



**Promat**

# PROMATECT®-XS for structural fire protection of steel structures

## Design guideline







# Contents

<b>Introduction to PROMATECT®-XS</b>	<b>4</b>
Description of PROMATECT®-XS	4
Applications	4
Advantages of PROMATECT®-XS	4
<b>General principles for structural steel protection</b>	<b>5</b>
General	5
European standard	8
Working life and durability	8
ETA - European Technical Assessment	8
DoP - Declaration of Performance	8
Intended use	8
<b>Performance of PROMATECT®-XS for structural steel protection</b>	<b>9</b>
Protective thickness	9
Choice of thicknesses and number of layers	9
Design tables	10



# Introduction to PROMATECT®-XS

Promat is the leading manufacturer of fire resistant materials that offers solutions for passive fire protection of steel structures. The complete solution range of fire protection of steel structures can be delivered by a single supplier. With our support during the design and application you can choose the optimal solution for your project. Safe, economical and peace of mind.

We ensure high fire resistance during the time. Considering the working life foreseen in Eurocodes, our products with high proven durability reduce maintenance costs throughout the designed life of a building. Promat is a large company with strong traditions and long history. We can offer long-term fire safety in your buildings, giving you peace for mind.

Thanks to the synergy between different technologies used in the Etex Group, Promat has developed a new fire protective product called PROMATECT®-XS. It is the outcome of an intense R&D work involving our best internal experts in material science, passive fire protection and manufacturing processes, reinforced by our 50 years of proven track records in delivering durable fire compartmentation solutions to ensure fire safety in buildings.

## Description of PROMATECT®-XS

PROMATECT®-XS is an innovative high performing fire protective board, specifically designed for the fire protection of structural steel elements such as columns, beams in either opened or hollow sections, when high fire protection performance is required.

PROMATECT®-XS can be applied directly on the steel structures, without the need of any secondary substructures like steel angles, clips or other ancillary products.

PROMATECT®-XS is a non-combustible product, based on a unique proven technology, which contributes to the fire rating of steel structures, tested according to the most severe international standards. The degree of fire protection depends on mass factor (S/V) and the required critical design temperature of the metal element. This in turn dictates the thickness of PROMATECT®-XS.

PROMATECT®-XS is strong, highly moisture resistant, non-combustible and has improved workability compared to traditional steel encasement products.

PROMATECT®-XS has a durability of at least 25 years, that is the highest design working life foreseen by the EU regulation, and is extremely easy to maintain and repair (reparation doesn't affect the fire resistance).

Mechanical stability, long durability, easy to cut/apply, good quality of finish and excellent fire behaviour are the main characteristics of PROMATECT®-XS.

PROMATECT®-XS is characterised by very good mechanical properties such as impact resistance, stiffness as well as bending strength and compressive strength.

It does not contain dangerous compounds - it is environmentally friendly and recyclable.

PROMATECT®-XS has square edge.

## Applications

Fire protective board for steel structures (beams and column) with either open or hollow sections, from R30 up to R240

## Advantages of PROMATECT®-XS

- Promat new fire protective board, based on the 50 years Promat experience in steel protection.
- Promat brand + technical support = Peace of mind.
- Extremely good fire performance/system price ratio.
- Outstanding performances for steel protection up to R 240: one of the thinnest board's solution on the market for fire protection.
- Less material to order, less material to stock, less material to install, less material to handle, cut and fix, less waste of material to remove from the jobsite.
- Mass factor up to 390 m<sup>-1</sup> and critical temperatures from 350°C up to 750 °C.
- Fully incombustible with a reaction to fire class A1 according EN 13501-1.
- High durability (25 years) for internal and external semi exposed applications.
- CE marked as fire protective board (intended use: fire resistance) according EAD 350142-00-1106 (former ETAG 018-4), under full ETA certification.
- Tests carried out by official laboratories with random product selection, manufacturing plant under third party factory production control.
- The steel columns and beams encasement does not require any additional substructure, which significantly increases the efficiency of the solution and reduces the assembly costs.
- Quick and simple installation using staples and wedge soldiers, no steel angles nor metallic clips required.
- Lightweight (5%-7% lighter than alternative boards). The low weight of the system (panels) influences the speed of the executed works and the work comfort.
- Maintenance and repairs system tested and approved in fire condition.

# General principles for structural steel protection

## General

Building Regulations require certain elements of structures to have fire resistance for a specified minimum period of time.

Steel is an increasingly essential building material. It is classified non-combustible without special certification, but structural steel loses a significant portion of its loadbearing capacity when it reaches a temperature of approximately 500-600°C.

Steel structures are designed according to Eurocode 1993, Part 1-2. The results of the static calculations should be used for the design with fire protection measures. One of the most important data is the critical temperature of each element of the steel structure. Critical temperature can vary between 350 and 750°C, depending on the static calculation.

During many actual fire scenarios, temperatures higher than 350°C or even 500°C can be attained within minutes, so a protective material is needed.

The amount of fire protection required to achieve this depends on the following:

### Fire resistance of load-bearing steel constructions

Fire resistance of the structure is indicated by the symbol R and REI for compartment structures. This is often achieved by protecting with fire protective systems. The fire protective system shall be tested according to the EN 13381 series by an accredited laboratory. The results of standardized tests should be used to develop a classification report or an assessment according to EN 13501-2. Dimensioning tables are part of the classification, which list the necessary thickness of the fire protective material. Contractor of the fire construction must apply the appropriate thickness of the correct fire protective material according to the dimensioning tables. To determine the proper thickness of the material the following input data is required:



### Determine the material and configuration of the fire protection measures (boxed or profiled configuration)

Boxed configuration is typical for fire protective cladding. It provides reliable fire protection of load-bearing structures and a good deal of construction details. The thickness of the used material is easy to control on the front of the boxes. The surface can be aesthetically adjusted. Required tests according to EN 13381-4.

### Fire resistance rate (e.g. R 90)

The fire protection rate of structure must be specified in the project. WARNING: Applicator who applies the fire protective material must have the basic information of the required characteristics for each case: fire resistance rate and design temperature.

### Information about requested thermal stresses on the time / temperature curve (e.g. ISO 834)

In the fire resistance test the structure exposed to thermal stress by fire of the chosen scenario. The common structures are tested according to the standard temperature/time curve (often called as ISO 834 curve). Unless stated otherwise, all information in this handbook is valid for the standard curve ISO 834. More fire scenarios exist for other uses. The tests for the petrochemical industry are carried out according to the hydrocarbon curve (HC) or the modified hydrocarbon curve (MHC). There are several other types of curves for the protection of tunnel structures. For these requirements contact the local Promat office.

### Design temperature (e.g. 500°C)

The load-bearing properties of the structural steel are temperature dependent. Reaching the critical temperature of the support element threatens its capacity. Design temperature can never be higher than the calculated critical temperature of the steel member. The results of static calculations according to Eurocodes should be used for determining the design temperature. Lower design temperature is more demanding and requires higher thickness of protective material. Dimensioning tables may include a number of design temperatures ranging from 350°C to 750°C, according to the EC requirements. Common design temperature is country specific. Please contact your local Promat office for further information.

### Details of all members of steel structures - section type, size, cross-sectional area, open / closed, exposure to fire.

The input data is the source for calculating section factor  $A_p/V$  for each member and determine the thickness of the fire protection.

The geometric shape of the steel section has a great influence on his behaviour under fire conditions. Sections are divided into two groups: • Open sections - no cavities, such as sections I, H, L, T, U, C • Hollow sections - RHS - Rectangular Hollow Sections, SHS - Square Hollow Sections and CHS - Circular Hollow Sections.

### Exposure to fire

Elements of steel structures are often exposed to fire from three or four sides. For example, if a steel beam is protected from the top by a concrete ceiling, it is exposed to the fire from three sides. Some features are only partially exposed to fire, from 1 or 2 sides (assuming that the fire resistance of the ceiling meets at least the required rating). The greater the surface exposed to fire, the faster the member overheats. This physical dependence is taken into account when calculating the section factor  $A_p/V$ .

### Calculation of section factor $A_p/V$

The degree of fire protection depends on the  $A_p/V$  section factor for the steel section. The  $A_p/V$  factor is a function of the area of the steel exposed to the fire and the volume of the steel section. The higher the  $A_p/V$ , the faster the steel section heats up, and so the greater the thickness of fire protection material required. The section factor and critical temperature are the most important factors used determine the thickness of protection required.

The section factor is defined as the surface area of the member per unit length  $A_p$  divided by the volume per unit length  $V$ . It is measured in units of  $m^{-1}$ .

Area exposed to fire  $A_p$  is a multiple of the inner perimeter of the fire protection measures  $U$  and unit length  $L$ .

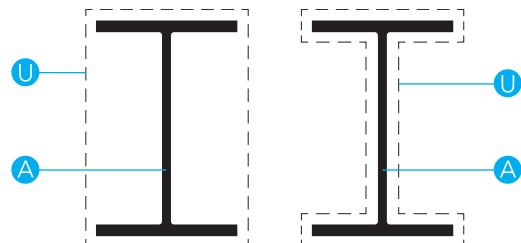
The perimeter is calculated depending on the configuration of the fire protective system. In the case of a boxed configuration the perimeter  $U$  is calculated as the sum of the side lengths of the perfect rectangle described around the steel section. In the case of the profiled configuration perimeter  $U$  is equal to the sprayed surface of the section per unit length  $L$ .

The volume  $V$  of the section is a multiple of the cross section area  $A_{cs}$  and the unit length  $L$ . For the section of the unit length  $L$  the following formula applies:

$$\frac{A_p}{V} = \frac{U \times L}{A_{cs} \times 10^{-6} \times L} = \frac{U}{A_{cs} \times 10^{-6}}$$

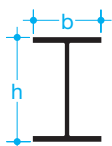
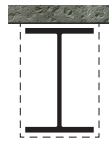
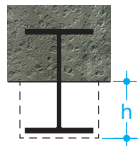
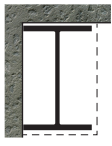

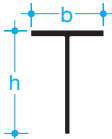
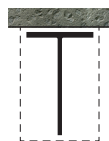
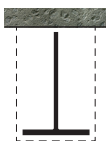

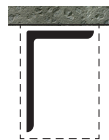
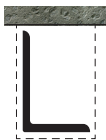
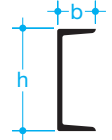

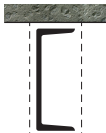
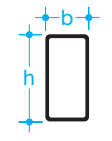
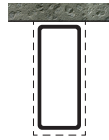
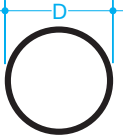
$$A_p [m^2], V [m^3], A_p/V [m^{-1}], U [m], L [m], A_{cs} [mm^2]$$

The section factor  $A_p/V$  is used in older literature as  $U/A$  or  $H_p/V$  etc. It is a different expression of the same quantity. When calculating the area exposed to fire  $A_p$  the number of the exposed sides of the section should be taken into account. Calculation is based on the perimeter  $U$  depending on the configuration (boxed or profiled configuration).



### Various box protection

Various boxed protection configurations with values of perimeter  $U$  for use in the calculation of section factor  $A_p/V$  ( $U/A_{cs}$ )

Steel section	Box protection				
	Four sides	Three sides	Three sides (partially exposed)	Two sides	One side (partially exposed)
I & H sections	 $2b + 2h$	 $b + 2h$	 $b + 2d$	 $b + h$	 $b$
T sections	 $2b + 2h$	 $b + 2h$	 $b + 2h$		
L sections	 $2b + 2h$	 $b + 2h$	 $b + 2h$		
U sections	 $2b + 2h$	 $2b + h$	 $b + 2h$		
Square or rectangular hollow sections	 $2b + 2h$	 $2b + h$			
Circular hollow sections	 $\pi D$	NOTE: The air space created in boxing a circular section improves the insulation and the value of $A_p/V$ . Therefore, $A_p$ higher than profile protection would be anomalous. Hence, the calculated $A_p$ per section length is taken as the circumference of the circular section ( $\pi D$ ) and not $4D$ .			



### European standard

Construction products suitable for fire protection According to the EC Regulation 305/2011 (often referred as "CPR" Construction Product Regulation) construction work must satisfy the basic requirements for construction work for an economically reasonable working life. Therefore, the functionality of the fire protective materials must also be considered in the context of time. Special construction products for fire protection do not have any harmonized European standards. Their assessment follows ETAG 018.

ETAG 018 has four parts (1: General; 2: intumescent paints; 3: rendering(spray); 4: boards). Intended uses are defined differently for the three groups of construction products.

ETAG 018-4 defines the conditions for boards:

- Type X: for all uses (internal, semi-exposed and exposed).
- Type Y: for internal and semi-exposed use.
- Type Z1: for internal use, in high humidity environments.
- Type Z2: for internal use only.

NOTE: Products that meet requirements for type X meet the requirements for all other types. Products that meet requirements for types Y and Z1 also meet the requirements for type Z2.

### Working life and durability

Designed working life for buildings is provided in table 2.1 of Eurocode 1990. For building structures and other common structures, a 50 year is foreseen.

Working life of products is a different matter, as it depends upon its durability, environmental condition and normal maintenance.

The durability of fire protective materials has to be assessed according to ETAG 018 under defined environmental conditions (X, Y, Z1, Z2) and is defined as products' ability to preserve fire performance after ageing therefore it is not the same as "product life". The maximum durability for boards according to the current standard is 25 years and must be proven by specific tests and reported in a specific document called ETA.

### ETA - European Technical Assessment

Test results according to ETAG 018 are used for the assessment of the construction product. European technical assessment carried out by one TAB (Technical Assessment Body) only, should be a member of EOTA (European Organisation for Technical Assessment). A European Technical Assessment (ETA) issued by a TAB is valid across the European economic area. A construction product assessed by an ETA must be CE marked.

### DoP - Declaration of Performance

The manufacturer shall draw for the product a declaration of performance (DoP) described in the CPR. The declaration of performance is the final document for the construction product. It allows free movement of this product on the European market. The declaration of performance shall be provided in the language required by the member state in which the product is made available (CPR Art. 7). Fire resistance of the structure depends on the test assembly (design). The fire resistance of the construction product could be different in each proved system. The fire resistance of the elements of the structure is demonstrated by the tests of accredited testing laboratories and a classification according to the relevant EN standard. The results are shown in the classification protocols or the assessments and not in the declaration of performance which is valid for the construction product only.

### Intended use

The manufacturer has to declare intended use or uses of the construction product in the declaration of performance in accordance with ETAG 018. Use categories related to climatic conditions are defined for outdoor and indoor use (see previous pages for X, Y, Z1, Z2). Use categories related to the element intended to be protected have been divided into 10 product families. Two are defined for the fire protection of steel structures: • Type 1: Fire protective products as a horizontal membrane protection, • Type 4: Fire protective products to protect load-bearing steel elements and Type 5: Load-bearing flat concrete profiled sheet composite elements.





# Performance of PROMATECT®-XS for structural steel protection

### Protective thickness

- The minimal thicknesses of the fire protective material can be found in the following documents:
  - Assessment report from Efectis Nederland, 2017-Efectis-R001834[Rev.1] - May 2018, "Determination of the contribution to the fire resistance of structural steel members by a three sided boxed protection of PROMATECT®-XS boards",
  - Assessment report from Efectis Nederland, 2017-Efectis-R002321[Rev.2] - May 2018, "Determination according to EN 13381-4:2013 of the contribution to the fire resistance of structural steel members by a single layer three or four sided boxed protection from PROMATECT®-XS boards",
  - Assesement report from Efectis Nederland, 2017-Efectis-R002323[Rev.2] - May 2018, "Determination according to EN 13381-4:2013 of the contribution to the fire resistance of structural steel members by a multi-layer layer three or four sided boxed protection from PROMATECT®-XS boards".
- The required thicknesses and number of PROMATECT®-XS cladding to fit the assessment reports and to be installed for 3-sided boxed protection of structural horizontal beams are shown in table 1 to 6.
- The required thicknesses and number of PROMATECT®-XS cladding to fit the assessment reports and to be installed for 4-sided boxed protection of structural vertical column are shown in table 7 to 12.
- Any extrapolation beyond the tables is strictly forbidden for the applicators (Interpolation can be done under specific condition reported in the tests standard).
- "2x15" means 2 layers of PROMATECT®-XS 15mm (total thickness 30 mm),
- "12.7+18" means 1 layer of PROMATECT®-XS 12.7mm installed on top of 1 layer or Promatect 18mm (total thickness 30.7 mm),
- "12.7+20" means 1 layer of PROMATECT®-XS 12.7mm installed on top of 1 layer or Promatect 20mm (total thickness 32.7mm),
- "15+18" means 1 layer of PROMATECT®-XS 15mm installed on top of 1 layer or Promatect 18mm (total thickness 33mm),
- "15+20" means 1 layer of PROMATECT®-XS 15mm installed on top of 1 layer or Promatect 20mm (total thickness 35mm),
- "2x 18" means 2 layers of PROMATECT®-XS 18mm (total thickness 36mm),
- "12.7+25" means 1 layer of PROMATECT®-XS 12.7mm installed on top of 1 layer or Promatect 25mm (total thickness 37.7 mm),
- "18+20" means 1 layer of PROMATECT®-XS 18mm installed on top of 1 layer or Promatect 20mm (total thickness 38mm)
- "2x20 or 15+25" means either 2 layers of PROMATECT®-XS 20mm or alternatively 1 layer of PROMATECT®-XS 15mm installed on top of 1 layer or Promatect 25mm (total thickness 40mm),
- "18+25" means 1 layer of PROMATECT®-XS 18mm installed on top of 1 layer or Promatect 25mm (total thickness 43mm),
- "20+25" means 1 layer of PROMATECT®-XS 20mm installed on top of 1 layer or Promatect 25mm (total thickness 45mm),
- "2x 25" means 2 layers of PROMATECT®-XS 25mm (total thickness 50mm),
- "-" means "non applicable".

### Choice of thicknesses and number of layers

- Increasing the thickness of the cladding is allowed from the fire safety point of view.
- The thinner board should always be mounted on the thicker board.
- In tables 1 to 12 below:
  - "12.7" means 1 layer of PROMATECT®-XS 12.7mm,
  - "15" means 1 layer of PROMATECT®-XS 15mm,
  - "18" means 1 layer of PROMATECT®-XS 18mm,
  - "20" means 1 layer of PROMATECT®-XS 20mm,
  - "25" means 1 layer of PROMATECT®-XS 25mm,
  - "2x12.7" means 2 layers of PROMATECT®-XS 12.7mm (total thickness 25.4 mm),
  - "12.7+15" means 1 layer of PROMATECT®-XS 12.7mm installed on top of 1 layer or Promatect 15mm (total thickness 27.7 mm),

### Design tables

**Table 1: Number of layer and thickness of PROMATECT®-XS for 30 minutes fire protection of beams**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
0	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
45 to 370	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
380 to 390	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7

**Table 2: Number of layer and thickness of PROMATECT®-XS for 60 minutes fire protection of beams**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45 to 90	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
100 to 110	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
120 to 140	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
150	20	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
160 to 170	20	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
180	25	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
190	25	18	15	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
200	25	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
210	25	20	18	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
220 to 230	25	20	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7
240 to 250	25	20	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7	12.7
260	25	20	18	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7
270 to 280	25	25	18	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7
290	25	25	18	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7
300	25	25	20	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7
310	25	25	20	18	18	18	15	15	15	12.7	12.7	12.7	12.7
320 to 360	25	25	20	18	18	18	18	15	15	15	12.7	12.7	12.7
370 to 390	25	25	20	20	18	18	18	18	15	15	12.7	12.7	12.7



**Table 3: Number of layer and thickness of PROMATECT®-XS for 90 minutes fire protection of beams**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45 to 60	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
70	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
80	20	18	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
90	25	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
100	25	20	18	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
110	25	25	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7
120	2x12.7	25	20	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7
130	2x15	25	20	20	18	18	15	15	12.7	12.7	12.7	12.7	12.7
140	2x15	25	20	20	18	18	18	15	15	12.7	12.7	12.7	12.7
150	2x15	25	25	25	20	18	18	15	15	15	12.7	12.7	12.7
160	2x15	25	25	25	20	18	18	18	15	15	15	12.7	12.7
170	2x15	2x12.7	25	25	20	18	18	18	18	15	15	12.7	12.7
180	12.7+18	12.7+15	25	25	20	20	18	18	18	15	15	12.7	12.7
190	12.7+20	2x15	25	25	25	20	18	18	18	15	15	15	12.7
200	12.7+20	2x15	25	25	25	20	20	18	18	18	15	15	12.7
210	12.7+20	2x15	25	25	25	20	20	18	18	18	18	15	12.7
220	12.7+20	2x15	25	25	25	25	20	18	18	18	18	15	12.7
230	12.7+20	2x15	25	25	25	25	20	20	18	18	18	15	15
240	12.7+20	2x15	2x12.7	25	25	25	20	20	18	18	18	15	15
250	12.7+20	12.7+18	12.7+15	25	25	25	25	20	20	18	18	15	15
260	12.7+20	12.7+18	12.7+15	2x12.7	25	25	25	20	20	18	18	15	15
270	15+18	12.7+18	12.7+15	2x12.7	25	25	25	20	20	18	18	18	15
280	15+18	12.7+18	12.7+15	12.7+15	25	25	25	20	20	18	18	18	15
290	15+20	12.7+20	2x15	12.7+15	25	25	25	20	20	18	18	18	15
300	15+20	12.7+20	2x15	12.7+15	25	25	25	20	20	20	18	18	15
310	15+20	12.7+20	2x15	12.7+15	12.7+15	12.7+15	25	25	25	25	25	20	18
320	15+20	12.7+20	2x15	2x15	12.7+15	12.7+15	25	25	25	25	25	20	18
330 to 340	15+20	12.7+20	2x15	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25	20	18
350	15+20	12.7+20	2x15	2x15	12.7+15	12.7+15	12.7+15	25	25	25	25	20	18
360	15+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	25	25	25	25	20	20
370 to 380	15+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25	20

**Table 4: Number of layer and thickness of PROMATECT®-XS for 120 minutes fire protection of beams**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45 to 60	25	20	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
70	25	25	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7
80	2x15	25	20	20	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7
90	12.7+18	25	25	25	20	18	18	15	15	12.7	12.7	12.7	12.7
100	12.7+20	2x15	25	25	20	20	18	18	18	15	15	12.7	12.7
110	15+18	12.7+18	25	25	25	20	20	18	18	18	15	12.7	12.7
120	15+20	12.7+20	12.7+15	2x12.7	25	25	20	20	18	18	18	15	12.7
130	15+20	12.7+20	12.7+18	2x15	25	25	25	20	20	18	18	15	15
140	2x18	15+18	12.7+20	2x15	25	25	25	25	20	20	18	18	15
150	2x18	15+20	12.7+20	2x15	2x12.7	25	25	25	25	20	18	18	15
160	12.7+25	15+20	12.7+20	12.7+18	12.7+15	25	25	25	25	20	20	18	18
170	12.7+25	15+20	12.7+20	12.7+18	12.7+18	2x15	25	25	25	25	20	18	18
180	12.7+25	15+20	15+18	12.7+20	12.7+18	2x15	25	25	25	25	20	18	18
190	18+20	2x18	15+20	12.7+20	12.7+20	12.7+18	25	25	25	25	25	20	18
200	2x20 or 15+25	2x18	15+20	12.7+20	12.7+20	12.7+18	2x12.7	25	25	25	25	20	18
210 to 220	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	12.7+15	25	25	25	25	20	18
230	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	12.7+18	2x15	25	25	25	20	20
240	2x20 or 15+25	12.7+25	15+20	15+18	12.7+20	12.7+20	12.7+18	2x15	25	25	25	25	20
250	2x20 or 15+25	12.7+25	15+20	15+20	12.7+20	12.7+20	12.7+20	2x15	25	25	25	25	20
260	2x20 or 15+25	12.7+25	2x18	15+20	15+18	12.7+20	12.7+20	12.7+18	25	25	25	25	20
270	18+25	12.7+25	2x18	15+20	15+20	12.7+20	12.7+20	12.7+18	2x12.7	25	25	25	20
280	18+25	18+20	2x18	15+20	15+20	12.7+20	12.7+20	12.7+18	12.7+15	25	25	25	20
290	18+25	18+20	2x18	15+20	15+20	12.7+20	12.7+20	12.7+20	12.7+15	25	25	25	20
300	18+25	2x20 or 15+25	2x18	15+20	15+20	15+18	12.7+20	12.7+20	12.7+15	25	25	25	20
310	18+25	2x20 or 15+25	2x18	15+20	15+20	15+18	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	2x12.7
320 to 330	18+25	2x20 or 15+25	12.7+25	15+20	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	2x12.7
340 to 380	18+25	2x20 or 15+25	12.7+25	15+20	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	12.7+15
390	-	-	-	-	-	-	-	-	-	-	-	-	-



**Table 5: Number of layer and thickness of PROMATECT®-XS for 180 minutes fire protection of beams**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45	15+18	12.7+18	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25	25	25	25
60	12.7+25	15+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25
70	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	2x15	2x15	12.7+15	12.7+15	12.7+15	25	25
80	18+25	2x20 or 15+25	12.7+25	15+20	15+20	15+20	12.7+20	12.7+20	2x15	2x15	12.7+15	12.7+15	25
90	18+25	18+25	18+20	12.7+25	2x18	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	12.7+15	12.7+15
100	20+25	18+25	2x20 or 15+25	12.7+25	12.7+25	12.7+25	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	12.7+15
110	2x25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	2x18	2x18	15+20	15+20	12.7+20	2x15	2x15
120	2x25	20+25	18+25	2x20 or 15+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	15+20	15+20	15+18	12.7+20	2x15
130	-	20+25	18+25	18+25	18+25	2x20 or 15+25	18+20	12.7+25	2x18	15+20	15+20	12.7+20	2x15
140	-	2x25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	2x18	15+20	12.7+20	12.7+18
150	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	15+20	15+20	12.7+20
160	-	-	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	2x18	15+20	12.7+20
170	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	15+20	12.7+20
180	-	-	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	18+20	12.7+25	15+20	15+18
190	-	-	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20	15+20
200	-	-	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	2x18	15+20
210	-	-	2x25	20+25	20+25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	2x18	15+20
220	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	18+20	2x18	15+20
230	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20
240	-	-	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20
250	-	-	-	-	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20
260 to 270	-	-	-	-	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25	2x18
280	-	-	-	-	2x25	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25	2x18
290 to 300	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	12.7+25	2x18
310	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	18+20	2x18
320	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	18+20	12.7+25
330	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25
340 to 360	-	-	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25
370 to 380	-	-	-	-	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25

**Table 6: Number of layer and thickness of PROMATECT®-XS for 240 minutes fire protection of beams**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45	18+25	18+25	2x20 or 15+25	12.7+25	2x18	2x18	15+20	15+18	12.7+20	12.7+18	2x15	12.7+15	25,0
60	2x25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	2x18	15+20	15+18	12.7+20	2x15
70	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	18+20	12.7+25	2x18	15+20	12.7+20
80	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	2x18	15+20
90	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	18+20	2x18
100	-	-	-	-	-	-	2x25	2x25	20+25	18+25	18+25	2x20 or 15+25	12.7+25
110	-	-	-	-	-	-	-	-	20+25	20+25	18+25	18+25	2x20 or 15+25
120	-	-	-	-	-	-	-	-	2x25	2x25	20+25	18+25	2x20 or 15+25
130	-	-	-	-	-	-	-	-	2x25	2x25	20+25	18+25	18+25
140 to 160	-	-	-	-	-	-	-	-	-	-	2x25	20+25	18+25
170	-	-	-	-	-	-	-	-	-	-	-	2x25	18+25
180 to 220	-	-	-	-	-	-	-	-	-	-	-	2x25	20+25
230 to 330	-	-	-	-	-	-	-	-	-	-	-	-	2x25



**Table 7: Number of layer and thickness of PROMATECT®-XS for 30 minutes fire protection of columns**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	350	400	450	490	500	520	550	570	600	620	650	700	750
45 to 370	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
380 to 390	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7

**Table 8: Number of layer and thickness of PROMATECT®-XS for 60 minutes fire protection of columns**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
	350	400	450	490	500	520	550	570	600	620	650	700	750
45 to 60	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
70	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
80	18	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
90 to 110	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
120 to 140	20	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
150	25	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
160 to 170	25	18	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
180 to 200	25	20	18	15	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7
210 to 220	25	20	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7	12.7
230 to 240	25	20	18	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7
250	25	25	18	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7
260 to 310	25	25	18	18	18	18	15	15	12.7	12.7	12.7	12.7	12.7
320 to 360	25	25	20	18	18	18	18	15	15	15	12.7	12.7	12.7
370 to 390	25	25	20	20	18	18	18	18	15	15	12.7	12.7	12.7

**Table 9: Number of layer and thickness of PROMATECT®-XS for 90 minutes fire protection of columns**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45	20	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
60	25	18	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
70	25	20	18	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
80	25	25	18	15	15	15	12.7	12.7	12.7	12.7	12.7	12.7	12.7
90	25	25	20	18	18	15	15	15	12.7	12.7	12.7	12.7	12.7
100	12.7+15	25	20	18	18	18	15	15	12.7	12.7	12.7	12.7	12.7
110	12.7+15	25	25	20	18	18	18	15	15	15	13	13	13
120	12.7+15	25	25	20	20	18	18	18	15	15	13	13	13
130	2x15	2x12.7	25	20	20	20	18	18	15	15	15	13	13
140	2x15	12.7+15	25	25	25	20	18	18	18	15	15	13	13
150	2x15	12.7+15	25	25	25	20	20	18	18	18	15	15	13
160	2x15	12.7+15	25	25	25	25	20	20	18	18	15	15	13
170	2x15	2x15	25	25	25	25	20	20	18	18	18	15	13
180	12.7+18	2x15	2x12.7	25	25	25	25	20	18	18	18	15	13
190	12.7+20	2x15	12.7+15	25	25	25	25	20	20	18	18	15	15
200	12.7+20	2x15	12.7+15	25	25	25	25	25	20	20	18	18	15
210 to 220	12.7+20	2x15	12.7+15	12.7+15	25	25	25	25	20	20	18	18	15
230	12.7+20	2x15	12.7+15	12.7+15	25	25	25	25	25	20	20	18	15
240	12.7+20	2x15	2x15	12.7+15	25	25	25	25	25	20	20	18	15
250	12.7+20	12.7+18	2x15	12.7+15	2x12.7	25	25	25	25	25	20	18	18
260	12.7+20	12.7+18	2x15	12.7+15	12.7+15	25	25	25	25	25	20	18	18
270	15+18	12.7+18	2x15	12.7+15	12.7+15	25	25	25	25	25	20	18	18
280	15+18	12.7+18	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25	20	18	18
290 to 310	15+20	12.7+20	2x15	12.7+15	12.7+15	12.7+15	25	25	25	25	25	20	18
320	15+20	12.7+20	2x15	2x15	12.7+15	12.7+15	25	25	25	25	25	20	18
330 to 240	15+20	12.7+20	2x15	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25	20	18
350	15+20	12.7+20	2x15	2x15	12.7+15	12.7+15	12.7+15	25	25	25	25	20	18
360	15+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	25	25	25	25	20	20
370 to 380	15+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	2x12.7	25	25	25	25	20
390	-	-	-	-	-	-	-	-	25	25	25	25	20

**Table 10: Number of layer and thickness of PROMATECT®-XS for 120 minutes fire protection of columns**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45	25	25	18,0	15,0	15,0	15,0	12,7	12,7	12,7	12,7	12,7	12,7	12,7
60	12.7+15	25	20	18,0	18,0	18,0	15,0	15,0	12,7	12,7	12,7	12,7	12,7
70	12.7+15	2x12.7	25	20	20	18,0	18,0	18,0	15,0	15,0	12,7	12,7	12,7
80	2x15	12.7+15	25	25	25	20	18,0	18,0	18,0	15,0	15,0	12,7	12,7
90	12.7+18	2x15	12.7+15	25	25	25	20	20	18,0	18,0	18,0	15,0	12,7
100	12.7+20	2x15	12.7+15	12.7+15	25	25	25	20	20,0	18,0	18,0	15,0	15,0
110	15+18	12.7+18	2x15	12.7+15	25	25	25	25	20	20	18	18	15
120	15+20	12.7+20	2x15	2x15	12.7+15	2x12.7	25	25	25	20	20	18	15
130	15+20	12.7+20	12.7+18	2x15	2x15	12.7+15	25	25	25	25	20	18	18
140	2x18	15+18	12.7+20	2x15	2x15	2x15	2x12.7	25	25	25	25	20	18
150	2x18	15+20	12.7+20	2x15	2x15	2x15	12.7+15	2x12.7	25	25	25	20	18
160	12.7+25	15+20	12.7+20	12.7+18	2x15	2x15	2x15	12.7+15	25	25	25	20	20
170	12.7+25	15+20	12.7+20	12.7+18	12.7+18	2x15	2x15	12.7+15	2x12.7	25	25	25	20
180	12.7+25	15+20	15+18	12.7+20	12.7+18	2x15	2x15	2x15	12.7+15	25	25	25	20
190	18+20	2x18	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	12.7+15	25	25	25
200	2x20 or 15+25	2x18	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	12.7+15	25	25	25
210	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	2x12.7	25	25
220	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	25	25
230	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	12.7+18	2x15	2x15	2x15	12.7+15	25	25
240	2x20 or 15+25	12.7+25	15+20	15+18	12.7+20	12.7+20	12.7+18	2x15	2x15	2x15	12.7+15	25	25
250	2x20 or 15+25	12.7+25	15+20	15+20	12.7+20	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	2x12.7	25
260	2x20 or 15+25	12.7+25	2x18	15+20	15+18	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	12.7+15	25
270	18+25	12.7+25	2x18	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	12.7+15	25
280	18+25	18+20	2x18	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	2x15	12.7+15	25
290	18+25	18+20	2x18	15+20	15+20	12.7+20	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	25
300	18+25	2x20 or 15+25	2x18	15+20	15+20	15+18	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	25
310	18+25	2x20 or 15+25	2x18	15+20	15+20	15+18	12.7+20	12.7+20	2x15	2x15	2x15	12.7+15	2x12.7
320 to 330	18+25	2x20 or 15+25	12.7+25	15+20	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	2x12.7
340 to 380	18+25	2x20 or 15+25	12.7+25	15+20	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	2x15	12.7+15	12.7+15



**Table 11: Number of layer and thickness of PROMATECT®-XS for 180 minutes fire protection of columns**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45	15+18	12.7+18	2x15	12.7+15	12.7+15	2x12.7	25,0	25,0	25,0	25,0	25,0	25,0	25,0
60	12.7+25	15+20	12.7+20	2x15	2x15	2x15	12.7+15	12.7+15	2x12.7	25,0	25,0	25,0	25,0
70	2x20 or 15+25	12.7+25	15+20	12.7+20	12.7+20	12.7+20	2x15	2x15	12.7+15	12.7+15	12.7+15	25,0	25,0
80	18+25	2x20 or 15+25	12.7+25	15+20	15+20	15+20	12.7+20	12.7+20	2x15	2x15	12.7+15	12.7+15	25,0
90	18+25	18+25	18+20	12.7+25	2x18	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	12.7+15	12.7+15
100	20+25	18+25	2x20 or 15+25	12.7+25	12.7+25	12.7+25	15+20	15+20	12.7+20	12.7+20	12.7+18	2x15	12.7+15
110	2x25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	2x18	2x18	15+20	15+20	12.7+20	2x15	2x15
120	2x25	20+25	18+25	2x20 or 15+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	15+20	15+20	15+18	12.7+20	2x15
130	-	20+25	18+25	18+25	18+25	2x20 or 15+25	18+20	12.7+25	2x18	15+20	15+20	12.7+20	2x15
140	-	2x25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	2x18	15+20	12.7+20	12.7+18
150	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	15+20	15+20	12.7+20
160	-	-	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	2x18	15+20	12.7+20
170	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	15+20	12.7+20
180	-	-	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	18+20	12.7+25	15+20	15+18
190	-	-	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20	15+20
200	-	-	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	2x18	15+20
210	-	-	2x25	20+25	20+25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	2x18	15+20
220	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	18+20	2x18	15+20
230	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20
240	-	-	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20
250	-	-	-	-	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	15+20
260 to 270	-	-	-	-	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25	2x18
280	-	-	-	-	2x25	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25	2x18
290 to 300	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	12.7+25	2x18
310	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	18+20	2x18
320	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	18+20	12.7+25
330	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25
340 to 360	-	-	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25
370 to 380	-	-	-	-	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	12.7+25

**Table 12: Number of layer and thickness of PROMATECT®-XS for 240 minutes fire protection of columns**

A/V, m <sup>-1</sup>	design temperature °C												
	350	400	450	490	500	520	550	570	600	620	650	700	750
45	18+25	18+25	2x20 or 15+25	12.7+25	2x18	2x18	15+20	15+18	12.7+20	12.7+18	2x15	12.7+15	25,0
60	2x25	20+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	12.7+25	12.7+25	2x18	15+20	15+18	12.7+20	2x15
70	-	-	2x25	20+25	18+25	18+25	18+25	2x20 or 15+25	18+20	12.7+25	2x18	15+20	12.7+20
80	-	-	-	-	20+25	20+25	18+25	18+25	18+25	2x20 or 15+25	2x20 or 15+25	2x18	15+20
90	-	-	-	-	2x25	2x25	20+25	20+25	18+25	18+25	2x20 or 15+25	18+20	2x18
100	-	-	-	-	-	-	2x25	2x25	20+25	18+25	18+25	2x20 or 15+25	12.7+25
110	-	-	-	-	-	-	-	-	20+25	20+25	18+25	18+25	2x20 or 15+25
120	-	-	-	-	-	-	-	-	2x25	2x25	20+25	18+25	2x20 or 15+25
130	-	-	-	-	-	-	-	-	2x25	2x25	20+25	18+25	18+25
140 to 160	-	-	-	-	-	-	-	-	-	-	2x25	20+25	18+25
170	-	-	-	-	-	-	-	-	-	-	-	2x25	18+25
180 to 220	-	-	-	-	-	-	-	-	-	-	-	2x25	20+25
230 to 330	-	-	-	-	-	-	-	-	-	-	-	-	2x25

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