VTT Expert Services Oy
PL 1001
02044 VTT
Puh. +358 20 722 4911
Telekopio +358 20 722 7003

VTT EXPERT SERVICES OY

Rakennustuotedirektiivin (89/106/EEC) artiklan 10, neuvoston direktiivi 21. joulukuuta 1988, mukaisesti notifioitu tuotehyväksyntälaitos

EOTAN JÄSEN

Eurooppalainen tekninen hyväksyntä ETA-08/0093
European Technical Approval

Kauppanimi:
Trade name

PAROC FireSAFE konsepti
PAROC FireSAFE system

Hyväksynnän haltija:
Holder of approval:

Paroc Group
Energiakuja 3, P.O. Box 240
FI-00181 Helsinki

Tuotetyyppi ja sen käyttötarkoitus:

Generic type and use of construction product:

TERÄSRAKENTEEN PALOSUOJA

FIRE PROTECTION OF LOADBEARING STEEL STRUCTURE

Voimassaoloaika:
Validity from/to

From April 27, 2013 to April 26, 2018

Tämä versio korvaa: This version replaces:

ETA-08/0093 valid from April 28, 2008 to April 27, 2013

Valmistuspaikat:
Manufacturing plants:

Finland: Parainen, Lappeenranta and Oulu
Sweden: Hällekis and Hässleholm
Poland: Trzemeszno
Lithuania: Vilnius

Tämä hyväksyntä sisältää
This European Technical Approval contains

sivuja/liitteitä

15 sivua sisältäen 8 liitesivua

pages/annexes

15 pages including 8 annex pages

Eurooppalainen tekninen hyväksyntäorganisaatio
European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the VTT Expert Services Ltd in accordance with:

   - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Council Directive 93/68/EEC of 22 July 1993[2]; and regulation (EC) Nº 1882/2003 of the European Parliament and of the Council[3];

   -- Laki rakennustuotteiden hyväksynnästä (230/2003) luvut 3 ja 10, Ympäristöministeriön asetus rakennustuotteiden hyväksynnästä 3 § sekä Ympäristöministeriön 18.12.2009 antama valtuutuspäätös (19/629/2009).

   - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC [4];

   - Guideline for European Technical Approval of « Fire protective products, Part 4: Fire protective board, slab and mat products and kits, ETAG 018, edition November 2004.

2. The VTT Expert services Ltd is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant (for example concerning the fulfilment of assumptions made in this European Technical Approval with regard to manufacturing). Nevertheless, the responsibility for the conformity of the products with the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1; or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4. This European Technical Approval may be withdrawn by the VTT Expert services Ltd (pursuant to Article 5 (1) of the Council Directive 89/106/EEC.

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6. The European Technical Approval is issued by VTT Expert services Ltd in English. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities Nº L 40, 11.2.1989, p. 12

2. Official Journal of the European Communities Nº L 220, 30.8.1993, p. 1

3 Official Journal of the European Union Nº L 284, 31.10.2003, p. 25

4 Official Journal of the European Communities Nº L 17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1. Definition of the product and intended use

The PAROC FireSAFE fire protection concept comprises stone wool slabs and two types of alternative fasteners. Fasteners can be steel pins with washers which are welded to the steel construction on which the fire protection mineral wool slabs will be installed. Fasteners can also be spiral spring screws; Paroc XFS 001 Fire springs.

The steel pins are 2,7 mm thick and Cu-coated. The washers attached to the steel pins are 30 mm wide and galvanized. The height of the pins vary according to the thickness of mineral wool slabs both from 20 mm to 60 mm. Paroc XFS 001 Fire springs are made of zinc coated steel rod with diameter 1,6 mm. The external diameter of the spring is 8 mm and the diameter of the top is 15 mm. The length of the spring is selected so that it is at least twice the thickness of the current mineral wool slabs. Width and height of the stone wool slabs are 1200x600 or 1200x900 mm.

The PAROC FPS 17 stone wool slab is CE-marked according to the harmonized product standard EN 13162 with the designation code MW-EN13162-T5-DS(T+)-WS-WL(P)-MU1 and is in the reaction to fire class A1 and thermal conductivity class (lambda declared) 0,041 W/mK. The nominal density of the insulation is 170 kg/m^3 and tolerances are according to the standard EN 13163, thickness – 1%or -1mm/+ 3mm (class T5), length, ± 2%, width ± 1,5 %, squareness ≤ 5 mm/m.

The stone wool slab PAROC FPS 17 might be delivered with a covering of glass fibre tissue or a glass fibre tissue and an aluminium foil. The product is then called PAROC FPS 17t or PAROC FPS 17ta. Also those variants are CE-marked according to the standard EN 13162 with above mentioned designation code and are classified into the reaction to fire class A1.

The **PAROC FireSAFE Fire protection** system is intended to be used as fire protective kit to protect load bearing steel elements (Type 4 use category according to the ETAG 018).

Fire protection is intended for internal and semi exposed use (Type Y in the ETAG 018). In semi exposed use there is no wetting caused by water only temporary condensation.

The fire protection slabs are fastened onto surface of steel beams or columns with the washers and steel pins welded on to the steel beam or column. Alternatively the boards are installed on the steel beams and fastened to each other with the Fire springs.

Any special tightening of joints between mineral wool boards is not needed. It is only about installation of the slabs with tight connection between them.

Examples of the fire protection solutions with fastenings are presented in the Appendix 2.

The provisions made in this ETA are based on an assumed intended working life for a fire protection kit of 25 years provided that the kit is subjected to appropriate use and maintenance. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the approval body, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2. Characteristics of product and assessment

ETAG paragraph	Characteristic	Assessment of the characteristic
	2.1 Mechanical resistance and stability	Not relevant
	2.2 Safety in case of fire	
5.2.1	Reaction to fire (EN 13501-1)	Mineral wool slabs classified as A1 class Mechanical fasteners (steel) classified as A1 class
5.2.2.	Resistance to fire (EN 13501-2 and ENV 13381-4 tests and Annex H calculation)	R30 - R 180 depending on the thickness of mineral wool, steel beam type and temperature limit. (See "PAROC FireSAFE system" in Appendix 1)
	2.3 Hygiene, health and environment	
5.1.3	Water permeability EN 1609 and EN 12087	≤ 1kg/m^2 and ≤ 3 kg/m^2
	Release of dangerous substances	No flame/fire retardants *Other dangerous substances: NPD
	2.4 Safety in use	
5.1.4	Flexural strength of the boards (EN 12089)	300 kPa
	Dimensional stability of the boards (EN 1604**)**	≤ 1%
	Pull-through resistance of the welded fasteners	100 N (taking into account safety factor)
	Pull out resistance of the welded fasteners	40 N (taking into account safety factor)
	Pull out /through of the Fire springs	15 N (taking into account safety factor)
	Shear load resistance of the fastening systems	NPD
	Resistance to soft body impact	NPD
	Resistance to hard body impact	NPD
	Resistance to eccentric load	NPD
	2.5 Protection against noise	
5.1.5	Sound insulation	Not relevant
	2.6 Energy economy and heat retention	
5.1.6	Lambda $_{DECLARED}$ of the mineral wool slabs	0,041 W/mK.
	Water vapour transmission coefficient of the mineral wool slabs	4,6 x 10^{-11} (kg/(m s Pa)) or μ = 4,28
	Water absorption of the slabs ,WS and WL(P)	1 and 3 kg/m^2
5.1.7.1	**2.7 Durability and serviceability**	
	Resistance to deterioration caused by water	**NPD,** Property is not relevant for intended use
	Resistance to soak/dry	**NPD,** Property is not relevant for intended use
	Resistance to freeze/thaw	**NPD,** Property is not relevant for intended use
	Resistance to heat rain	**NPD,** Property is not relevant for intended use
	Basic durability assessment	Product performances confirm working life of 25 years for the intended use Z_2 (internal use) and Y (internal and semi exposed use) without expected wetting
5.1.7.2	**2.8 Identification**	
	Mineral wool properties	MW-EN13162-T5-DS(T+)-WS-WL(P)-MU1
	Fasteners properties:	
	Steel pins	The steel pins are 2,7 mm thick and Cu-coated. The washers attached to the steel pins are 30 mm wide and galvanized.
	Fire springs	Fire springs are 1,6 mm thick steel rod and galvanized
	Properties of other components if any	Not relevant

*In addition of the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products directive, these requirements need also to be compiled with, when and where they apply.

**Note: Fibre lengths and diameters of the mineral wool according to the EUCEB rules.

3. Evaluation of conformity and CE marking

3.1 Attestation of conformity

3.3.1 For fire protective uses

The attestation of conformity applied to this product specified by the European Commission in Decision 1999/454/EC is system 1.

For the initial type testing of the product (see Annex III.1a of the CPD) the tasks of the approved body will be limited to the following characteristics, where relevant:
- Resistance to fire
- Mechanical resistance and stability
- Release of dangerous substances

For the initial inspection of the factory and factory production control (see Annex III.1f of the CPD), and for the continuous surveillance, judgement and assessment of the factory production control (see Annex III.1g of the CPD), parameters related to the following characteristics shall be of interest to the approved body, where relevant:
- Resistance to fire
- Mechanical resistance and stability

3.3.2 For uses subject to reaction to fire regulations

The system of attestation of conformity is specified in the EC decision 99/454/EC, as amended by EC decision 2001/596/EC, is system 1, because mineral wool used in the product is in the system 1 in the CE-marking and is declared to be class A1.

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1 Factory production control

The ETA holder continues to operate a factory production control system. Quality control checks are made on incoming materials, and at regular stages throughout the production sequence to ensure the quality and fitness for use of the components, storage of the products and deliveries to the building site.

Mineral wool is CE-marked and controlled by the manufacturer and notified body according to the standard EN 13162 including properties connected reaction to fire. Also properties mentioned in the table 8.1 of the ETAG 018-4 concerning insulation and fasteners are controlled.

The quality control of the other components includes checking of:
- Dimensions
- Materials quality (incoming materials data sheets)

VTT Expert services Ltd maintains a file (control plan) describing the tasks and tests imposed on ETA holder and the component manufacturers by the approval holder.

The file includes information of the main components, insulation material and fixings. The file include also the type and frequency of the control agreed between VTT Expert Services Ltd and approval holder.

3.2.2 Tasks of the approved bodies

3.2.2.1 Initial type testing of the product

For initial type testing the results of the tests performed as part of the assessment for this European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between VTT Expert Services Ltd and the manufacturer.

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

Assessment of the factory production control system is in the responsibility of the approved body.
An assessment shall be carried out to demonstrate that the factory production control is in conformity with the ETA and any subsidiary information. This assessment shall be based on an initial inspection of the factory.
Continuous surveillance is necessary to ensure continuing conformity with the ETA. Surveillance visits shall be done at least once a year.

3.2.2.3 Certification of conformity

Once ITT and the initial inspection of the FPC system have been performed, and favourable results achieved, the notified certification body shall issue an EC-certification of conformity.

3.3 CE-marking

The CE-marking shall be affixed to each delivery of fire protection system and accompanying commercial documents.

The symbol “CE” shall be accompanied by the following information:

- Identification number of the notified body
- Name of the product: Commercial trade name as indicated in this ETA
- Name of the ETA holder and manufacturer(s) (both/all if they are separate)
- The last two digits of the year in which the CE marking was affixed
- Number of the European Technical Approval
- Number of the ETAG: ETAG 018, part 4, 2004
- Indications to clarify intended use

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

4.1 Manufacturing

All materials of the fire protection kit belonging into the ETA shall be in accordance with the provisions laid down in the European technical Approval. All materials used shall fulfil the criteria given in this ETA.

4.2 Installation and design rules

4.2.1 Design rules

The PAROC FireSAFE, fire protection system, installed into indoor spaces with normal indoor temperature and moisture conditions. See Appendix 3

4.2.2 *Installation*

The fire protection kit will be installed according to the separate installation instructions of the ETA holder "PAROC FireSAFE system".
It is important that all contractors are educated and trained how the insulation shall be erected and installed and in which cases and how the installation can be made without affecting the intended performance of the fire protection.

4.3 Maintenance and repair

The assessment of the fitness for use is based on the assumption that abrasion and minor impact damage are inevitable and shall be easy to repair. In case of damage, repair can be made by changing the current part of the insulation.

On behalf of VTT Expert Services Ltd

Espoo April 27. 2013

Lina Markelin-Rantala
Team Manager

Liisa Rautiainen
Assessment Manager

Dimensioning of the insulation

COLUMNS AND BEAMS

Fire resistance

The bigger volume of steel in relation to exposed area the better fire resistance it has. How quickly the steel structure is heated up at a specified fire exposure can simply be described as the relation between the fire exposed surface and the steel volume of the profile. This relation is called the section factor F/A.

A high section factor gives a quick temperature raise of the steel. This means that slim steel structures demands thicker insulation boards. See Figure 2.

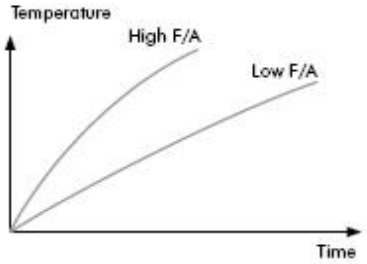


Figure 2

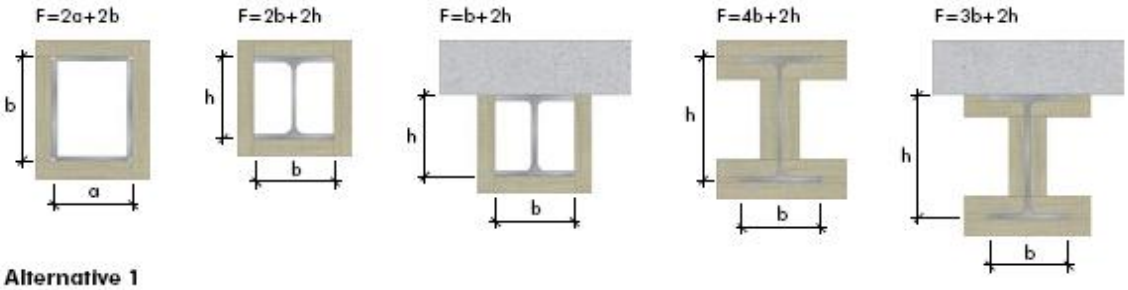
When I profiles has a greater height than 450 mm the insulation shall be installed following the profile. At pictures below you can find the formulas for different profiles and their positions in the building.

Calculation

The simplified dimension tool is based on a more advanced instruction from Assessment report 103203.22 from SINTEF NBL. The approximate method is built on the fact that the steel profile is fully used from statically point of view. Dimensioning can always be done due to the following tool with acceptable safety margins.

Methods

Tests are made according to
EN 13501-2 and ENV 13381-4 and calculations according to ENV 13381-4 Annex H.



Alternative 1

Use the table 1 and 2 to find the fire class and the needed thickness for the most common steel profiles.

Table 1:

Insulation thickness at square RHS -profiles, fire from 4 sides, critical temperature 450 °C

Fire class							
R 30		R 60		R 90		R 120	
Thickness of steel mm	Thickness of PAROC FPS 17 mm	Thickness of steel mm	Thickness of PAROC FPS 17 mm	Thickness of steel mm	Thickness of PAROC FPS 17 mm	Thickness of steel mm	Thickness of PAROC FPS 17 mm
>4	20	>10	20	>14	20	12.0	40
		8.0	20	12.0	25	10.0	50
		6.3	25	8.0 - 10.0	30	8.0	60
		5.0	30	6.3	50	6.3	–
		4.0	30	5.0	50		

Table 2:

Insulation thickness for different beams, 3- and 4-sided fire exposure, critical temperature 450 °C

Fire class											
R 30			R 60			R 90			R 120		
Steel profile	Thickness of PAROC FPS 17 mm		Steel profile	Thickness of PAROC FPS 17 mm		Steel profile	Thickness of PAROC FPS 17 mm		Steel profile	Thickness of PAROC FPS 17 mm	
	3-sided fire exp.	4-sided fire exp.		3-sided fire exp.	4-sided fire exp.		3-sided fire exp.	4-sided fire exp.		3-sided fire exp.	4-sided fire exp.
IPE 160 – 600	20	20	IPE 330-600	20	20	IPE 600	25	30	IPE 600	40	50
			IPE 240-300	20	25	IPE 500	30	40	IPE 550	50	50
			IPE 160-220	25	30	IPE 360-450	40	40	IPE 450-500	50	60
						IPE 220-330	50	50	IPE 400	60	60
						IPE 160-200	50	60	IPE 300-360	60	–
HE 100A – HE 600A	20	20	HEA 180-600	20	20	HEA 600	20	20	HEA 360-600	40	40
			HEA 100-160	20	25	HEA 320-500	20	25	HEA 300-340	40	50
						HEA 300	20	30	HEA 240-280	40	60
						HEA 200-280	30	40	HEA 220	50	60
						HEA 100-180	40	50	HEA 200	50	–
									HEA 100-180	60	–
HE 100B – HE 600B	20	20	HEB 100-600	20	20	HEB 320-600	20	20	HEB 300-600	30	40
						HEB 220-300	20	25	HEB 240-280	40	40
						HEB 200	20	30	HEB 180-220	40	50
						HEB140-180	25	40	HEB 160	40	60
						HEB 120	30	40	HEB 120-140	50	60
						HEB 100	40	50	HEB 100	60	–

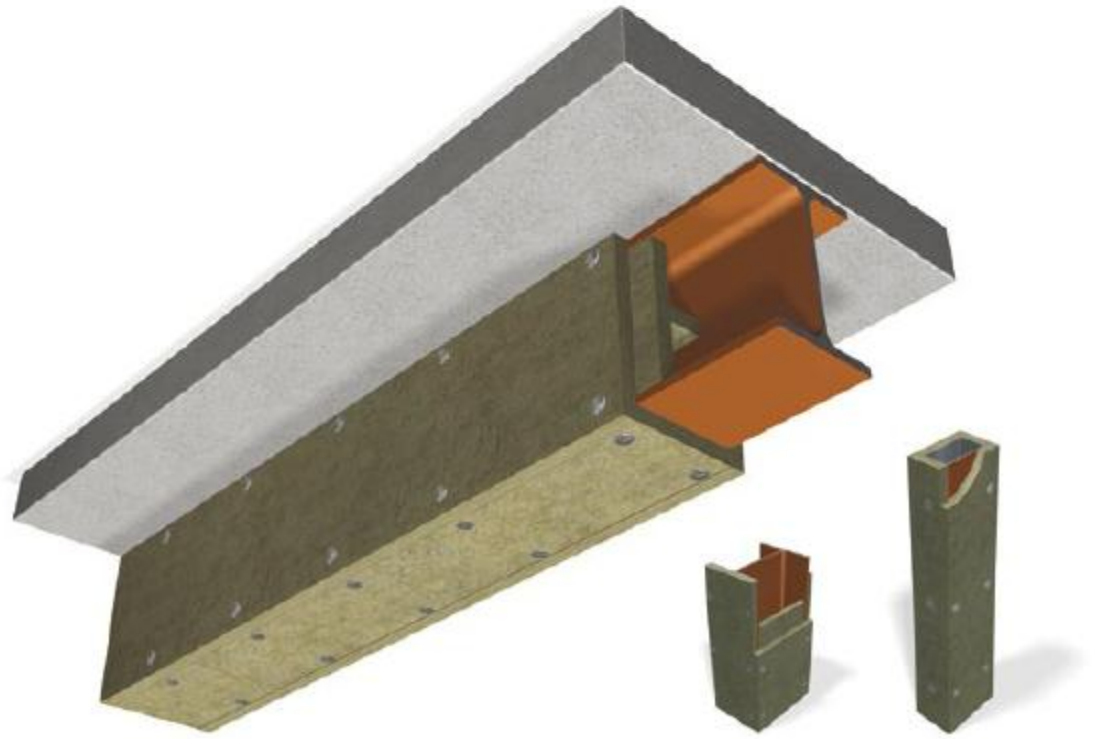
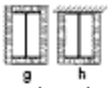
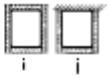
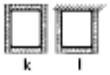


Table 3:

F/A for the most usual profiles

HEA profile			HEB profile			HEM profile		
								
a	b		c	d		e	f	
	c F/A (m^{-1})	b F/A (m^{-1})		c F/A (m^{-1})	d F/A (m^{-1})		e F/A (m^{-1})	f F/A (m^{-1})
HE 100 A	184	138	HE 100 B	154	115	HE 100 M	95	65
HE 120 A	185	137	HE 120 B	141	106	HE 120 M	80	61
HE 140 A	174	129	HE 140 B	130	98	HE 140 M	76	58
HE 160 A	161	120	HE 160 B	118	89	HE 160 M	71	54
HE 180 A	155	115	HE 180 B	110	83	HE 180 M	68	52
HE 200 A	145	108	HE 200 B	103	77	HE 200 M	65	49
HE 220 A	134	100	HE 220 B	97	73	HE 220 M	62	47
HE 240 A	122	91	HE 240 B	91	68	HE 240 M	52	40
HE 260 A	118	88	HE 260 B	88	66	HE 260 M	51	39
HE 280 A	113	84	HE 280 B	85	64	HE 280 M	50	38
HE 300 A	105	78	HE 300 B	81	60	HE 300 M	43	33
HE 320 A	98	74	HE 320 B	77	58			
HE 340 A	94	72	HE 340 B	75	57			
HE 360 A	91	70	HE 360 B	73	57			
HE 400 A	87	68	HE 400 B	71	56			
HE 450 A	83	66	HE 450 B	69	55			
HE 500 A	80	65	HE 500 B	67	55			
HE 550 A	79	65	HE 550 B	67	55			
HE 600 A	79	65	HE 600 B	67	56			
HE 650 A	79	65	HE 650 B	66	56			

IPE profile			Rectangular RHS profile				Square RHS profile			
										
g	h		i	j			k	l		
	g F/A (m^{-1})	h F/A (m^{-1})	DxB mm	Godstj. mm	i F/A (m^{-1})	j F/A (m^{-1})	DxB mm	Godstj. mm	k F/A (m^{-1})	l F/A (m^{-1})
IPE 80	330	270	100x50	3,2	313	274	40x40	3,2	313	258
IPE 100	300	247		4	250	221		4	250	211
IPE 120	279	230	100x60	3,6	278	238	60x60	3,2	313	249
IPE 140	259	215		5	200	175		4	250	203
IPE 160	241	200	120x60	3,6	278	242	80x90	3,6	278	220
IPE 180	226	188		5	200	178		5	200	161
IPE 200	211	176	120x80	5	200	169	100x100	5	200	159
IPE 220	198	165		8	125	110		8	125	103
IPE 240	184	153	150x100	5	200	167	120x120	5	200	157
IPE 270	176	147		8	125	108		8	125	101
IPE 300	167	139	160x80	5	200	175	150x150	6,3	159	125
IPE 330	156	131		8	125	113		12,5	80	66
IPE 360	146	122	200x100	5	200	173	180x180	6,3	159	124
IPE 400	137	116		10	100	90		12,5	80	65
IPE 450	130	110	250x150	6,3	159	134	200x200	6,3	159	124
IPE 500	121	104		12,5	80	70		12,5	80	65
IPE 550	113	98	300x200	6,3	159	131	250x250	6,3	159	123
IPE 600	105	91		12,5	80	68		12,5	80	64
							300x300	10	100	78
								12,5	80	63

Alternative 2

Find the section factor F/A by using data for the steel profile due to the information from the steel supplier. In figures 1-8 the fire class and the needed thickness of insulation are to be found.

Figure 1:

Insulation thickness for PAROC FPS 17.

Critical steel temperature 350 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	40	50	60	
60	20	20	25	40	50		
70	20	20	30	50	60		
80	20	20	40	50			
90	20	20	40	60			
100	20	20	40	60			
110	20	25	50				
120	20	25	50				
130	20	30	50				
140	20	30	50				
150	20	30	60				
160	20	40	60				
170	20	40	60				
180	20	40	60				
190	20	40					
200	20	40					
210	20	40					
220	20	40					
230	20	40					
240	20	40					
250	20	40					

Figure 2:

Insulation thickness for PAROC FPS 17.

Critical steel temperature 400 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	25	40	50	60
60	20	20	20	40	50	60	
70	20	20	25	40	50		
80	20	20	30	50	60		
90	20	20	30	50			
100	20	20	40	60			
110	20	20	40	60			
120	20	20	40	60			
130	20	25	40				
140	20	25	50				
150	20	25	50				
160	20	25	50				
170	20	30	50				
180	20	30	60				
190	20	30	60				
200	20	30	60				
210	20	40	60				
220	20	40	60				
230	20	40	60				
240	20	40					
250	20	40					

Figure 3:

Insulation thickness for PAROC FPS 17.

Critical steel temperature 450 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	25	40	40	50
60	20	20	20	30	40	50	60
70	20	20	20	40	50	60	
80	20	20	25	40	50		
90	20	20	25	40	60		
100	20	20	30	50			
110	20	20	40	50			
120	20	20	40	60			
130	20	20	40	60			
140	20	20	40	60			
150	20	20	50				
160	20	25	50				
170	20	25	50				
180	20	25	50				
190	20	25	50				
200	20	25	50				
210	20	30	60				
220	20	30	60				
230	20	30	60				
240	20	30	60				
250	20	30	60				

Figure 4:

Insulation thickness for PAROC FPS 17.

Critical steel temperature 500 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	20	30	40	50
60	20	20	20	25	40	50	60
70	20	20	20	30	40	50	
80	20	20	20	30	50	60	
90	20	20	25	40	50		
100	20	20	25	40	60		
110	20	20	30	50	60		
120	20	20	30	50			
130	20	20	30	50			
140	20	20	40	60			
150	20	20	40	60			
160	20	20	40	60			
170	20	20	40	60			
180	20	20	40				
190	20	20	50				
200	20	20	50				
210	20	25	50				
220	20	25	50				
230	20	25	50				
240	20	25	50				
250	20	25	50				

Figure 5:

Insulation thickness for PAROC FPS 17.
Critical steel temperature 550 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	20	25	30	40
60	20	20	20	20	30	40	50
70	20	20	20	25	40	50	60
80	20	20	20	30	40	50	
90	20	20	20	30	50	60	
100	20	20	20	40	50		
110	20	20	25	40	60		
120	20	20	25	40	60		
130	20	20	30	50	60		
140	20	20	30	50			
150	20	20	30	50			
160	20	20	40	50			
170	20	20	40	60			
180	20	20	40	60			
190	20	20	40	60			
200	20	20	40	60			
210	20	20	40				
220	20	20	50				
230	20	20	50				
240	20	20	50				
250	20	20	50				

Figure 6:

Insulation thickness for PAROC FPS 17.
Critical steel temperature 600 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	20	20	25	40
60	20	20	20	20	25	40	40
70	20	20	20	20	30	40	50
80	20	20	20	25	40	50	60
90	20	20	20	25	40	50	60
100	20	20	20	30	40	60	
110	20	20	20	40	50	60	
120	20	20	20	40	50		
130	20	20	25	40	60		
140	20	20	25	40	60		
150	20	20	25	50	60		
160	20	20	30	50			
170	20	20	30	50			
180	20	20	30	50			
190	20	20	40	60			
200	20	20	40	60			
210	20	20	40	60			
220	20	20	40	60			
230	20	20	40				
240	20	20	40				
250	20	20	40				

Figure 7:

Insulation thickness for PAROC FPS 17.
Critical steel temperature 650 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	20	20	25	30
60	20	20	20	20	20	30	40
70	20	20	20	20	25	40	40
80	20	20	20	20	30	40	50
90	20	20	20	25	30	40	50
100	20	20	20	25	40	50	60
110	20	20	20	30	40	50	
120	20	20	20	30	50	60	
130	20	20	20	40	50	60	
140	20	20	20	40	50		
150	20	20	20	40	60		
160	20	20	25	40	60		
170	20	20	25	50	60		
180	20	20	25	50			
190	20	20	30	50			
200	20	20	30	50			
210	20	20	30	60			
220	20	20	30	60			
230	20	20	40	60			
240	20	20	40	60			
250	20	20	40	60			

Figure 8:

Insulation thickness for PAROC FPS 17.
Critical steel temperature 700 °C

F/A	R 30	R 60	R 90	R 120	R 150	R 180	R 210
50	20	20	20	20	20	20	25
60	20	20	20	20	20	25	30
70	20	20	20	20	20	30	40
80	20	20	20	20	25	30	40
90	20	20	20	20	30	40	50
100	20	20	20	20	30	40	50
110	20	20	20	25	40	50	60
120	20	20	20	25	40	50	60
130	20	20	20	25	40	50	
140	20	20	20	30	50	60	
150	20	20	20	30	50	60	
160	20	20	20	40	50		
170	20	20	20	40	60		
180	20	20	20	40	60		
190	20	20	20	40	60		
200	20	20	20	50			
210	20	20	25	50			
220	20	20	25	50			
230	20	20	25	50			
240	20	20	25	60			
250	20	20	30	60			

Appendix 2 1/3

Installation

Installation of PAROC® FireSAFE system

General:

Mounting I-profiles >200 mm

1. Cut the installation pieces with a width of 100 mm and a length suitable to the profile with 2-3 mm extra length. Use always the same thickness of slab as used for the current profile.
2. Press the pieces of insulation between the flanges behind a coming joint. When the beam or column has a height over 300 mm the piece of insulation is completed with across placed piece against the web.

Welding

The insulation is fixed using steel pin/washers. The pin is an Ø 2, 8 mm and has a fixed washer at Ø 30.0 mm. The pin used is chosen 2-3 mm greater than the insulation thickness. The welding is done by Capacitor Discharge (CD) equipment - or equal. The pin is a copper covered steel pin with the washer included. The slab should cover the end of the slab it is installed against. No steel shall be visible as shown in the schematic figures below.

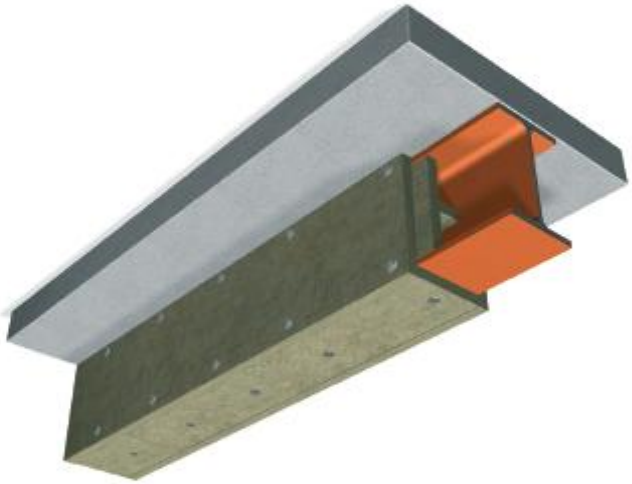
Follow the instructions at the welding equipment to install the pins properly.

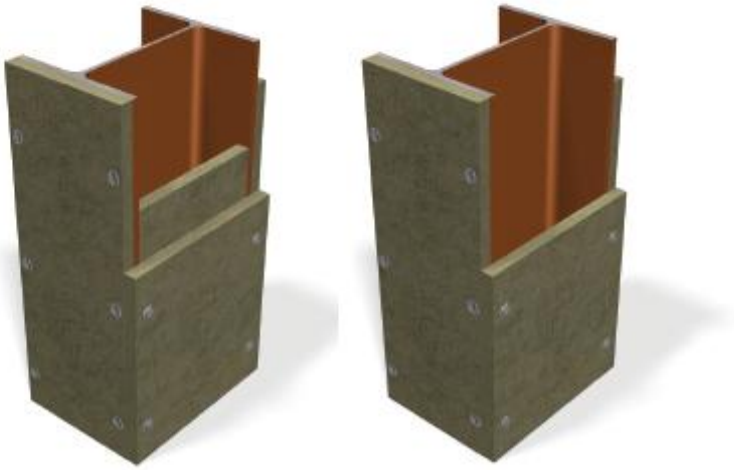
Foresee that the pins are properly fastened. The pins should be possible to bend aside (without insulation) and stay fastened. The same method is used for welding to steel sheet in roofs.

See instructions on page 2.

Appendix 2 2/3

1. The insulation is fastened by welding of steel pins (Ø 2, 8 mm) with washers (Ø 30 mm).
2. Pins on beams are fastened maximum 50 mm from the edges.
3. Pins on columns are fastened maximum 110 mm from the edges.
4. The maximum distance between fasteners on columns is 400 mm.
5. For beams the maximum distance between fasteners is 300 mm
6. When installing insulation on H or I profiles with a distances between flanges of more than 200 mm a butt-butt board is placed behind board joints.
7. The butt-butt board shall be 100 mm in width and of the same thickness as the main insulation.
8. When the distance between flanges is more than 300 mm a rear noggin is placed behind the butt-butt board, made from the main insulation thickness.
9. Both slabs are cut with over dimension so they fit tight. No glue or equal is needed.
10. All edges are fully covered by the connecting slab.
11. At installation on beams the slabs on the sides shall cover the bottom layer slab and not vice versa.
12. No openings are allowed.





Alternative installation method

The ETA approval allows also the steel structure fire protection to be installed by screwing.

Screwing

The insulation is fixed using special screws, PAROC XFS 001 Fire Spring. The first stage of installation is to push 100 mm wide pieces of PAROC FPS 17 between the flanges of the steel profile, with a maximum centre-to centre spacing of 600 mm. The thickness of the slab must be at least 40 mm. If the height of the beam is greater than 400 mm a piece of slab must be placed edge-on between the insulation and web to provide additional support. If the breadth is greater than 300 mm then 2, 8 mm pins must be welded to the centre line of the flange at 300 mm intervals.

Cut the insulation so that it is equal to the height of the beam, plus the thickness of the flange insulation. At least two bolts at intervals of 200 mm or less. The spacing between the bolts is shown in the figure below. It is recommended that the bolts length is twice the insulation thickness.

Insulation should be fixed to the top of RHS profiles by butt welding. The steel pins are fixed at intervals of less than 400 mm and less than 110 mm from joints in the insulation.