

European Technical Assessment

ETA 18/0645
Version 01
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UBAtc Assessment Operator:
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Technical Assessment Body issuing the European Technical Assessment: UBAtc.
UBAtc has been designated according to Article 29 of Regulation (EU) No 305/2011
and is member of EOTA (European Organisation for Technical Assessment)

Trade name of the construction product:

PROMATECT®-XS

Product family to which the construction product belongs:

35 - Fire Protective board

Manufacturer:

ETEX Building Performance nv
Bormstraat 24
B-2830 Tiselt (Belgium)

Manufacturing plant(s):

ETEX Building Performance production plant 08

Website:

www.promat-international.com

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:

European Assessment Document (EAD) EAD 350142-00-1106
(September 2017)

This European Technical Assessment contains:

38 pages, including 2 Annexes, which form an integral part of the document.



**European Organisation
for Technical Assessment**

Legal bases and general conditions

- 1 This European Technical Assessment is issued by UBAtc (Union belge pour l'Agrément technique de la construction, i.e. Belgian Union for technical Approval in construction), in accordance with:
 - Regulation (EU) No 305/2011¹ of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
 - Commission Implementing Regulation (EU) No 1062/2013² of 30 October 2013 on the format of the European Technical Assessment for construction products
 - European Assessment Document (EAD): EAD 350142-00-1106
- 2 Under the provisions of Regulation (EU) No 305/2011, UBAtc is not authorized to check whether the provisions of this European Technical Assessment are met once the ETA has been issued.
- 3 The responsibility for the conformity of the performances of the products with this European Technical Assessment and the suitability of the products for the intended use remains with the holder of the European Technical Assessment.
- 4 Depending on the applicable Assessment and verification of constancy of performance (AVCP) system, (a) notified body(ies) may carry out third-party tasks in the process of assessment and verification of constancy of performance under this Regulation once the European Technical Assessment has been issued.
- 5 This European Technical Assessment allows the manufacturer of the construction product covered by this ETA to draw up a declaration of performance for the construction product.
- 6 CE marking should be affixed to all construction products for which the manufacturer has drawn up a declaration of performance.
- 7 This European Technical Assessment is not to be transferred to other manufacturers, agents of manufacturers, or manufacturing plants other than those indicated on page 1 of this European Technical Assessment.
- 8 The European Technical Assessment holder confirms to guarantee that the product(-s) to which this assessment relates, is/are produced and marketed in accordance with and comply with all applicable legal and regulatory provisions, including, without limitation, national and European legislation on the safety of products and services. The ETA-holder shall notify the UBAtc immediately in writing of any circumstance affecting the aforementioned guarantee. This assessment is issued under the condition that the aforementioned guarantee by the ETA-holder will be continuously observed.
- 9 According to Article 11(6) of Regulation (EU) No 305/2011, when making a construction product available on the market, the manufacturer shall ensure that the product is accompanied by instructions and safety information in a language determined by the Member State concerned which can be easily understood by users. These instructions and safety information should fully correspond with the technical information about the product and its intended use which the manufacturer has submitted to the responsible Technical Assessment Body for the issuing of the European Technical Assessment.
- 10 Pursuant to Article 11(3) of Regulation (EU) No 305/2011, manufacturers shall adequately take into account changes in the product-type and in the applicable harmonised technical specifications. Therefore, when the contents of the issued European Technical Assessment do not any longer correspond to the product-type, the manufacturer should refrain from using this European Technical Assessment as the basis for their declaration of performance.
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- 13 Subject to the application introduced, this European Technical Assessment is issued in English and may be issued by the UBAtc in its official languages. The translations correspond fully to the English reference version circulated in EOTA.
- 14 This European Technical Assessment was first issued by UBAtc on 25 September 2018.

¹ OJEU, L 88 of 2011/04/04

² OJEU, L 289 of 2013/10/31

Technical Provisions

1 Technical description of the product

1.1 General

PROMATECT®-XS is a fire protective board, made of aerated calcium sulphate di-hydrate, reinforcing glass fibres, functional additives and water. The core is reinforced by glass-mat facers on the front and back of the boards.

PROMATECT®-XS exhibits smooth surface finishes on front and back. The core of the board is light blue coloured, whereas the front and back surfaces are off-white coloured.

The board is printed on its back and exhibits square edges on its longitudinal and transversal side.

PROMATECT®-XS is manufactured at ETEX Building Performance production plant 08 (known at UBAtc).

1.2 Dimensions and density

Dimensions and density of the boards are given in Table 1.

Table 1 : Dimensions and density PROMATECT®-XS

Dimensions and density	Tolerances
Apparent density (kg/m ³) : 915	± 8%
Length x width (mm x mm): 2500 x 1200	-5 / +0 mm
Thickness (mm):	
12,7	-0,6 / +0,2 mm
15	± 0,5 mm
18	± 0,5 mm
20	± 0,5 mm
25	± 0,5 mm

Other dimensions (length and width), inferior to the above values, and other thicknesses between the above minimum and maximum thickness, may be available on special request.

1.3 Ancillary products

Ancillary products referred to in this ETA, as a part of installation provisions or in the framework of determining performances (e.g. fire resistance test), are not covered by this ETA and may not be CE-marked on the basis of it.

2 Specification of the intended use(s) in accordance with the applicable EAD

2.1 Intended uses

This ETA covers fire protective PROMATECT®-XS intended for:

- Internal use (EAD 350142-00-1106, type Z₂);
- Internal and semi-exposed use (EAD 350142-00-1106, type Y)

PROMATECT®-XS is a fire protective board, specifically designed for the fire protection of steel elements, such as columns, beams and hollows sections.

PROMATECT®-XS is intended to protect elements or to be used in assemblies as specified in Table 2.

Table 2: Intended use

Protection of	EAD 350142-00-1106 reference
Horizontal membrane protection	Type 1
Vertical membrane protection	Type 2
Load-bearing concrete elements	Type 3
Load-bearing steel elements	Type 4
Load-bearing flat concrete profiled sheet composite elements	Type 5
Load-bearing concrete filled hollow steel columns	Type 6
Load-bearing timber elements	Type 7
Fire separating assemblies with no load-bearing requirements	Type 8
Technical services assemblies in buildings	Type 9
Uses not covered by types 1-9	Type 10

Table 2 shows the possible intended uses of the boards. Not all of these have been assessed in the framework of this ETA with regard to fire resistance performance. This ETA, Annex 2, shows a list of the uses for which fire resistance assessment was carried out. This ETA covers assemblies installed in accordance with the provisions given in this ETA, Annex 2.

With regard to fire resistance performance, the other intended uses may be supported by other means at national level (as specified in the note in this ETA, clause 3.2.2).

The provisions made in this European Technical Assessment are based on an assumed intended working life of at least 25 years, provided that the assembled product is subject to appropriate use and maintenance, in accordance with this ETA.

Indications given regarding the working life cannot be interpreted as a guarantee given by the producer or the UBAtc, but are to be regarded only as a means for choosing the appropriate product(s) in relation to the expected economically reasonable working life of the construction works.

2.2 Assumptions

2.2.1 Manufacturing directives

This European Technical Assessment is issued for PROMATECT®-XS on the basis of agreed data/information, deposited with the UBAtc, which identifies the product that has been assessed. Changes to the product/production process which could result in the deposited data/information being incorrect should be notified to the UBAtc before the changes are introduced.

Raw materials are mixed in a continuous procedure to form a slurry. This slurry is poured on a fibreglass liner and covered by a second liner. The products pass through some rolls to form a long continuous board with the required thickness and width. The first hardening of the slurry occurs while the boards move over the continuous belt. When the boards have sufficiently hardened, the boards are cut to the required length. An identification is printed on each individual board. The boards pass through an oven for curing and drying.

2.2.2 Installation

2.2.2.1 Supporting structure

The distance between supports shall be in accordance with the information provided in the assemblies described in Annex 2 of this ETA.

2.2.2.2 Cutting and machining

The fire protective PROMATECT®-XS shall be cut using the 'score and snap' method as used with plasterboards. No power tools are required to cut the board. When machining the fire protective board, dust extraction shall take place and inhalation of dust shall be avoided.

A safety data sheet is available from the manufacturer upon request.

2.2.2.3 Joints

The realisation of joints in adjacent boards and the use and type of joint filler shall be in accordance with the assemblies described in Annex 2 of this ETA.

2.2.2.4 Mechanical fasteners

Fastening of PROMATECT®-XS boards onto the support structure shall be in accordance with the assembly information provided in Annex 2 of this ETA.

When applied in more than one layer, PROMATECT®-XS boards may be attached to each other by staples. The thinner board shall always be mounted on the thicker board. The joints of boards are arranged with the offset of 500mm to each other.

2.2.2.5 Surface treatment

The PROMATECT®-XS board surface allows for most types of decoration. When applying a surface treatment, the absorption capacity and alkalinity of the boards have to be taken into account.

Assessment of the influence of surface treatment (such as plastering, paints, tiles, wallpaper), on the performance of the PROMATECT®-XS boards, has not been performed in the framework of this ETA.

2.2.2.6 Assembly

The PROMATECT®-XS board shall be applied as specified in the assemblies in this ETA, Annex 2.

2.3 Recommendations

2.3.1 Recommendations on packaging, transport and storage

The boards are delivered on pallets.

PROMATECT®-XS boards shall be horizontally stacked on a flat surface, in a dry and well-ventilated space.

The boards shall always be manipulated from the stack by 2 persons and then be transported vertically.

2.3.2 Recommendations on use, maintenance and repair

Future modifications to the building should not adversely affect the fire protective properties of the system in which PROMATECT®-XS boards are used. Care should be taken to prevent any reduction of fire performance as a result of increased applied load to protected elements of the works (e.g. beams, columns, ceilings, floors, or walls).

The assessment is based on the assumption that damage, for example caused by accidental impact, is repaired. It is further assumed that replacement of components during maintenance/repair will be undertaken using materials specified by the ETA.

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

3.1 Mechanical resistance and stability (BWR1)

This basic requirement for construction works is not relevant for PROMATECT®-XS boards according to EAD 350142-00-1106.

3.2 Safety in case of Fire (BWR2)

3.2.1 Reaction to fire

PROMATECT®-XS boards have a reaction to fire classification **A1** according to EN 13501-1.

3.2.2 Fire resistance

The fire resistance of assemblies incorporating PROMATECT®-XS boards have been assessed according to EN 13881-4 as presented in annex 2 of this ETA.

The tested assembly is a boxed protection of structural steel members (intended use type 4 according to Table 2), composed of a single or double layer PROMATECT®-XS fire protective boards. The method for processing the results is the numerical regression assessment method as presented in annex 2 of the ETA.

NOTE: In accordance with EAD 350142-00-1106, until 10 years after the initial issuing of this ETA, or until the withdrawal of relevant national test and classification standards, CE-marking will cover a limited number of assemblies subjected to fire resistance assessment. As time progresses, the performance declaration for fire resistance covered by CE-marking should gradually be enlarged by the ETA-holder and incorporated 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 - his portfolio of test data for this characteristic, based on relevant national standards, next to the performance declaration covered by the CE-marking based on this ETA.

3.3 Hygiene, Health and the environment (BWR3)

3.3.1 Air and/or water permeability

No performance assessed.

3.3.2 Release of dangerous substances

No performance assessed.

3.4 Safety in Use (BWR4)

3.4.1 Flexural strength

The 12,7 mm PROMATECT®-XS boards have a longitudinal modulus of rupture (MOR) of $\geq 12,0$ MPa and a transversal MOR of $\geq 7,0$ MPa (95% confidence level) when tested in accordance with EN 12467.

The 25 mm PROMATECT®-XS boards have a longitudinal modulus of rupture (MOR) of $\geq 6,0$ MPa and a transversal MOR of $\geq 5,0$ MPa (95% confidence level) when tested in accordance with EN 12467.

The PROMATECT®-XS boards have sufficient strength to support their own mass. The PROMATECT®-XS boards are not intended to support additional loads.

3.4.2 Dimensional stability

The PROMATECT®-XS boards, tested in accordance with EN 318, are dimensionally stable.

The manufacturer declares a dimensional stability (EN 318), length:

- 65%RH 20°C to 85%RH 20°C:
 - longitudinal 0,2 mm/m
 - transversal 0,2 mm/m
 - thickness -0,3%
- 65%RH 20°C to 30%RH 20°C:
 - longitudinal -0,4 mm/m
 - transversal -0,3 mm/m
 - Thickness 0,1%

3.4.3 Resistance to impact and eccentric load

No performance assessed.

3.5 Protection against noise (BWR5)

3.5.1 Airborne sound insulation

No performance assessed.

3.5.2 Sound absorption

No performance assessed.

3.5.3 Impact sound insulation

No performance assessed.

3.6 Energy economy and heat retention (BWR6)

3.6.1 Thermal conductivity

No performance assessed.

3.6.2 Water vapour permeability

In accordance with EN ISO 12572, the PROMATECT®-XS boards have a water vapour permeability coefficient μ between 10 (for 25 mm boards) and 13 (for 12,7 mm boards).

3.7 Aspects of durability, serviceability and identification

3.7.1 Durability and serviceability

3.7.1.1 Resistance to deterioration caused by water

This characteristic is not relevant for the intended use Z2 (internal use) and Y (semi exposed). No performance assessed.

3.7.1.2 Resistance to soak/dry

This characteristic is not relevant for the intended use Z2 (internal use) and Y (semi exposed). No performance assessed.

3.7.1.3 Resistance to freeze/thaw

When assessed in accordance with annex D of EAD 350142-00-1106, the PROMATECT®-XS boards are resistant to freeze/thaw cycles.

3.7.1.4 Resistance to heat/rain

This characteristic is not relevant for the intended use Z2 (internal use) and Y (semi exposed). No performance assessed.

3.7.1.5 Basic durability assessment

Product performances confirm a working life of minimum 25 years for the intended uses Z₂ (internal use) and Y (semi exposed) when no more than accidental wetting is expected.

3.7.2 Identification

3.7.2.1 Length, Width (see Table 1)

The width of the PROMATECT®-XS boards is not greater than 1200 mm. The length of the PROMATECT®-XS boards is not greater than 2500 mm.

3.7.2.2 Thickness (see Table 1)

The PROMATECT®-XS boards are available in thicknesses 12 mm, 15 mm, 18 mm, 20 mm and 25 mm.

3.7.2.3 Dimensional tolerances

The tolerances of the PROMATECT®-XS boards on length, width and thickness are given in Table 1).

3.7.2.4 Apparent density

The apparent density of the PROMATECT®-XS boards is $915 \text{ kg/m}^3 \pm 8\%$.

3.7.2.5 Perpendicular tensile strength

The minimum perpendicular tensile strength of PROMATECT®-XS boards, based on testing in accordance with EAD 350142-00-1106 and EN 319 is greater than 0,15x MPa for the 12,7 mm boards and 0,05 MPa for the 25 mm boards.

3.7.2.6 Parallel tensile strength

The longitudinal parallel tensile strength of the PROMATECT®-XS boards, based on testing in accordance with EAD 350142-00-1106 and EN 789 is greater than 3,0 MPa for 12,7 mm boards and 1,5 MPa for 25 mm boards.

The transversal parallel tensile strength of the PROMATECT®-XS boards, based on testing in accordance with EAD 350142-00-1106 and EN 789 is greater than 2,0 MPa for the 12,7 mm boards and 1,0 MPa for the 25 mm boards.

These values are guidance values, and do not reflect a statistical evaluation nor a minimum guaranteed value.

3.7.2.7 Compressive strength

The longitudinal compressive strength of the PROMATECT®-XS boards, based on testing in accordance EAD 350142-00-1106 and EN 789 is greater than 8 MPa for 12,7 mm boards and 7 MPa for 25 mm boards.

The transversal compressive strength of the PROMATECT®-XS boards, based on testing in accordance EAD 350142-00-1106 and EN 789 is greater than 7 MPa for 12,7 mm boards and 6 MPa for 25 mm boards.

These values are guidance values, and do not reflect a statistical evaluation nor a minimum guaranteed value.

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

In accordance with Regulation (EU) N° 305/2011, Article 65, Directive 89/106/EEC is repealed, but references to the repealed Directive shall be construed as references to the Regulation. The system of assessment and verification of constancy of performance, specified in the Decision of the Commission 1999/454/EC of 1999/07/14³, as amended, is specified in the following Table.

Table 3– System of assessment and verification of constancy of performance applicable to PROMATECT®-XS

Product(s)	Intended use(s)	Level(s) or class(es)	Assessment and verification of constancy of performance system(s)*
Fire Protective Products	For fire compartmentation and/or fire protection or fire performance	Any	1

* See Annex V to Regulation (EU) N° 305/2011

In addition, according to the decision 1999/454/EC of 1999/07/14³ of the European Commission, as amended, the systems of assessment and verification of constancy of performance specified in table 4 apply to fire protective products with regard to reaction to fire, as amended, and Commission Delegated Regulation (EU) 2016/364⁴.

Table 4– Systems of assessment and verification of constancy of performance with respect to the reaction to fire

Product(s)	Intended use(s)	Level(s) or class(es)	Assessment and verification of constancy of performance system(s) ^a
Fire Protective Products	For uses subject to regulations on reaction to fire	(A1, A2, B, C)*	1
		(A1, A2, B, C)**, D, E, F	3
		(A1 to F)***, NPD****	4

^a Systems 1, 3 and 4 : See Regulation (EU) N° 305/2011, Annex V
* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material)
** Products/materials not covered by footnote (*)
*** Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of class A1 according to Commission Decision 96/603/EC⁵, as amended)
**** 'No Performance Declared' in accordance with Regulation (EU) N° 305/2011, Article 6(f)

5 Technical details necessary for the implementation of the AVCP system, as foreseen in EAD 350142-00-1106

5.1 Tasks for the ETA-holder

5.1.1 Factory production control (FPC)

The ETA-holder shall exercise permanent internal control of the production. All the elements, requirements and provisions adopted by the ETA-holder shall be documented in a systematic manner in the form of written policies and procedures. This factory production control system shall ensure that production is in conformity with this ETA.

The personnel involved in the production process shall be identified, sufficiently qualified and trained to operate and maintain the production equipment. Machinery equipment shall be regularly maintained and this shall be documented. All processes and procedures of production shall be recorded at regular intervals.

The ETA-holder shall maintain a traceable documentation of the production process from purchasing or delivery of raw or basic raw materials up to the storage and delivery of finished products.

The factory production control system for the product includes relevant design specifications, including adequate drawings and written instructions for:

- type and quality of all materials
- overall dimensions
- packaging and transport protection

The production control system shall specify how the control measures are carried out, and at which frequencies.

ETA-holders which have an FPC system that complies with EN ISO 9001 and that addresses the requirements of this ETA are recognised as satisfying the FPC requirements.

Products that do not comply with requirements as specified in the ETA shall be separated from the conforming products and marked as such. The ETA-holder shall register non-compliant production and action(-s) taken to prevent further non-conformities. External complaints shall also be documented, as well as actions taken.

When materials/products are delivered for incorporation into the production process, verification of conformity with specifications in the quality manual shall take place and be recorded.

If supplied materials/components are not manufactured and tested by the supplier in accordance with agreed methods, or where the ETA-holder purchases materials/components on the open market, then where appropriate, they shall be subject to suitable documented checks/tests by the ETA-holder before acceptance.

³ OJEU L178/52 of 1999/07/14

⁴ OJEU L68/4 of 2016/03/15

⁵ OJEU L267 of 1996/10/19

The characteristics of incoming material and components, for which the supplier demonstrates documented compliance with a product specification, for an intended use that is appropriate for its use as a raw material or component of the product, shall be considered satisfactory and need, except in justified doubt, no further checking, unless the control plan specifies differently.

5.1.2 Testing of samples taken at the factory

5.1.2.1 General

At least the following minimum information shall be recorded:

- date and time of manufacture
- type of product produced (boards)
- material specification (dimensions and thickness)
- all results of the verifications performed within the agreed upon control plan

5.1.2.2 Maintenance, checking and calibration of equipment

All testing equipment shall be maintained, calibrated and/or checked against equipment or test specimens traceable to relevant international or nationally recognised reference test specimens (standards). In case no such reference test specimens exist, the basis used for internal checks and calibration shall be documented.

The ETA-holder shall ensure that handling, preservation and storage of test equipment is such that the performances are maintained

When production is intermittent, the ETA-holder shall ensure that any test equipment which may be affected by the interruption is suitably checked and/or calibrated before use. The calibration of all test equipment shall be repeated if any repair or failure occurs which could upset the calibration of the test equipment.

5.1.2.3 Testing as part of Factory Production Control

Table 5 specifies minimum requirements for testing as part of FPC.

If constituent materials or components are supplied by other manufacturers to the ETA-holder, the supplier shall perform FPC on those constituent materials or components. If that is the case, those suppliers should submit the relevant records to the ETA-holder.

5.2 Initial Type Testing

The assessment tests will have been conducted by the UBAtc or under its responsibility (which may include a proportion conducted by an independent laboratory or by the ETA-applicant, witnessed by the UBAtc). The UBAtc will have assessed the results of these tests in accordance with chapter 3 of this ETA, as part of the ETA issuing procedure.

Table 5 : FPC test plan for PROMATECT®-XS

Property	Minimum frequency
Determination of organic content (reaction to fire)	1 per week ⁶
Determination of dimensional stability at high temperatures (fire resistance)	1 per week
Indirect test method (small oven test) ⁷	1 per year
Dimensional stability	1 per year
Identification	
length, width	1 per day ⁸ , per dimension
Thickness	1 per day, per thickness
apparent density	1 sample per 250 boards
Flexural strength	1 sample per 250 boards

6 Other marking and/or information

Each board shall at least be marked with product name and a traceability code. Each package is marked with the product name, traceability code, thickness of the boards, and dimensions of the boards.

⁶ A week represents 5 production days.

⁷ Production shall be subjected to a small oven test (test performed on one thickness).

⁸ A day represents a 24h time period in which production is considered to be as usual for the production facility concerned.

UBAtc asbl is a non-profit organization according to Belgian law. It is a Technical Assessment Body notified by the Belgian notifying authority, the Federal Public Services Economy, SMEs, Self-Employed and Energy, on 17 July 2013 in the framework of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC and is member of the European Organisation for Technical Assessment, EOTA (www.eota.eu).

This European Technical Assessment has been issued by UBAtc asbl, in Sint-Stevens-Woluwe, on the basis of the technical work carried out by the Assessment Operator, BCCA.

On behalf of UBAtc asbl,



Peter Wouters,
director

On behalf of the Assessment Operator, BCCA, responsible for the technical content of the ETA,



Benny De Blaere,
director general

The most recent version of this European Technical Assessment may be consulted on the UBAtc website (www.ubatc.be).

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Annexes

Annex I: References

Reference number EAD 350142-00-1106

Document title *Fire protective products - Fire protective board, slab and mat products and kits.*

Reference number EN 13501-1:2007+A1:2009

Document title Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests

Reference number EN 13501-2:2016

Document title Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services

Reference number EN 12467:2012

Document title Fibre-cement flat sheets - Product specification and test methods

Reference number EN 318:2002

Document title Wood based panels - Determination of dimensional changes associated with changes in relative humidity

Reference number EN 319:1994

Document title Particleboards and fibreboards - Determination of tensile strength perpendicular to the plane of the board

Reference number EN 789:2004

Document title Timber structures - Test methods - Determination of mechanical properties of wood based panels

Reference number EN ISO 9001:2009

Document title Quality management systems - Requirements (ISO 9001:2008)(+ AC:2009)

Reference number EN 1364-1:2015

Document title Fire resistance tests for non-loadbearing elements - Part 1: Walls

Reference number EN 14195

Document title Metal framing components for gypsum plasterboard systems - Definitions, requirements and test methods

NOTE: The editions of reference documents given above are those which have been adopted by the UBAtc for its specific use when establishing this ETA. When new editions become available, these supersede the editions mentioned only when confirmed by the UBAtc.

Annex II : Fire resistance performances and assembly methods for uses of boards covered by this ETA

A 2.1 Overview of fire resistance performances for PROMATECT®-XS assemblies

Table A2.1					
Assemblies assessed within the framework of this ETA	Classification according to EN 13501-224	Test Standard	Intended use category according to EAD 350142-00-1106	Installation details	Date of addition to this ETA
Single layer 3 sided boxed protection of structural steel members	See annex A2.2	EN 13381-4	Type 4	Annex A2.2	2018-09-25
Single layer 3- or 4-sided boxed protection of structural steel members	See annex A2.3	EN 13381-4	Type 4	Annex A2.3	2018-09-25
Double layer 3- or 4-sided boxed protection of structural steel members	See annex A2.4	EN 13381-4	Type 4	Annex A2.4	2018-09-25

Annex 2.2: Determination of the contribution to the fire resistance of structural steel elements (intended use type 4) by a three sided boxed protection of PROMATECT®-XS boards

A2.2.1 Date of addition to this ETA

This annex was added to ETA 18/0645 on 25 September 2018. This assembly was not covered by this ETA prior to the addition of this annex.

A2.2.2 Classification

The assembly described in this annex has been tested and assessed according to EN 13381-4.

The assessment of the required thickness of PROMATECT®-XS in function of the section factor, the critical temperature of the steel and the exposure time is given in A.2.2.8.

A2.2.3 Fire protection system

The fire protection system is presented in the following clauses. The installation provisions given in paragraph 2.2.2 of this ETA shall be taken into account.

A2.2.3.1 Fire protective board

The fire protective elements are composed of a single layer of PROMATECT®-XS boards with thicknesses of 12,7 mm, 15 mm, 18 mm, 20 mm or 25 mm.

A2.2.3.2 Noggings

Noggings are made of 20 mm PROMATECT®-XS board with a width of 120 mm. The maximum center distance between noggings is 1200 mm

A2.2.3.3 Staples

The boards are connected by using steel staples. The distance between the staples will not be greater than 100 mm.

Board thickness (mm)	Dimensions of staples		
	Length (mm)	Bridge (mm)	Wire dimensions (mm)
12,7	30	5,85	1,27 x 1,05
15	35	10,5	1,45 x 1,30
20	40	10,5	1,45 x 1,30
25	50	10,5	1,45 x 1,30

A2.2.5 Fire resistance

The fire resistance of structural steel members protected with a single layer three sided boxed protection from PROMATECT®-XS may according to EN 13381-4 be determined using the tables in paragraph A2.2.8.

A2.2.6 Field of application

The section factor has to be determined according to figure 1 of EN 13381-4:2013.

The tables in paragraph A2.2.8 are only valid under the conditions mentioned below:

- Three sided protection only
- $65 \text{ m}^{-1} \leq A_m/V \leq 300 \text{ m}^{-1}$ (section factor)
- $11,9 \leq d_p \leq 26,3$ (thickness)
- $350^\circ\text{C} \leq \theta_a \leq 750^\circ\text{C}$

Intermediate values for the critical steel temperature may be interpolated using linear interpolation

A2.2.7 Drawing

Steel beam protection

Detail scale 1/10

Steel section

PROMATECT-XS Noggin
Thickness 20 mm

PROMATECT-XS
12,7, 15, 20, or 25

Staples every 100 mm

STAPLES	
Material	Steel
	Staple dimensions
For PROMATECT®-XS 12.7 boards	Length 30 mm; Bridge 5.85 mm; Wire 1.27x1.05 mm
For PROMATECT®-XS 15 boards	Length 35 mm; Bridge 10.5 mm; Wire 1.45x1.30 mm
For PROMATECT®-XS 20 boards	Length 40 mm; Bridge 10.5 mm; Wire 1.45x1.30 mm
For PROMATECT®-XS 25 boards	Length 50 mm; Bridge 10.5 mm; Wire 1.45x1.30 mm
c.t.c distance	100 mm
Page: 1/1	Subject: Steel beam protection
Promat Research and Technology Centre NV Bormstraat 24 B-2830 Tiselt Tel. : 015/71.82.70 Fax. : 015/71.82.79 Mail : info@prtc.be	Drawing: KDC - NP120 - PTXS Date: 3/11/17 Mod. Date:
	etex innovation and technology centre
	Scale: A3 - 1/15

A2.2.8 Fire resistance

In the following table the following code is applies

- A : PROMATECT®-XS 12,7 mm
- B : PROMATECT®-XS 15 mm
- C : PROMATECT®-XS 18 mm
- D : PROMATECT®-XS 20 mm
- E : PROMATECT®-XS 25 mm

Design table A2.2.8.1 : required board for fire resistance 30 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	A	A	A	A	A	A	A	A	A	A	A	A	A
64,8	A	A	A	A	A	A	A	A	A	A	A	A	A
70	A	A	A	A	A	A	A	A	A	A	A	A	A
80	A	A	A	A	A	A	A	A	A	A	A	A	A
90	A	A	A	A	A	A	A	A	A	A	A	A	A
100	A	A	A	A	A	A	A	A	A	A	A	A	A
110	A	A	A	A	A	A	A	A	A	A	A	A	A
120	A	A	A	A	A	A	A	A	A	A	A	A	A
130	A	A	A	A	A	A	A	A	A	A	A	A	A
140	A	A	A	A	A	A	A	A	A	A	A	A	A
150	A	A	A	A	A	A	A	A	A	A	A	A	A
160	A	A	A	A	A	A	A	A	A	A	A	A	A
170	A	A	A	A	A	A	A	A	A	A	A	A	A
180	A	A	A	A	A	A	A	A	A	A	A	A	A
190	A	A	A	A	A	A	A	A	A	A	A	A	A
200	A	A	A	A	A	A	A	A	A	A	A	A	A
210	A	A	A	A	A	A	A	A	A	A	A	A	A
220	A	A	A	A	A	A	A	A	A	A	A	A	A
230	A	A	A	A	A	A	A	A	A	A	A	A	A
240	A	A	A	A	A	A	A	A	A	A	A	A	A
250	A	A	A	A	A	A	A	A	A	A	A	A	A
260	B	A	A	A	A	A	A	A	A	A	A	A	A
270	B	A	A	A	A	A	A	A	A	A	A	A	A
280	B	A	A	A	A	A	A	A	A	A	A	A	A
290	B	A	A	A	A	A	A	A	A	A	A	A	A
300	B	A	A	A	A	A	A	A	A	A	A	A	A
300,3	B	A	A	A	A	A	A	A	A	A	A	A	A

Design table A2.2.8.2 : required board for fire resistance 45 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	A	A	A	A	A	A	A	A	A	A	A	A	A
64,8	A	A	A	A	A	A	A	A	A	A	A	A	A
70	A	A	A	A	A	A	A	A	A	A	A	A	A
80	A	A	A	A	A	A	A	A	A	A	A	A	A
90	A	A	A	A	A	A	A	A	A	A	A	A	A
100	A	A	A	A	A	A	A	A	A	A	A	A	A
110	A	A	A	A	A	A	A	A	A	A	A	A	A
120	A	A	A	A	A	A	A	A	A	A	A	A	A
130	A	A	A	A	A	A	A	A	A	A	A	A	A
140	B	A	A	A	A	A	A	A	A	A	A	A	A
150	B	A	A	A	A	A	A	A	A	A	A	A	A
160	B	A	A	A	A	A	A	A	A	A	A	A	A
170	B	A	A	A	A	A	A	A	A	A	A	A	A
180	C	B	A	A	A	A	A	A	A	A	A	A	A
190	C	B	A	A	A	A	A	A	A	A	A	A	A
200	C	B	A	A	A	A	A	A	A	A	A	A	A
210	C	B	A	A	A	A	A	A	A	A	A	A	A
220	C	B	A	A	A	A	A	A	A	A	A	A	A
230	C	B	A	A	A	A	A	A	A	A	A	A	A
240	C	B	A	A	A	A	A	A	A	A	A	A	A
250	C	B	A	A	A	A	A	A	A	A	A	A	A
260	C	C	B	A	A	A	A	A	A	A	A	A	A
270	D	C	B	A	A	A	A	A	A	A	A	A	A
280	D	C	B	A	A	A	A	A	A	A	A	A	A
290	D	C	B	A	A	A	A	A	A	A	A	A	A
300	D	C	B	A	A	A	A	A	A	A	A	A	A
300,3	D	C	B	A	A	A	A	A	A	A	A	A	A

Design table A2.2.8.3 : required board for fire resistance 60 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	A	A	A	A	A	A	A	A	A	A	A	A	A
64,8	A	A	A	A	A	A	A	A	A	A	A	A	A
70	A	A	A	A	A	A	A	A	A	A	A	A	A
80	A	A	A	A	A	A	A	A	A	A	A	A	A
90	A	A	A	A	A	A	A	A	A	A	A	A	A
100	B	A	A	A	A	A	A	A	A	A	A	A	A
110	B	A	A	A	A	A	A	A	A	A	A	A	A
120	B	B	A	A	A	A	A	A	A	A	A	A	A
130	C	B	A	A	A	A	A	A	A	A	A	A	A
140	C	B	A	A	A	A	A	A	A	A	A	A	A
150	D	C	B	A	A	A	A	A	A	A	A	A	A
160	D	C	B	B	A	A	A	A	A	A	A	A	A
170	D	C	B	B	A	A	A	A	A	A	A	A	A
180	E	C	B	B	A	A	A	A	A	A	A	A	A
190	E	C	B	B	B	A	A	A	A	A	A	A	A
200	E	C	C	B	B	A	A	A	A	A	A	A	A
210	E	D	C	C	B	A	A	A	A	A	A	A	A
220	E	D	C	C	B	B	A	A	A	A	A	A	A
230	E	D	C	C	B	B	A	A	A	A	A	A	A
240	E	D	C	C	B	B	B	A	A	A	A	A	A
250	E	D	C	C	B	B	B	A	A	A	A	A	A
260	E	D	C	C	C	B	B	A	A	A	A	A	A
270	E	E	C	C	C	B	B	A	A	A	A	A	A
280	E	E	C	C	C	B	B	A	A	A	A	A	A
290	E	E	C	C	C	B	B	B	A	A	A	A	A
300	E	E	D	C	C	B	B	B	A	A	A	A	A
300,3	E	E	D	C	C	B	B	B	A	A	A	A	A

Design table A2.2.8.4 : required board for fire resistance 90 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	B	A	A	A	A	A	A	A	A	A	A	A	A
64,8	B	A	A	A	A	A	A	A	A	A	A	A	A
70	C	B	A	A	A	A	A	A	A	A	A	A	A
80	D	C	A	A	A	A	A	A	A	A	A	A	A
90	E	C	B	B	A	A	A	A	A	A	A	A	A
100	E	D	C	C	B	A	A	A	A	A	A	A	A
110	E	E	C	C	B	B	A	A	A	A	A	A	A
120	-	E	D	C	C	B	B	A	A	A	A	A	A
130	-	E	D	D	C	C	B	B	A	A	A	A	A
140	-	E	E	D	C	C	C	B	B	A	A	A	A
150	-	E	E	E	D	C	C	B	B	B	A	A	A
160	-	E	E	E	D	C	C	C	B	B	B	A	A
170	-	-	E	E	D	C	C	C	C	B	B	A	A
180	-	-	E	E	D	D	C	C	C	B	B	A	A
190	-	-	E	E	E	D	C	C	C	C	B	B	A
200	-	-	E	E	E	D	D	C	C	C	B	B	A
210	-	-	E	E	E	D	D	C	C	C	C	B	A
220	-	-	E	E	E	E	D	C	C	C	C	B	A
230	-	-	E	E	E	E	D	D	C	C	C	B	B
240	-	-	-	E	E	E	D	D	C	C	C	B	B
250	-	-	-	E	E	E	E	D	D	C	C	B	B
260	-	-	-	-	E	E	E	D	D	C	C	B	B
270	-	-	-	-	E	E	E	D	D	C	C	C	B
280	-	-	-	-	E	E	E	D	D	C	C	C	B
290	-	-	-	-	E	E	E	D	D	C	C	C	B
300	-	-	-	-	E	E	E	D	D	D	C	C	B
300,3	-	-	-	-	E	E	E	D	D	D	C	C	B

Design table A2.2.8.5: required board for fire resistance 120 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	E	D	C	C	B	A	A	A	A	A	A	A	A
64,8	E	D	C	C	B	A	A	A	A	A	A	A	A
70	E	E	C	D	C	B	A	A	A	A	A	A	A
80	-	E	D	D	C	C	B	A	A	A	A	A	A
90	-	E	E	E	D	C	C	B	B	A	A	A	A
100	-	-	E	E	D	D	C	C	C	B	B	A	A
110	-	-	E	E	E	D	D	C	C	C	B	A	A
120	-	-	-	-	E	E	D	D	C	C	C	B	A
130	-	-	-	-	E	E	E	D	D	C	C	B	B
140	-	-	-	-	E	E	E	E	D	D	C	C	B
150	-	-	-	-	-	E	E	E	E	D	D	C	B
160	-	-	-	-	-	E	E	E	E	D	D	C	C
170	-	-	-	-	-	-	E	E	E	E	D	C	C
180	-	-	-	-	-	-	E	E	E	E	D	C	C
190	-	-	-	-	-	-	E	E	E	E	E	D	C
200	-	-	-	-	-	-	-	E	E	E	E	D	C
210	-	-	-	-	-	-	-	E	E	E	E	D	C
220	-	-	-	-	-	-	-	E	E	E	E	D	C
230	-	-	-	-	-	-	-	-	E	E	E	D	D
240	-	-	-	-	-	-	-	-	E	E	E	E	D
250	-	-	-	-	-	-	-	-	E	E	E	E	D
260	-	-	-	-	-	-	-	-	E	E	E	E	D
270	-	-	-	-	-	-	-	-	-	E	E	E	D
280	-	-	-	-	-	-	-	-	-	E	E	E	D
290	-	-	-	-	-	-	-	-	-	E	E	E	D
300	-	-	-	-	-	-	-	-	-	E	E	E	D
300,3	-	-	-	-	-	-	-	-	-	E	E	E	D

Design table A2.2.8.6 : required board for fire resistance 150 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	-	-	E	E	D	C	C	B	B	A	A	A	A
64,8	-	-	E	E	D	C	C	B	B	A	A	A	A
70	-	-	E	E	E	D	C	C	B	B	B	A	A
80	-	-	-	-	E	E	D	D	C	C	B	B	A
90	-	-	-	-	E	E	E	E	D	C	C	B	B
100	-	-	-	-	-	-	E	E	E	D	D	C	B
110	-	-	-	-	-	-	E	E	E	E	D	C	C
120	-	-	-	-	-	-	-	E	E	E	E	D	C
130	-	-	-	-	-	-	-	-	E	E	E	D	D
140	-	-	-	-	-	-	-	-	-	E	E	E	D
150	-	-	-	-	-	-	-	-	-	E	E	E	D
160	-	-	-	-	-	-	-	-	-	-	E	E	E
170	-	-	-	-	-	-	-	-	-	-	-	E	E
180	-	-	-	-	-	-	-	-	-	-	-	E	E
190	-	-	-	-	-	-	-	-	-	-	-	E	E
200	-	-	-	-	-	-	-	-	-	-	-	E	E
210	-	-	-	-	-	-	-	-	-	-	-	E	E
220	-	-	-	-	-	-	-	-	-	-	-	-	E
230	-	-	-	-	-	-	-	-	-	-	-	-	E
240	-	-	-	-	-	-	-	-	-	-	-	-	E
250	-	-	-	-	-	-	-	-	-	-	-	-	E
260	-	-	-	-	-	-	-	-	-	-	-	-	E
270	-	-	-	-	-	-	-	-	-	-	-	-	E
280	-	-	-	-	-	-	-	-	-	-	-	-	E
290	-	-	-	-	-	-	-	-	-	-	-	-	-
300	-	-	-	-	-	-	-	-	-	-	-	-	-
300,3	-	-	-	-	-	-	-	-	-	-	-	-	-

Annex 2.3: Determination of the contribution to the fire resistance of structural steel elements (intended use type 4) by a single layer three of four sided boxed protection from PROMATECT®-XS boards

A2.3.1 Date of addition to this ETA

This annex was added to ETA 18/0645 on 25 September 2018. This assembly was not covered by this ETA prior to the addition of this annex.

A2.3.2 Classification

The assembly described in this annex has been tested and assessed according to EN 13381-4.

The assessment of the required thickness of PROMATECT®-XS in function of the section factor, the critical temperature of the steel and the exposure time is given in A.2.3.7.

A2.3.3 Fire protection system

The fire protection system is presented in the following clauses. The installation provisions given in paragraph 2.2.2 of this ETA shall be taken into account.

A2.3.3.1 Fire protective board

The fire protective elements are composed of a single layer of PROMATECT®-XS boards with a thickness of 12,7 mm, 15 mm, 18 mm, 20 mm and 25 mm. The fire protective elements are intended to protect beams or columns.

The board parallel to the flange are between the boards parallel to the web. For the joints on the flanges there is no joint cover.

The joints are not finished.

A2.3.3.2 Noggings

Noggings (or wedge soldiers) are made of 20 mm PROMATECT®-XS board with a width of 120 mm. Maximum center distance between noggings is 1200 mm

A2.3.3.3 Staples

The boards are connected to the noggings or to the other boards by using steel staples. The distance between the staples will not be greater than 100 mm.

Board thickness (mm)	Dimensions of staples		
	Length (mm)	Bridge (mm)	Wire dimensions (mm)
12,7	30	5,85	1,27 x 1,05
15	35	10,5	1,45 x 1,30
20	40	10,5	1,45 x 1,30
25	50	10,5	1,45 x 1,30

A2.3.5 Fire resistance

The fire resistance of structural steel members protected with a single layer three sided boxed protection from PROMATECT®-XS may according to EN 13381-4 be determined using the tables in paragraph A2.3.7.

A2.3.6 Field of application

The section factor has to be determined according to figure 1 of EN 13381-4:2013.

The tables in paragraph A2.3.7 are only valid under the conditions mentioned below :

- $44 \text{ m}^{-1} \leq A_m/V \leq 390,5 \text{ m}^{-1}$ (section factor)
- $11,8 \leq d_p \leq 26,25$ (thickness)
- $350^\circ\text{C} \leq \theta_a \leq 750^\circ\text{C}$

Intermediate values for the critical steel temperature may be interpolated using linear interpolation

A2.3.8 Fire resistance

In the following tables the following code is applies

- A : PROMATECT®-XS 12,7 mm
- B : PROMATECT®-XS 15 mm
- C : PROMATECT®-XS 18 mm
- D : PROMATECT®-XS 20 mm
- E : PROMATECT®-XS 25 mm

Design table A2.3.7.1 : required board for fire resistance 30 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	A	A	A	A	A	A	A	A	A	A	A	A	A
44,1	A	A	A	A	A	A	A	A	A	A	A	A	A
50	A	A	A	A	A	A	A	A	A	A	A	A	A
60	A	A	A	A	A	A	A	A	A	A	A	A	A
70	A	A	A	A	A	A	A	A	A	A	A	A	A
80	A	A	A	A	A	A	A	A	A	A	A	A	A
90	A	A	A	A	A	A	A	A	A	A	A	A	A
100	A	A	A	A	A	A	A	A	A	A	A	A	A
110	A	A	A	A	A	A	A	A	A	A	A	A	A
120	A	A	A	A	A	A	A	A	A	A	A	A	A
130	A	A	A	A	A	A	A	A	A	A	A	A	A
140	A	A	A	A	A	A	A	A	A	A	A	A	A
150	A	A	A	A	A	A	A	A	A	A	A	A	A
160	A	A	A	A	A	A	A	A	A	A	A	A	A
170	A	A	A	A	A	A	A	A	A	A	A	A	A
180	A	A	A	A	A	A	A	A	A	A	A	A	A
190	A	A	A	A	A	A	A	A	A	A	A	A	A
200	A	A	A	A	A	A	A	A	A	A	A	A	A
210	A	A	A	A	A	A	A	A	A	A	A	A	A
220	A	A	A	A	A	A	A	A	A	A	A	A	A
230	A	A	A	A	A	A	A	A	A	A	A	A	A
240	A	A	A	A	A	A	A	A	A	A	A	A	A
250	A	A	A	A	A	A	A	A	A	A	A	A	A
260	A	A	A	A	A	A	A	A	A	A	A	A	A
270	A	A	A	A	A	A	A	A	A	A	A	A	A
280	A	A	A	A	A	A	A	A	A	A	A	A	A
290	A	A	A	A	A	A	A	A	A	A	A	A	A
300	A	A	A	A	A	A	A	A	A	A	A	A	A
310	A	A	A	A	A	A	A	A	A	A	A	A	A
320	A	A	A	A	A	A	A	A	A	A	A	A	A
330	A	A	A	A	A	A	A	A	A	A	A	A	A
340	A	A	A	A	A	A	A	A	A	A	A	A	A
350	A	A	A	A	A	A	A	A	A	A	A	A	A
360	A	A	A	A	A	A	A	A	A	A	A	A	A
370	A	A	A	A	A	A	A	A	A	A	A	A	A
380	B	A	A	A	A	A	A	A	A	A	A	A	A
390	B	A	A	A	A	A	A	A	A	A	A	A	A
390.5	B	A	A	A	A	A	A	A	A	A	A	A	A

Design table A2.3.7.2 : required board for fire resistance 45 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	A	A	A	A	A	A	A	A	A	A	A	A	A
44,1	A	A	A	A	A	A	A	A	A	A	A	A	A
50	A	A	A	A	A	A	A	A	A	A	A	A	A
60	A	A	A	A	A	A	A	A	A	A	A	A	A
70	A	A	A	A	A	A	A	A	A	A	A	A	A
80	A	A	A	A	A	A	A	A	A	A	A	A	A
90	A	A	A	A	A	A	A	A	A	A	A	A	A
100	A	A	A	A	A	A	A	A	A	A	A	A	A
110	B	A	A	A	A	A	A	A	A	A	A	A	A
120	B	A	A	A	A	A	A	A	A	A	A	A	A
130	B	A	A	A	A	A	A	A	A	A	A	A	A
140	B	A	A	A	A	A	A	A	A	A	A	A	A
150	B	A	A	A	A	A	A	A	A	A	A	A	A
160	C	B	A	A	A	A	A	A	A	A	A	A	A
170	C	B	A	A	A	A	A	A	A	A	A	A	A
180	C	B	A	A	A	A	A	A	A	A	A	A	A
190	C	B	A	A	A	A	A	A	A	A	A	A	A
200	C	B	A	A	A	A	A	A	A	A	A	A	A
210	C	B	A	A	A	A	A	A	A	A	A	A	A
220	C	B	A	A	A	A	A	A	A	A	A	A	A
230	C	B	A	A	A	A	A	A	A	A	A	A	A
240	C	B	A	A	A	A	A	A	A	A	A	A	A
250	C	B	B	A	A	A	A	A	A	A	A	A	A
260	C	C	B	A	A	A	A	A	A	A	A	A	A
270	C	C	B	A	A	A	A	A	A	A	A	A	A
280	C	C	B	A	A	A	A	A	A	A	A	A	A
290	C	C	B	A	A	A	A	A	A	A	A	A	A
300	C	C	B	A	A	A	A	A	A	A	A	A	A
310	C	C	B	A	A	A	A	A	A	A	A	A	A
320	C	C	B	A	A	A	A	A	A	A	A	A	A
330	D	C	B	A	A	A	A	A	A	A	A	A	A
340	D	C	B	A	A	A	A	A	A	A	A	A	A
350	D	C	B	A	A	A	A	A	A	A	A	A	A
360	D	C	B	A	A	A	A	A	A	A	A	A	A
370	D	C	B	B	A	A	A	A	A	A	A	A	A
380	D	C	B	B	A	A	A	A	A	A	A	A	A
390	D	C	B	B	A	A	A	A	A	A	A	A	A
390.5	D	C	B	B	A	A	A	A	A	A	A	A	A

Design table A2.3.7.3 : required board for fire resistance 60 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	A	A	A	A	A	A	A	A	A	A	A	A	A
44,1	A	A	A	A	A	A	A	A	A	A	A	A	A
50	A	A	A	A	A	A	A	A	A	A	A	A	A
60	A	A	A	A	A	A	A	A	A	A	A	A	A
70	B	A	A	A	A	A	A	A	A	A	A	A	A
80	C	A	A	A	A	A	A	A	A	A	A	A	A
90	C	B	A	A	A	A	A	A	A	A	A	A	A
100	C	B	A	A	A	A	A	A	A	A	A	A	A
110	C	B	A	A	A	A	A	A	A	A	A	A	A
120	D	C	B	A	A	A	A	A	A	A	A	A	A
130	D	C	B	A	A	A	A	A	A	A	A	A	A
140	D	C	B	A	A	A	A	A	A	A	A	A	A
150	E	C	B	B	A	A	A	A	A	A	A	A	A
160	E	C	C	B	B	A	A	A	A	A	A	A	A
170	E	C	C	B	B	B	A	A	A	A	A	A	A
180	E	D	C	B	B	B	A	A	A	A	A	A	A
190	E	D	C	B	B	B	A	A	A	A	A	A	A
200	E	D	C	B	B	B	A	A	A	A	A	A	A
210	E	D	C	C	B	B	B	A	A	A	A	A	A
220	E	D	C	C	B	B	B	A	A	A	A	A	A
230	E	D	C	C	C	B	B	A	A	A	A	A	A
240	E	D	C	C	C	B	B	B	A	A	A	A	A
250	E	E	C	C	C	B	B	B	A	A	A	A	A
260	E	E	C	C	C	C	B	B	A	A	A	A	A
270	E	E	D	C	C	C	B	B	A	A	A	A	A
280	E	E	D	C	C	C	B	B	A	A	A	A	A
290	E	E	D	C	C	C	B	B	B	A	A	A	A
300	E	E	D	C	C	C	B	B	B	A	A	A	A
310	E	E	D	C	C	C	B	B	B	A	A	A	A
320	E	E	D	C	C	C	C	B	B	A	A	A	A
330	E	E	D	C	C	C	C	B	B	B	A	A	A
340	E	E	D	C	C	C	C	B	B	B	A	A	A
350	E	E	D	C	C	C	C	B	B	B	A	A	A
360	E	E	D	C	C	C	C	B	B	B	A	A	A
370	E	E	D	D	C	C	C	C	B	B	A	A	A
380	E	E	D	D	C	C	C	C	B	B	A	A	A
390	E	E	D	D	C	C	C	C	B	B	A	A	A
390.5	E	E	D	D	C	C	C	C	B	B	A	A	A

Design table A2.3.7.4 : required board for fire resistance 90 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	C	B	A	A	A	A	A	A	A	A	A	A	A
44,1	C	B	A	A	A	A	A	A	A	A	A	A	A
50	D	B	A	A	A	A	A	A	A	A	A	A	A
60	E	C	B	B	A	A	A	A	A	A	A	A	A
70	E	D	C	B	B	A	A	A	A	A	A	A	A
80	E	E	C	B	B	B	A	A	A	A	A	A	A
90	-	E	D	C	C	B	B	A	A	A	A	A	A
100	-	E	D	C	C	C	B	B	A	A	A	A	A
110	-	E	E	C	C	C	C	B	B	A	A	A	A
120	-	E	E	D	C	C	C	C	B	B	A	A	A
130	-	-	E	D	C	C	C	C	B	B	B	A	A
140	-	-	E	E	D	C	C	C	C	B	B	A	A
150	-	-	E	E	D	D	C	C	C	B	B	B	A
160	-	-	E	E	D	D	D	C	C	B	B	B	A
170	-	-	E	E	E	E	D	C	C	C	B	B	A
180	-	-	-	E	E	E	D	D	C	C	C	B	A
190	-	-	-	E	E	E	E	D	D	C	C	B	B
200	-	-	-	E	E	E	E	D	D	D	C	B	B
210	-	-	-	-	E	E	E	E	D	D	C	B	B
220	-	-	-	-	E	E	E	E	D	D	C	C	B
230	-	-	-	-	E	E	E	E	E	D	D	C	B
240	-	-	-	-	E	E	E	E	E	D	D	C	C
250	-	-	-	-	-	E	E	E	E	E	D	C	C
260	-	-	-	-	-	E	E	E	E	E	D	C	C
270	-	-	-	-	-	E	E	E	E	E	D	C	C
280	-	-	-	-	-	-	E	E	E	E	D	C	C
290	-	-	-	-	-	-	E	E	E	E	E	D	C
300	-	-	-	-	-	-	E	E	E	E	E	D	C
310	-	-	-	-	-	-	E	E	E	E	E	D	C
320	-	-	-	-	-	-	E	E	E	E	E	D	C
330	-	-	-	-	-	-	-	E	E	E	E	D	C
340	-	-	-	-	-	-	-	E	E	E	E	D	C
350	-	-	-	-	-	-	-	E	E	E	E	D	C
360	-	-	-	-	-	-	-	E	E	E	E	D	D
370	-	-	-	-	-	-	-	-	E	E	E	E	D
380	-	-	-	-	-	-	-	-	E	E	E	E	D
390	-	-	-	-	-	-	-	-	E	E	E	E	D
390.5	-	-	-	-	-	-	-	-	E	E	E	E	D

Design table A2.3.7.5 : required board for fire resistance 120 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	E	D	C	B	A	A	A	A	A	A	A	A	A
44,1	E	D	C	B	A	A	A	A	A	A	A	A	A
50	-	E	C	B	B	B	A	A	A	A	A	A	A
60	-	E	D	C	C	CC	B	B	A	A	A	A	A
70	-	-	E	D	D	C	C	B	B	B	A	A	A
80	-	-	E	E	E	D	C	C	C	B	B	A	A
90	-	-		E	E	E	D	D	C	C	C	B	A
100	-	-			E	E	E	D	D	C	C	B	B
110	-	-				E	E	E	D	D	C	C	B
120	-	-					E	E	E	D	D	C	B
130	-	-	-	-	-	-	-E	E	E	E	D	C	C
140	-	-	-	-	-	-	-	E	E	E	E	D	C
150	-	-	-	-	-	-	-	E	E	E	E	D	C
160	-	-	-	-	-	-	-	E	E	E	E	D	D
170	-	-	-	-	-	-	-		E	E	E	E	D
180	-	-	-	-	-	-	-			E	E	E	D
190	-	-	-	-	-	-	-			E	E	E	E
200	-	-	-	-	-	-	-				E	E	E
210	-	-	-	-	-	-	-	-	-	-	-	-E	E
220	-	-	-	-	-	-	-	-	-	-	-	-E	E
230	-	-	-	-	-	-	-	-	-	-	-	-E	E
240	-	-	-	-	-	-	-	-	-	-	-	-E	E
250	-	-	-	-	-	-	-	-	-	-	-	-	E
260	-	-	-	-	-	-	-	-	-	-	-	-	E
270	-	-	-	-	-	-	-	-	-	-	-	-	E
280	-	-	-	-	-	-	-	-	-	-	-	-	E
290	-	-	-	-	-	-	-	-	-	-	-	-	E
300	-	-	-	-	-	-	-	-	-	-	-	-	
310	-	-	-	-	-	-	-	-	-	-	-	-	
320	-	-	-	-	-	-	-	-	-	-	-	-	
330	-	-	-	-	-	-	-	-	-	-	-	-	
340	-	-	-	-	-	-	-	-	-	-	-	-	
350	-	-	-	-	-	-	-	-	-	-	-	-	
360	-	-	-	-	-	-	-	-	-	-	-	-	
370	-	-	-	-	-	-	-	-	-	-	-	-	
380	-	-	-	-	-	-	-	-	-	-	-	-	
390	-	-	-	-	-	-	-	-	-	-	-	-	
390.5	-	-	-	-	-	-	-	-	-	-	-	-	

Design table A2.3.7.6 : required board for fire resistance 150 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	-	-	E	C	C	C	B	B	A	A	A	A	A
44,1	-	-	E	C	C	C	B	B	A	A	A	A	A
50	-	-	E	D	D	D	C	C	B	B	A	A	A
60	-	-	-	E	E	E	D	D	C	C	B	B	A
70	-	-	-	-	E	E	E	E	D	C	C	B	B
80	-	-	-	-	-	-	E	E	E	D	D	C	B
90	-	-	-	-	-	-	-	E	E	E	E	D	C
100	-	-	-	-	-	-	-	-	E	E	E	D	C
110	-	-	-	-	-	-	-	-	-	E	E	E	D
120	-	-	-	-	-	-	-	-	-	-	E	E	E
130	-	-	-	-	-	-	-	-	-	-	-	E	E
140	-	-	-	-	-	-	-	-	-	-	-	E	E
150	-	-	-	-	-	-	-	-	-	-	-	-	E
160	-	-	-	-	-	-	-	-	-	-	-	-	E
170	-	-	-	-	-	-	-	-	-	-	-	-	-
180	-	-	-	-	-	-	-	-	-	-	-	-	-
190	-	-	-	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	-	-	-	-	-
240	-	-	-	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	-	-	-	-	-	-
260	-	-	-	-	-	-	-	-	-	-	-	-	-
270	-	-	-	-	-	-	-	-	-	-	-	-	-
280	-	-	-	-	-	-	-	-	-	-	-	-	-
290	-	-	-	-	-	-	-	-	-	-	-	-	-
300	-	-	-	-	-	-	-	-	-	-	-	-	-
310	-	-	-	-	-	-	-	-	-	-	-	-	-
320	-	-	-	-	-	-	-	-	-	-	-	-	-
330	-	-	-	-	-	-	-	-	-	-	-	-	-
340	-	-	-	-	-	-	-	-	-	-	-	-	-
350	-	-	-	-	-	-	-	-	-	-	-	-	-
360	-	-	-	-	-	-	-	-	-	-	-	-	-
370	-	-	-	-	-	-	-	-	-	-	-	-	-
380	-	-	-	-	-	-	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-	-	-	-	-	-	-
390.5	-	-	-	-	-	-	-	-	-	-	-	-	-

Annex 2.4: Determination of the contribution to the fire resistance of structural steel elements (intended use type 4) by a multi-layer three of four sided boxed protection from PROMATECT®-XS boards

A2.4.1 Date of addition to this ETA

This annex was added to ETA 18/0645 on 25 September 2018. This assembly was not covered by this ETA prior to the addition of this annex.

A2.4.2 Classification

The assembly described in this annex has been tested and assessed according to EN 13381-4.

The assessment of the required combination of 2 PROMATECT®-XS boards in function of the section factor, the critical temperature of the steel and the exposure time is given in A.2.4.7.

A2.4.3 Fire protection system

The fire protection system is presented in the following clauses. The installation provisions given in paragraph 2.2.2 of this ETA shall be taken into account.

A2.4.3.1 Fire protective board

The fire protective elements are composed of at least 2 layers of PROMATECT®-XS boards with thicknesses of 12,7 mm, 15 mm, 18 mm, 20 mm or 25 mm. The fire protective elements are intended to protect beams or columns.

The board parallel to the flange are between the boards parallel to the web. For the joints on the flanges there is no joint cover.

The joints are not finished.

A2.4.3.2 Noggings

Noggings (or wedge soldiers) are made of 20 mm PROMATECT®-XS board with a width of 120 mm. Maximum center distance between noggings is 1200 mm

A2.4.3.3 Staples

The boards are connected to the noggings or to the other boards by using steel staples. The distance between the staples will not be greater than 100 mm.

Board thickness (mm)	Dimensions of staples		
	Length (mm)	Bridge (mm)	Wire dimensions (mm)
12,7	30	5,85	1,27 x 1,05
15	35	10,5	1,45 x 1,30
20	40	10,5	1,45 x 1,30
25	50	10,5	1,45 x 1,30

A2.4.5 Fire resistance

The fire resistance of structural steel members protected with a single layer three sided boxed protection from PROMATECT®-XS may according to EN 13381-4 be determined using the tables in paragraph A2.4.7.

A2.4.6 Field of application

The section factor has to be determined according to figure 1 of EN 13381-4:2013.

The tables in paragraph A2.3.7 are only valid under the conditions mentioned below :

- $45 \text{ m}^{-1} \leq A_m/V \leq 380,6 \text{ m}^{-1}$ (section factor)
- $11,75 \leq d_p \leq 47,25$ (thickness)
- $350^\circ\text{C} \leq \theta_o \leq 750^\circ\text{C}$

Intermediate values for the critical steel temperature may be interpolated using linear interpolation

A2.4.7 Fire resistance

In the following tables the following code is applies

- F : PROMATECT®-XS 12,7 mm + PROMATECT®-XS 12,7 mm = nominal thickness of 25,4 mm
- G : PROMATECT®-XS 15 mm + PROMATECT®-XS 12,7 mm = nominal thickness of 27,7 mm
- H : PROMATECT®-XS 15 mm + PROMATECT®-XS 15 mm = nominal thickness of 30 mm
- I : PROMATECT®-XS 18 mm + PROMATECT®-XS 12,7 mm = nominal thickness of 30,7 mm
- J : PROMATECT®-XS 20 mm + PROMATECT®-XS 12,7 mm = nominal thickness of 32,7 mm
- K : PROMATECT®-XS 18 mm + PROMATECT®-XS 15 mm = nominal thickness of 33 mm
- L : PROMATECT®-XS 20 mm + PROMATECT®-XS 15 mm = nominal thickness of 35 mm
- M : PROMATECT®-XS 18 mm + PROMATECT®-XS 18 mm = nominal thickness of 36 mm
- N : PROMATECT®-XS 25 mm + PROMATECT®-XS 12,7 mm = nominal thickness of 37,7 mm
- O : PROMATECT®-XS 20 mm + PROMATECT®-XS 18 mm = nominal thickness of 38 mm
- P : PROMATECT®-XS 20 mm + PROMATECT®-XS 20 mm
- or PROMATECT®-XS 25 mm + PROMATECT®-XS 15 mm = nominal thickness of 40 mm
- Q : PROMATECT®-XS 25 mm + PROMATECT®-XS 18 mm = nominal thickness of 43 mm
- R : PROMATECT®-XS 25 mm + PROMATECT®-XS 20 mm = nominal thickness of 45 mm

Design table A2.4.7.1 : required board combination for fire resistance 30 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	F	F	F	F	F	F	F	F	F	F	F	F	F
45	F	F	F	F	F	F	F	F	F	F	F	F	F
50	F	F	F	F	F	F	F	F	F	F	F	F	F
60	F	F	F	F	F	F	F	F	F	F	F	F	F
70	F	F	F	F	F	F	F	F	F	F	F	F	F
80	F	F	F	F	F	F	F	F	F	F	F	F	F
90	F	F	F	F	F	F	F	F	F	F	F	F	F
100	F	F	F	F	F	F	F	F	F	F	F	F	F
110	F	F	F	F	F	F	F	F	F	F	F	F	F
120	F	F	F	F	F	F	F	F	F	F	F	F	F
130	F	F	F	F	F	F	F	F	F	F	F	F	F
140	F	F	F	F	F	F	F	F	F	F	F	F	F
150	F	F	F	F	F	F	F	F	F	F	F	F	F
160	F	F	F	F	F	F	F	F	F	F	F	F	F
170	F	F	F	F	F	F	F	F	F	F	F	F	F
180	F	F	F	F	F	F	F	F	F	F	F	F	F
190	F	F	F	F	F	F	F	F	F	F	F	F	F
200	F	F	F	F	F	F	F	F	F	F	F	F	F
210	F	F	F	F	F	F	F	F	F	F	F	F	F
220	F	F	F	F	F	F	F	F	F	F	F	F	F
230	F	F	F	F	F	F	F	F	F	F	F	F	F
240	F	F	F	F	F	F	F	F	F	F	F	F	F
250	F	F	F	F	F	F	F	F	F	F	F	F	F
260	F	F	F	F	F	F	F	F	F	F	F	F	F
270	F	F	F	F	F	F	F	F	F	F	F	F	F
280	F	F	F	F	F	F	F	F	F	F	F	F	F
290	F	F	F	F	F	F	F	F	F	F	F	F	F
300	F	F	F	F	F	F	F	F	F	F	F	F	F
310	F	F	F	F	F	F	F	F	F	F	F	F	F
320	F	F	F	F	F	F	F	F	F	F	F	F	F
330	F	F	F	F	F	F	F	F	F	F	F	F	F
340	F	F	F	F	F	F	F	F	F	F	F	F	F
350	F	F	F	F	F	F	F	F	F	F	F	F	F
360	F	F	F	F	F	F	F	F	F	F	F	F	F
370	F	F	F	F	F	F	F	F	F	F	F	F	F
380	F	F	F	F	F	F	F	F	F	F	F	F	F
380.6	F	F	F	F	F	F	F	F	F	F	F	F	F

Design table A2.4.7.2 : required board combination for fire resistance 45 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	F	F	F	F	F	F	F	F	F	F	F	F	F
45	F	F	F	F	F	F	F	F	F	F	F	F	F
50	F	F	F	F	F	F	F	F	F	F	F	F	F
60	F	F	F	F	F	F	F	F	F	F	F	F	F
70	F	F	F	F	F	F	F	F	F	F	F	F	F
80	F	F	F	F	F	F	F	F	F	F	F	F	F
90	F	F	F	F	F	F	F	F	F	F	F	F	F
100	F	F	F	F	F	F	F	F	F	F	F	F	F
110	F	F	F	F	F	F	F	F	F	F	F	F	F
120	F	F	F	F	F	F	F	F	F	F	F	F	F
130	F	F	F	F	F	F	F	F	F	F	F	F	F
140	F	F	F	F	F	F	F	F	F	F	F	F	F
150	F	F	F	F	F	F	F	F	F	F	F	F	F
160	F	F	F	F	F	F	F	F	F	F	F	F	F
170	F	F	F	F	F	F	F	F	F	F	F	F	F
180	F	F	F	F	F	F	F	F	F	F	F	F	F
190	F	F	F	F	F	F	F	F	F	F	F	F	F
200	F	F	F	F	F	F	F	F	F	F	F	F	F
210	F	F	F	F	F	F	F	F	F	F	F	F	F
220	F	F	F	F	F	F	F	F	F	F	F	F	F
230	F	F	F	F	F	F	F	F	F	F	F	F	F
240	F	F	F	F	F	F	F	F	F	F	F	F	F
250	F	F	F	F	F	F	F	F	F	F	F	F	F
260	F	F	F	F	F	F	F	F	F	F	F	F	F
270	F	F	F	F	F	F	F	F	F	F	F	F	F
280	F	F	F	F	F	F	F	F	F	F	F	F	F
290	F	F	F	F	F	F	F	F	F	F	F	F	F
300	F	F	F	F	F	F	F	F	F	F	F	F	F
310	F	F	F	F	F	F	F	F	F	F	F	F	F
320	F	F	F	F	F	F	F	F	F	F	F	F	F
330	F	F	F	F	F	F	F	F	F	F	F	F	F
340	F	F	F	F	F	F	F	F	F	F	F	F	F
350	F	F	F	F	F	F	F	F	F	F	F	F	F
360	F	F	F	F	F	F	F	F	F	F	F	F	F
370	F	F	F	F	F	F	F	F	F	F	F	F	F
380	F	F	F	F	F	F	F	F	F	F	F	F	F
380.6	F	F	F	F	F	F	F	F	F	F	F	F	F

Design table A2.4.7.3 : required board combination for fire resistance 60 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	F	F	F	F	F	F	F	F	F	F	F	F	F
45	F	F	F	F	F	F	F	F	F	F	F	F	F
50	F	F	F	F	F	F	F	F	F	F	F	F	F
60	F	F	F	F	F	F	F	F	F	F	F	F	F
70	F	F	F	F	F	F	F	F	F	F	F	F	F
80	F	F	F	F	F	F	F	F	F	F	F	F	F
90	F	F	F	F	F	F	F	F	F	F	F	F	F
100	F	F	F	F	F	F	F	F	F	F	F	F	F
110	F	F	F	F	F	F	F	F	F	F	F	F	F
120	F	F	F	F	F	F	F	F	F	F	F	F	F
130	F	F	F	F	F	F	F	F	F	F	F	F	F
140	F	F	F	F	F	F	F	F	F	F	F	F	F
150	F	F	F	F	F	F	F	F	F	F	F	F	F
160	F	F	F	F	F	F	F	F	F	F	F	F	F
170	F	F	F	F	F	F	F	F	F	F	F	F	F
180	F	F	F	F	F	F	F	F	F	F	F	F	F
190	F	F	F	F	F	F	F	F	F	F	F	F	F
200	F	F	F	F	F	F	F	F	F	F	F	F	F
210	F	F	F	F	F	F	F	F	F	F	F	F	F
220	F	F	F	F	F	F	F	F	F	F	F	F	F
230	F	F	F	F	F	F	F	F	F	F	F	F	F
240	F	F	F	F	F	F	F	F	F	F	F	F	F
250	F	F	F	F	F	F	F	F	F	F	F	F	F
260	F	F	F	F	F	F	F	F	F	F	F	F	F
270	G	F	F	F	F	F	F	F	F	F	F	F	F
280	G	F	F	F	F	F	F	F	F	F	F	F	F
290	G	F	F	F	F	F	F	F	F	F	F	F	F
300	G	F	F	F	F	F	F	F	F	F	F	F	F
310	G	F	F	F	F	F	F	F	F	F	F	F	F
320	G	F	F	F	F	F	F	F	F	F	F	F	F
330	G	F	F	F	F	F	F	F	F	F	F	F	F
340	G	F	F	F	F	F	F	F	F	F	F	F	F
350	G	F	F	F	F	F	F	F	F	F	F	F	F
360	G	F	F	F	F	F	F	F	F	F	F	F	F
370	G	F	F	F	F	F	F	F	F	F	F	F	F
380	G	F	F	F	F	F	F	F	F	F	F	F	F
380.6	G	F	F	F	F	F	F	F	F	F	F	F	F

Design table A2.4.7.4 : required board combination for fire resistance 90 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	F	F	F	F	F	F	F	F	F	F	F	F	F
45	F	F	F	F	F	F	F	F	F	F	F	F	F
50	F	F	F	F	F	F	F	F	F	F	F	F	F
60	F	F	F	F	F	F	F	F	F	F	F	F	F
70	F	F	F	F	F	F	F	F	F	F	F	F	F
80	F	F	F	F	F	F	F	F	F	F	F	F	F
90	F	F	F	F	F	F	F	F	F	F	F	F	F
100	G	F	F	F	F	F	F	F	F	F	F	F	F
110	G	F	F	F	F	F	F	F	F	F	F	F	F
120	G	F	F	F	F	F	F	F	F	F	F	F	F
130	H	G	F	F	F	F	F	F	F	F	F	F	F
140	H	G	F	F	F	F	F	F	F	F	F	F	F
150	H	G	F	F	F	F	F	F	F	F	F	F	F
160	H	G	G	F	F	F	F	F	F	F	F	F	F
170	I	H	G	F	F	F	F	F	F	F	F	F	F
180	I	H	G	F	F	F	F	F	F	F	F	F	F
190	J	H	G	F	F	F	F	F	F	F	F	F	F
200	J	H	G	G	F	F	F	F	F	F	F	F	F
210	J	H	G	G	F	F	F	F	F	F	F	F	F
220	J	H	G	G	G	F	F	F	F	F	F	F	F
230	J	H	H	G	G	F	F	F	F	F	F	F	F
240	J	I	H	G	G	F	F	F	F	F	F	F	F
250	J	I	H	G	G	G	F	F	F	F	F	F	F
260	J	I	H	G	G	G	F	F	F	F	F	F	F
270	K	I	H	G	G	G	F	F	F	F	F	F	F
280	L	J	H	G	G	G	F	F	F	F	F	F	F
290	L	J	H	G	G	G	F	F	F	F	F	F	F
300	L	J	H	G	G	G	F	F	F	F	F	F	F
310	L	J	H	H	G	G	G	F	F	F	F	F	F
320	L	J	H	H	G	G	G	F	F	F	F	F	F
330	L	J	H	H	G	G	G	F	F	F	F	F	F
340	L	J	H	H	G	G	G	F	F	F	F	F	F
350	L	J	H	H	H	G	G	F	F	F	F	F	F
360	L	J	H	H	H	G	G	G	F	F	F	F	F
370	L	J	H	H	H	G	G	G	F	F	F	F	F
380	L	J	H	H	H	G	G	G	F	F	F	F	F
380.6	L	J	H	H	H	G	G	G	F	F	F	F	F

Design table A2.4.7.5 : required board combination for fire resistance 120 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	F	F	F	F	F	F	F	F	F	F	F	F	F
45	F	F	F	F	F	F	F	F	F	F	F	F	F
50	F	F	F	F	F	F	F	F	F	F	F	F	F
60	G	F	F	F	F	F	F	F	F	F	F	F	F
70	G	G	F	F	F	F	F	F	F	F	F	F	F
80	H	G	F	F	F	F	F	F	F	F	F	F	F
90	J	H	G	F	F	F	F	F	F	F	F	F	F
100	J	H	G	G	G	F	F	F	F	F	F	F	F
110	K	J	H	G	G	G	F	F	F	F	F	F	F
120	L	J	H	H	G	G	G	F	F	F	F	F	F
130	L	J	I	H	H	G	G	G	F	F	F	F	F
140	M	L	J	H	H	H	G	G	F	F	F	F	F
150	M	L	J	H	H	H	G	G	G	F	F	F	F
160	N	L	J	I	H	H	H	G	G	G	F	F	F
170	N	L	J	J	I	H	H	H	G	G	F	F	F
180	N	M	K	J	J	H	H	H	G	G	F	F	F
190	O	M	L	J	J	I	H	H	G	G	G	F	F
200	P	M	L	J	J	I	H	H	H	G	G	F	F
210	P	N	L	J	J	J	H	H	H	G	G	F	F
220	P	N	L	J	J	J	I	H	H	G	G	F	F
230	P	N	L	K	J	J	I	H	H	H	G	F	F
240	P	N	L	K	J	J	I	H	H	H	G	G	F
250	P	N	L	L	K	J	J	I	H	H	G	G	F
260	P	N	M	L	K	J	J	I	H	H	G	G	F
270	Q	N	M	L	L	J	J	I	H	H	G	G	F
280	Q	O	M	L	L	J	J	I	H	H	H	G	F
290	Q	O	M	L	L	K	J	J	H	H	H	G	F
300	Q	P	M	L	L	K	J	J	H	H	H	G	F
310	Q	P	M	L	L	L	J	J	I	H	H	G	F
320	Q	P	N	L	L	L	J	J	I	H	H	G	F
330	Q	P	N	L	L	L	J	J	I	H	H	G	G
340	Q	P	N	L	L	L	J	J	I	H	H	G	G
350	Q	P	N	L	L	L	J	J	I	H	H	G	G
360	Q	P	N	L	L	L	J	J	I	H	H	G	G
370	Q	P	N	L	L	L	J	J	J	I	H	G	G
380	Q	P	N	M	L	L	J	J	J	I	H	G	G
380.6	Q	P	N	M	L	L	J	J	J	I	H	G	G

Design table A2.4.7.6 : required board combination for fire resistance 150 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	G	F	F	F	F	F	F	F	F	F	F	F	F
45	G	F	F	F	F	F	F	F	F	F	F	F	F
50	H	G	F	F	F	F	F	F	F	F	F	F	F
60	I	H	G	F	F	F	F	F	F	F	F	F	F
70	J	J	H	G	G	G	F	F	F	F	F	F	F
80	L	K	I	H	H	H	G	G	F	F	F	F	F
90	N	L	J	I	I	H	H	G	G	F	F	F	F
100	P	M	L	J	J	I	H	H	G	G	G	F	F
110	P	N	L	K	J	J	I	H	H	G	G	F	F
120	Q	O	M	L	L	J	J	I	H	H	G	G	F
130	Q	P	N	L	L	L	J	J	I	H	H	G	F
140	Q	P	N	M	L	L	K	J	J	I	H	G	G
150	Q	Q	O	M	M	L	L	J	J	I	H	H	G
160	R	Q	P	N	N	M	L	L	J	J	I	H	G
170	R	Q	P	N	N	M	L	L	J	J	I	H	G
180	R	Q	P	N	N	M	L	L	K	J	J	H	G
190	R	Q	P	O	N	N	M	L	L	J	J	H	H
200	-	Q	Q	P	O	N	M	L	L	K	J	H	H
210	-	Q	Q	P	P	N	M	M	L	L	J	I	H
220	-	R	Q	P	P	N	N	M	L	L	J	I	H
230	-	R	Q	P	P	O	N	M	L	L	J	J	H
240	-	R	Q	P	P	P	N	M	L	L	K	J	H
250	-	R	Q	P	P	P	N	N	L	L	L	J	H
260	-	R	Q	P	P	P	N	N	M	L	L	J	H
270	-	R	Q	Q	P	P	N	N	M	L	L	J	H
280	-	R	Q	Q	P	P	N	N	M	L	L	J	I
290	-	-	Q	Q	Q	P	O	N	M	L	L	J	I
300	-	-	Q	Q	Q	P	O	N	M	M	L	J	I
310	-	-	Q	Q	Q	P	P	N	N	M	L	J	I
320	-	-	Q	Q	Q	P	P	N	N	M	L	J	J
330	-	-	R	Q	Q	P	P	N	N	M	L	J	J
340	-	-	R	Q	Q	P	P	O	N	M	L	K	J
350	-	-	R	Q	Q	Q	P	O	N	M	L	K	J
360	-	-	R	Q	Q	Q	P	O	N	M	L	K	J
370	-	-	R	Q	Q	Q	P	P	N	M	L	L	J
380	-	-	R	Q	Q	Q	P	P	N	N	L	L	J
380.6	-	-	R	Q	Q	Q	P	P	N	N	L	L	J

Design table A2.4.7.7 : required board combination for fire resistance 180 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	J	H	G	F	F	F	F	F	F	F	F	F	F
45	J	H	G	F	F	F	F	F	F	F	F	F	F
50	L	J	H	G	G	F	F	F	F	F	F	F	F
60	N	L	J	H	H	H	G	G	F	F	F	F	F
70	P	N	L	J	J	J	H	H	G	G	G	F	F
80	Q	P	N	L	L	L	J	J	H	H	G	G	F
90	Q	Q	O	N	M	L	L	K	J	I	H	G	G
100	R	Q	P	N	N	N	L	L	K	J	J	H	G
110	-	R	Q	P	P	N	N	M	L	L	J	I	H
120		R	Q	P	P	P	N	N	L	L	K	J	H
130		-	Q	Q	Q	P	O	N	M	L	L	J	I
140			R	Q	Q	Q	P	O	N	M	L	J	J
150			R	Q	Q	Q	P	P	N	N	M	L	J
160			R	Q	Q	Q	P	P	N	N	M	L	J
170			-	R	Q	Q	P	P	P	N	M	L	J
180				R	R	Q	Q	P	P	O	N	L	K
190				R	R	Q	Q	Q	P	P	N	M	L
200				R	R	R	Q	Q	P	P	N	M	L
210				R	R	R	Q	Q	P	P	O	M	L
220				-	R	R	Q	Q	Q	P	P	N	L
230					-	R	Q	Q	Q	P	P	N	L
240						R	Q	Q	Q	P	P	N	L
250						R	R	Q	Q	Q	P	N	L
260						R	R	Q	Q	Q	P	N	M
270						-	R	Q	Q	Q	P	N	M
280							R	Q	Q	Q	P	N	M
290							R	R	Q	Q	P	N	M
300							R	R	Q	Q	P	O	M
310							R	R	Q	Q	P	O	N
320							R	R	Q	Q	Q	P	N
330							R	R	Q	Q	Q	P	N
340							R	R	Q	Q	Q	P	N
350							R	R	Q	Q	Q	P	N
360							-	R	Q	Q	Q	P	N
370								R	Q	Q	Q	P	N
380								R	Q	Q	Q	P	N
380.6								R	Q	Q	Q	P	N

Design table A2.4.7.8 : required board combination for fire resistance 210 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	M	L	J	H	H	H	G	G	F	F	F	F	F
45	M	L	J	H	H	H	G	G	F	F	F	F	F
50	P	M	L	J	J	I	H	H	G	G	F	F	F
60	Q	P	N	M	L	L	J	J	I	H	H	G	F
70	R	Q	P	O	N	N	M	L	K	J	J	H	G
80	-	R	Q	Q	P	P	N	N	M	L	K	J	H
90	-	-	R	Q	Q	Q	P	P	N	N	L	J	J
100	-	-	-	R	Q	Q	Q	P	P	N	N	L	J
110	-	-	-	R	R	R	Q	Q	P	P	N	M	L
120	-	-	-	-	-	R	Q	Q	Q	P	P	N	L
130	-	-	-	-	-	-	R	Q	Q	Q	P	N	M
140	-	-	-	-	-	-	R	R	Q	Q	P	O	M
150	-	-	-	-	-	-	-	R	Q	Q	Q	P	N
160	-	-	-	-	-	-	-	R	R	Q	Q	P	N
170	-	-	-	-	-	-	-	-	R	R	Q	P	O
180	-	-	-	-	-	-	-	-	R	R	Q	Q	P
190	-	-	-	-	-	-	-	-	R	R	Q	Q	P
200	-	-	-	-	-	-	-	-	-	R	R	Q	P
210	-	-	-	-	-	-	-	-	-	R	R	Q	P
220	-	-	-	-	-	-	-	-	-	-	R	Q	P
230	-	-	-	-	-	-	-	-	-	-	R	Q	P
240	-	-	-	-	-	-	-	-	-	-	R	Q	Q
250	-	-	-	-	-	-	-	-	-	-	R	Q	Q
260	-	-	-	-	-	-	-	-	-	-	R	Q	Q
270	-	-	-	-	-	-	-	-	-	-	-	Q	Q
280	-	-	-	-	-	-	-	-	-	-	-	R	Q
290	-	-	-	-	-	-	-	-	-	-	-	R	Q
300	-	-	-	-	-	-	-	-	-	-	-	R	Q
310	-	-	-	-	-	-	-	-	-	-	-	R	Q
320	-	-	-	-	-	-	-	-	-	-	-	R	Q
330	-	-	-	-	-	-	-	-	-	-	-	R	Q
340	-	-	-	-	-	-	-	-	-	-	-	R	Q
350	-	-	-	-	-	-	-	-	-	-	-	R	Q
360	-	-	-	-	-	-	-	-	-	-	-	R	Q
370	-	-	-	-	-	-	-	-	-	-	-	R	Q
380	-	-	-	-	-	-	-	-	-	-	-	R	Q
380.6	-	-	-	-	-	-	-	-	-	-	-	R	Q

Design table A2.4.7.9 : required board combination for fire resistance 240 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	Q	P	N	L	L	K	J	I	H	H	G	F	F
45	Q	P	N	L	L	K	J	I	H	H	G	F	F
50	R	Q	P	N	N	M	L	K	J	I	H	G	F
60	-	R	Q	Q	P	P	N	N	M	L	L	J	H
70	-	-	-	R	Q	Q	Q	P	P	N	M	L	J
80	-	-	-	-	-	R	Q	Q	Q	P	P	N	L
90	-	-	-	-	-	-	R	R	Q	Q	P	O	M
100	-	-	-	-	-	-	-	-	R	Q	Q	P	N
110	-	-	-	-	-	-	-	-	-	R	Q	Q	P
120	-	-	-	-	-	-	-	-	-	-	R	Q	P
130	-	-	-	-	-	-	-	-	-	-	R	Q	Q
140	-	-	-	-	-	-	-	-	-	-	-	R	Q
150	-	-	-	-	-	-	-	-	-	-	-	R	Q
160	-	-	-	-	-	-	-	-	-	-	-	R	Q
170	-	-	-	-	-	-	-	-	-	-	-	-	Q
180	-	-	-	-	-	-	-	-	-	-	-	-	R
190	-	-	-	-	-	-	-	-	-	-	-	-	R
200	-	-	-	-	-	-	-	-	-	-	-	-	R
210	-	-	-	-	-	-	-	-	-	-	-	-	R
220	-	-	-	-	-	-	-	-	-	-	-	-	R

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Design table A2.4.7.10 : required board combination for fire resistance 270 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	-	R	Q	P	P	N	N	M	L	K	J	H	G
45	-	R	Q	P	P	N	N	M	L	K	J	H	G
50	-	-	R	Q	Q	P	P	N	N	M	L	J	H
60	-	-	-	-	R	R	Q	Q	Q	P	O	M	L
70	-	-	-	-	-	-	-	R	R	Q	Q	P	N
80	-	-	-	-	-	-	-	-	-	-	R	Q	P
90	-	-	-	-	-	-	-	-	-	-	-	R	Q
100	-	-	-	-	-	-	-	-	-	-	-	R	Q
110	-	-	-	-	-	-	-	-	-	-	-	-	R
120	-	-	-	-	-	-	-	-	-	-	-	-	R
130	-	-	-	-	-	-	-	-	-	-	-	-	-
140	-	-	-	-	-	-	-	-	-	-	-	-	-
150	-	-	-	-	-	-	-	-	-	-	-	-	-

Design table A2.4.7.11 : required board combination for fire resistance 300 minutes

Section Factor m ⁻¹	Design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	Board required to maintain the steel temperature below the design temperature												
0	-	-	-	R	Q	Q	Q	P	P	N	N	L	J
45	-	-	-	R	R	Q	Q	P	P	N	N	L	J
50	-	-	-	-	-	R	R	Q	Q	Q	P	N	L
60	-	-	-	-	-	-	-	-	-	R	Q	Q	P
70	-	-	-	-	-	-	-	-	-	-	-	R	Q
80	-	-	-	-	-	-	-	-	-	-	-	-	R
90	-	-	-	-	-	-	-	-	-	-	-	-	-