0.921	0.859	0.774	0.719
140	2.805	2.002	1.704	1.382	1.075	0.940	0.878	0.794	0.719
145	2.870	2.046	1.743	1.418	1.102	0.959	0.897	0.814	0.719
150	2.951	2.089	1.781	1.455	1.128	0.978	0.916	0.834	0.728
155	3.032	2.133	1.819	1.491	1.154	0.996	0.935	0.854	0.750
160	3.114	2.177	1.858	1.528	1.181	1.015	0.954	0.874	0.772
165	3.195	2.221	1.896	1.575	1.207	1.034	0.973	0.894	0.794
170	3.276	2.265	1.934	1.622	1.233	1.052	0.992	0.914	0.816
175	3.357	2.309	1.973	1.669	1.260	1.071	1.011	0.934	0.838
180	3.439	2.352	2.011	1.716	1.286	1.090	1.030	0.954	0.860
185	3.520	2.396	2.049	1.763	1.312	1.109	1.049	0.974	0.881
190	3.601	2.440	2.088	1.810	1.339	1.127	1.068	0.995	0.903
195	3.682	2.484	2.126	1.856	1.365	1.146	1.087	1.015	0.925
200	3.764	2.528	2.164	1.903	1.391	1.165	1.106	1.035	0.947
205	3.845	2.572	2.203	1.950	1.417	1.183	1.125	1.055	0.969
210	3.926	2.616	2.241	1.997	1.444	1.202	1.144	1.075	0.991
215	4.007	2.659	2.280	2.044	1.470	1.221	1.163	1.095	1.012
220	4.088	2.703	2.318	2.091	1.496	1.240	1.182	1.115	1.034
225	4.170	2.747	2.356	2.138	1.523	1.258	1.201	1.135	1.056
230		2.791	2.395	2.185	1.590	1.277	1.220	1.155	1.078
235		2.835	2.433	2.232	1.667	1.296	1.239	1.175	1.100
240		2.889	2.471	2.279	1.744	1.315	1.258	1.195	1.122
245		2.981	2.510	2.326	1.821	1.333	1.277	1.215	1.144
250		3.074	2.548	2.373	1.898	1.352	1.296	1.235	1.165
255		3.166	2.586	2.420	1.975	1.371	1.315	1.255	1.187
260		3.259	2.625	2.466	2.052	1.389	1.334	1.275	1.209
265		3.352	2.663	2.513	2.130	1.408	1.353	1.295	1.231
270		3.444	2.701	2.560	2.207	1.427	1.372	1.315	1.253
275		3.537	2.740	2.607	2.284	1.446	1.391	1.335	1.275
280		3.630	2.778	2.654	2.361	1.464	1.410	1.356	1.296
285		3.722	2.816	2.701	2.438	1.483	1.429	1.376	1.318
290		3.815	2.855	2.748	2.515	1.502	1.448	1.396	1.340
295		3.907	3.096	2.795	2.592	1.521	1.467	1.416	1.362
300		4.000	3.473	2.842	2.669	1.683	1.486	1.436	1.384
305		4.093	3.851	3.062	2.747	1.941	1.505	1.456	1.406
310		4.185	4.228	3.542	2.824	2.199	1.524	1.476	1.428
315				4.022	3.172	2.457	1.784	1.496	1.449
320					3.926	2.715	2.103	1.516	1.471

Thickness is intumescent only.

Table 2: I-Section Beams 120 Minutes

Section Factor up to m^{-1}	Thickness (mm) Required for a Design Temperature of								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
77		2.313	1.803	1.366	1.157	0.988	0.839	0.729	0.719
80		2.424	1.893	1.440	1.215	1.033	0.872	0.752	0.719
85		2.536	1.984	1.513	1.273	1.078	0.906	0.776	0.734
90		2.647	2.074	1.587	1.331	1.123	0.940	0.799	0.753
95		2.759	2.164	1.661	1.389	1.168	0.974	0.822	0.772
100		2.870	2.255	1.734	1.447	1.213	1.008	0.845	0.790
105			2.345	1.808	1.505	1.258	1.041	0.868	0.809
110			2.436	1.882	1.560	1.303	1.075	0.891	0.828
115			2.526	1.956	1.614	1.348	1.109	0.914	0.846
120			2.617	2.029	1.668	1.393	1.143	0.937	0.865
125			2.707	2.103	1.721	1.438	1.177	0.960	0.883
130			2.798	2.177	1.775	1.483	1.210	0.983	0.902
135				2.251	1.829	1.528	1.244	1.006	0.921
140				2.324	1.882	1.572	1.278	1.029	0.939
145				2.398	1.936	1.616	1.312	1.053	0.958
150				2.472	1.990	1.660	1.346	1.076	0.977
155				2.546	2.043	1.705	1.379	1.099	0.995
160				2.619	2.097	1.749	1.413	1.122	1.014
165				2.693	2.151	1.793	1.447	1.145	1.032
170				2.767	2.204	1.837	1.481	1.168	1.051
175				2.841	2.258	1.881	1.514	1.191	1.070
180				2.949	2.312	1.925	1.562	1.214	1.088
185				3.081	2.365	1.969	1.617	1.237	1.107
190				3.213	2.419	2.014	1.673	1.260	1.126
195				3.345	2.473	2.058	1.729	1.283	1.144
200				3.477	2.526	2.102	1.785	1.306	1.163
205				3.609	2.580	2.146	1.841	1.329	1.181
210				3.741	2.634	2.190	1.897	1.353	1.200
215				3.873	2.687	2.234	1.953	1.376	1.219
220				4.005	2.741	2.278	2.009	1.399	1.237
225				4.137	2.795	2.323	2.065	1.422	1.256
230					2.849	2.367	2.121	1.445	1.275
235					3.008	2.411	2.177	1.468	1.293
240					3.237	2.455	2.233	1.491	1.312
245					3.467	2.499	2.288	1.514	1.331
250					3.696	2.543	2.344	1.573	1.349
255					3.926	2.587	2.400	1.685	1.368
260					4.156	2.632	2.456	1.796	1.386
265						2.676	2.512	1.908	1.405
270						2.720	2.568	2.020	1.424
275						2.764	2.624	2.132	1.442
280						2.808	2.680	2.244	1.461
285						2.852	2.736	2.356	1.480
290						3.926	2.792	2.467	1.498
295							2.848	2.579	1.517
300							2.904	2.691	1.669
305							2.959	2.803	2.022
310							3.015	2.915	2.376
315							3.071	3.027	2.729
320							3.127	3.100	3.082

Thickness is intumescent only.

Table 3: H-Section Columns 90 Minutes									
Section Factor up to m^{-1}	Thickness (mm) Required for a Design Temperature of								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
49	1.931	1.560	1.288	1.067	0.884	0.708	0.634	0.634	0.634
50	2.072	1.667	1.371	1.134	0.928	0.746	0.634	0.634	0.634
55	2.212	1.775	1.454	1.200	0.972	0.785	0.665	0.634	0.634
60	2.352	1.882	1.537	1.267	1.016	0.823	0.704	0.634	0.634
65	2.492	1.990	1.620	1.334	1.060	0.861	0.743	0.634	0.634
70	2.633	2.098	1.702	1.401	1.104	0.899	0.782	0.664	0.634
75	2.773	2.205	1.785	1.467	1.148	0.938	0.821	0.704	0.634
80	2.885	2.313	1.868	1.534	1.192	0.976	0.860	0.744	0.634
85	2.979	2.420	1.951	1.601	1.236	1.014	0.899	0.783	0.634
90	3.073	2.528	2.034	1.668	1.280	1.053	0.938	0.823	0.653
95	3.167	2.635	2.117	1.734	1.324	1.091	0.976	0.863	0.696
100	3.261	2.743	2.199	1.801	1.368	1.129	1.015	0.902	0.738
105	3.355	2.838	2.282	1.868	1.412	1.167	1.054	0.942	0.780
110	3.449	2.884	2.365	1.935	1.456	1.206	1.093	0.982	0.822
115	3.543	2.929	2.448	2.001	1.500	1.244	1.132	1.021	0.864
120	3.637	2.974	2.531	2.068	1.544	1.282	1.171	1.061	0.907
125	3.731	3.020	2.614	2.135	1.588	1.321	1.210	1.100	0.949
130	3.825	3.065	2.696	2.202	1.632	1.359	1.249	1.140	0.991
135	3.919	3.111	2.779	2.268	1.676	1.397	1.288	1.180	1.033
140	4.013	3.156	2.849	2.335	1.720	1.435	1.327	1.219	1.075
145	4.107	3.202	2.899	2.402	1.764	1.474	1.366	1.259	1.117
150	4.201	3.247	2.949	2.469	1.808	1.512	1.405	1.299	1.160
155	4.295	3.293	3.000	2.535	1.852	1.550	1.443	1.338	1.202
160	4.389	3.338	3.050	2.602	1.896	1.589	1.482	1.378	1.244
165	4.483	3.383	3.100	2.669	1.940	1.627	1.521	1.418	1.286
170	4.577	3.429	3.150	2.736	1.984	1.665	1.560	1.457	1.328
175	4.671	3.474	3.200	2.802	2.028	1.703	1.599	1.497	1.371
180	4.765	3.520	3.250	2.864	2.072	1.742	1.638	1.537	1.413
185	4.995	3.565	3.300	2.923	2.116	1.780	1.677	1.576	1.455
190	5.225	3.611	3.351	2.982	2.160	1.818	1.716	1.616	1.497
195	5.456	3.656	3.401	3.041	2.204	1.857	1.755	1.655	1.539
200	5.686	3.702	3.451	3.101	2.248	1.895	1.794	1.695	1.582
205	5.916	3.747	3.501	3.160	2.292	1.933	1.833	1.735	1.624
210	6.146	3.792	3.551	3.219	2.336	1.971	1.872	1.774	1.666
215	6.376	3.838	3.601	3.278	2.380	2.010	1.911	1.814	1.708
220	6.607	3.883	3.652	3.337	2.424	2.048	1.949	1.854	1.750
225	6.837	3.929	3.702	3.396	2.468	2.086	1.988	1.893	1.793
230	7.067	3.974	3.752	3.455	2.512	2.125	2.027	1.933	1.835
235	7.297	4.020	3.802	3.514	2.556	2.163	2.066	1.973	1.877
240		4.065	3.852	3.573	2.600	2.201	2.105	2.012	1.919
245		4.111	3.902	3.632	2.644	2.239	2.144	2.052	1.961
250		4.156	3.952	3.691	2.688	2.278	2.183	2.092	2.004
255		4.201	4.003	3.750	2.732	2.316	2.222	2.131	2.046
260		4.247	4.053	3.809	2.776	2.354	2.261	2.171	2.088
265		4.292	4.103	3.868	2.820	2.393	2.300	2.211	2.130
270		4.338	4.153	3.927	2.931	2.431	2.339	2.250	2.172
275		4.383	4.203	3.986	3.058	2.469	2.378	2.290	2.215
280		4.429	4.253	4.045	3.186	2.507	2.416	2.329	2.257
285		4.474	4.304	4.104	3.313	2.546	2.455	2.369	2.299
290		4.520	4.354	4.163	3.440	2.584	2.494	2.409	2.341
295		4.565	4.404	4.222	3.568	2.622	2.533	2.448	2.383
300		4.610	4.454	4.281	3.695	2.661	2.572	2.488	2.426
305		4.656	4.504	4.340	3.822	2.699	2.611	2.528	2.468
310		4.701	4.554	4.399	3.950	2.737	2.650	2.567	2.510
315		4.747	4.605	4.458	4.077	2.775	2.689	2.607	2.552
320		5.163	4.655	4.517	4.205	2.814	2.728	2.647	2.594
325		5.827	4.705	4.576	4.332	3.082	2.767	2.686	2.636
330		6.490	4.755	4.635	4.459	3.502	2.806	2.742	2.679
335		7.154	5.240	4.694	4.587	3.923	3.181	2.951	2.721
340			5.834	4.753	4.714	4.344	4.061	3.412	2.763
345			6.427	5.195	5.036	4.765	4.833	3.819	2.805
350			7.021	5.732	5.487	5.183	5.175	4.062	2.949
355				6.269	5.938	5.601	5.517	4.508	3.499
360				6.806	6.389	6.018	5.859	4.954	4.049
365				7.343	6.841	6.436	6.201	5.400	4.599

Thickness is intumescent only.

Table4: H-Section Columns 120 Minutes									
Section Factor up to m^{-1}	Thickness (mm) Required for a Design Temperature of								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
49	2.827	2.301	1.917	1.652	1.402	1.189	1.012	0.820	0.634
50	3.069	2.477	2.074	1.783	1.502	1.270	1.076	0.869	0.661
55	3.312	2.653	2.231	1.914	1.603	1.351	1.141	0.918	0.704
60	3.554	2.829	2.389	2.045	1.703	1.432	1.206	0.967	0.747
65	3.796	3.005	2.546	2.175	1.804	1.513	1.271	1.016	0.789
70	4.038	3.181	2.703	2.306	1.904	1.595	1.336	1.065	0.832
75	4.281	3.357	2.854	2.437	2.005	1.676	1.401	1.114	0.874
80	4.523	3.533	2.980	2.568	2.105	1.757	1.466	1.163	0.917
85	4.765	3.709	3.106	2.698	2.206	1.838	1.531	1.212	0.959
90	5.007	3.885	3.231	2.829	2.306	1.919	1.596	1.261	1.002
95		4.061	3.357	2.918	2.407	2.001	1.661	1.310	1.044
100		4.237	3.483	3.007	2.507	2.082	1.726	1.359	1.087
105		4.413	3.608	3.095	2.608	2.163	1.790	1.408	1.129
110		4.589	3.734	3.184	2.708	2.244	1.855	1.457	1.172
115		4.765	3.860	3.273	2.809	2.326	1.920	1.506	1.214
120		4.941	3.986	3.362	2.886	2.407	1.985	1.555	1.257
125		5.117	4.111	3.451	2.956	2.488	2.050	1.604	1.299
130			4.237	3.539	3.027	2.569	2.115	1.653	1.342
135			4.363	3.628	3.097	2.650	2.180	1.702	1.384
140			4.488	3.717	3.168	2.732	2.245	1.751	1.427
145			4.614	3.806	3.239	2.813	2.310	1.800	1.470
150			4.740	3.895	3.309	2.888	2.375	1.849	1.512
155			4.935	3.983	3.380	2.962	2.440	1.898	1.555
160			5.148	4.072	3.451	3.036	2.504	1.947	1.597
165			5.361	4.161	3.521	3.110	2.569	1.996	1.640
170			5.574	4.250	3.592	3.184	2.634	2.045	1.682
175			5.787	4.339	3.663	3.258	2.699	2.094	1.725
180			5.999	4.428	3.733	3.331	2.764	2.143	1.767
185			6.212	4.516	3.804	3.405	2.829	2.192	1.810
190			6.425	4.605	3.875	3.479	2.933	2.241	1.852
195			6.638	4.694	3.945	3.553	3.037	2.290	1.895
200			6.851	4.790	4.016	3.627	3.141	2.339	1.937
205			7.064	4.915	4.087	3.701	3.245	2.388	1.980
210			7.276	5.041	4.157	3.775	3.349	2.437	2.022
215				5.166	4.228	3.849	3.454	2.486	2.065
220				5.291	4.299	3.923	3.558	2.535	2.107
225				5.417	4.369	3.997	3.662	2.584	2.150
230				5.542	4.440	4.070	3.766	2.633	2.193
235				5.667	4.511	4.144	3.870	3.052	2.235
240				5.793	4.581	4.218	3.974	3.126	2.278
245				5.918	4.652	4.292	4.078	3.199	2.320
250				6.043	4.723	4.366	4.182	3.273	2.363
255				6.169	4.820	4.440	4.286	3.346	2.405
260				6.294	4.958	4.514	4.390	3.419	2.448
265				6.419	5.095	4.588	4.494	3.492	2.490
270				6.545	5.233	4.662	4.598	3.566	2.533
275				6.670	5.370	4.735	4.703	3.639	2.575
280				6.795	5.508	4.871	4.830	3.724	2.618
285				6.921	5.645	5.047	4.994	3.827	2.660
290				7.046	5.783	5.223	5.157	3.930	2.703
295				7.171	5.921	5.400	5.321	4.033	2.745
300				7.297	6.058	5.576	5.484	4.136	2.788
305				7.422	6.196	5.752	5.648	4.239	2.830
310					6.333	5.928	5.811	4.486	3.161
315					6.471	6.105	5.975	4.769	3.563
320					6.608	6.281	6.138	5.052	3.965
325					6.746	6.457	6.302	5.334	4.367
330					6.883	6.633	6.465	5.617	4.769
335					7.021	6.810	6.629	5.900	5.171
340					7.159	6.986	6.792	6.183	5.573
345					7.296	7.162	6.956	6.466	5.976
350					7.434	7.338	7.119	6.749	6.378
355							7.283	7.031	6.780
360							7.441	7.312	7.182
365								7.350	7.261

Thickness is intumescent only.

Table 5: Hollow Columns 90 Minutes									
Section Factor up to m^{-1}	Thickness (mm) Required for a Design Temperature of								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
47	3.136	2.380	1.679	1.278	1.278	1.278	1.278	1.278	1.278
50	3.400	2.597	1.852	1.278	1.278	1.278	1.278	1.278	1.278
55	3.664	2.813	2.026	1.385	1.278	1.278	1.278	1.278	1.278
60	3.928	3.030	2.199	1.523	1.320	1.278	1.278	1.278	1.278
65	4.191	3.247	2.372	1.660	1.415	1.339	1.278	1.278	1.278
70	4.358	3.464	2.546	1.798	1.511	1.434	1.278	1.278	1.278
75	4.500	3.680	2.719	1.935	1.606	1.529	1.278	1.278	1.278
80	4.642	3.897	2.892	2.073	1.702	1.624	1.301	1.278	1.278
85	4.785	4.114	3.065	2.210	1.798	1.719	1.396	1.278	1.278
90	4.927	4.305	3.239	2.347	1.893	1.814	1.490	1.278	1.278
95	5.069	4.459	3.412	2.485	1.989	1.909	1.584	1.320	1.278
100	5.212	4.613	3.585	2.622	2.084	2.004	1.679	1.415	1.278
105	5.354	4.766	3.759	2.760	2.180	2.098	1.773	1.511	1.278
110	5.496	4.920	3.932	2.897	2.275	2.193	1.867	1.606	1.299
115	5.638	5.074	4.105	3.035	2.371	2.288	1.962	1.702	1.397
120	5.781	5.227	4.281	3.172	2.467	2.383	2.056	1.798	1.495
125	5.923	5.381	4.463	3.309	2.562	2.478	2.150	1.893	1.594
130	6.065	5.534	4.646	3.447	2.658	2.573	2.245	1.989	1.692
135	6.207	5.688	4.829	3.584	2.753	2.668	2.339	2.084	1.790
140	6.350	5.842	5.012	3.722	2.849	2.763	2.433	2.180	1.888
145	6.492	5.995	5.194	3.859	2.944	2.858	2.527	2.275	1.986
150	6.634	6.149	5.377	3.997	3.040	2.953	2.622	2.371	2.084
155	6.777	6.303	5.560	4.134	3.135	3.048	2.716	2.467	2.183
160	6.919	6.456	5.743	4.295	3.231	3.143	2.810	2.562	2.281
165	7.061	6.610	5.925	4.551	3.327	3.238	2.905	2.658	2.379
170	7.203	6.763	6.108	4.806	3.422	3.333	2.999	2.753	2.477
175	7.346	6.917	6.291	5.061	3.518	3.428	3.093	2.849	2.575
180	7.488	7.071	6.474	5.317	3.613	3.523	3.188	2.944	2.673
185	7.630	7.224	6.656	5.572	3.709	3.617	3.282	3.040	2.772
190	7.773	7.378	6.839	5.828	3.804	3.712	3.376	3.135	2.870
195	7.915	7.532	7.022	6.083	3.900	3.807	3.471	3.231	2.968
200	8.057	7.685	7.205	6.338	3.996	3.902	3.565	3.327	3.066
205	8.199	7.839	7.387	6.594	4.091	3.997	3.659	3.422	3.164
210	8.342	7.992	7.570	6.849	4.187	4.092	3.754	3.518	3.262
215	8.484	8.146	7.753	7.105	4.486	4.187	3.848	3.613	3.361
220	8.626	8.300	7.936	7.360	5.092	4.518	3.942	3.709	3.459
225	8.769	8.453	8.118	7.616	5.698	5.201	4.037	3.804	3.557

Thickness is intumescent only.

Table 6: Hollow Columns 120 Minutes									
Section Factor up to m^{-1}	Thickness (mm) Required for a Design Temperature of								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
47			3.689	2.744	2.035	1.720	1.278	1.278	1.278
50			3.941	3.070	2.298	1.963	1.278	1.278	1.278
55			4.194	3.396	2.561	2.205	1.328	1.278	1.278
60			4.446	3.722	2.824	2.448	1.478	1.278	1.278
65			4.698	4.048	3.087	2.691	1.629	1.358	1.278
70			4.951	4.306	3.350	2.933	1.779	1.457	1.278
75			5.203	4.462	3.613	3.176	1.929	1.556	1.338
80			5.455	4.618	3.876	3.419	2.080	1.655	1.437
85			5.708	4.774	4.139	3.661	2.230	1.753	1.536
90			5.960	4.930	4.347	3.904	2.380	1.852	1.635
95			6.213	5.086	4.518	4.147	2.530	1.951	1.734
100			6.465	5.242	4.689	4.356	2.681	2.050	1.832
105			6.717	5.398	4.859	4.542	2.831	2.149	1.931
110			6.970	5.553	5.030	4.728	2.981	2.248	2.030
115			7.222	5.709	5.201	4.913	3.132	2.346	2.129
120			7.474	5.865	5.372	5.099	3.282	2.445	2.228
125			7.727	6.021	5.543	5.285	3.432	2.544	2.327
130			7.979	6.177	5.714	5.471	3.583	2.643	2.425
135			8.232	6.333	5.885	5.657	3.733	2.742	2.524
140			8.484	6.489	6.056	5.843	3.883	2.841	2.623
145			8.736	6.645	6.227	6.029	4.034	2.939	2.722
150			8.989	6.800	6.398	6.215	4.184	3.038	2.821
155				6.956	6.569	6.401	4.421	3.137	2.920
160				7.112	6.740	6.587	4.715	3.236	3.018
165				7.268	6.911	6.773	5.010	3.335	3.117
170				7.424	7.082	6.959	5.304	3.434	3.216
175				7.580	7.253	7.145	5.598	3.532	3.315
180				7.736	7.424	7.331	5.893	3.631	3.414
185				7.892	7.595	7.517	6.187	3.730	3.513
190				8.048	7.766	7.703	6.482	3.829	3.611
195				8.203	7.937	7.889	6.776	3.928	3.710
200				8.359	8.108	8.075	7.071	4.027	3.809
205				8.515	8.279	8.261	7.365	4.125	3.908
210				8.671	8.450	8.447	7.660	4.224	4.007
215				8.827	8.621	8.620	7.954	5.186	4.106
220				8.983	8.792	8.770	8.248	6.364	4.204
225					8.963	8.950	8.543	7.542	4.303

Thickness is intumescent only.