FIRE PROTECTION GUIDE 2/CONCRETE

LOADBEARING CONCRETE SLABS, HOLLOW-CORE SLABS AND BEAMS

OWENS CORNING® PAROC®

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DETERMINE THE NEEDED FIRE RESISTANCE PERIOD

Even if concrete has advantages over other building materials by its inherent fire-resistive properties, concrete structures must still be designed for fire effects. Structural components must be able to withstand dead and live loads without collapse even though the rise in temperature causes a decrease in the strength and modulus of elasticity for concrete and steel reinforcement.

The fire resistance requirement for a building is defined in terms of fire resistance period and stated in terms of minutes (15, 30, 45, 60, 75, 90 or 120 minutes). This information is usually given in local building regulations and it depends on the height, occupants and type of the building. It is the responsibility of the design engineer, using design codes such as EN 1992 Eurocode 2 (Design of concrete structures) to design the structure in a way that the fire resistance requirements are met.

Typically fire resistance test results are expressed in terms of time of failure against one or more of three criteria:

- **Load bearing capacity (R)**
- **Integrity (passage of hot gases) (E)**
- **Insulation (temperature raise) (I)**

In load-bearing structural elements such as beams, columns, walls and slabs, the resistance R prevents the structure from collapsing. In general, the separating function (E and I) applies to elements that form an integral part of the walls and envelope of the compartment: i.e. the walls and slabs (one-sided fire exposure).

To avoid a fire-resistance test being necessary for each construction product, calculation methods have been developed to define the thermal and mechanical effects and thereby evaluate the resistance to fire of structures made from concrete. Different calculation methods can be found e.g. in Eurocodes.

DETERMINE PROTECTION METHOD

The fire part of the Eurocodes presents three ways to design fire resistance of concrete structures:

1. Calculations by tabulated values; cold dimensioning

For reinforced or pre-stressed concrete girders, columns, walls and slabs Eurocode 2 gives tables which defines the minimum dimensions of sections as well as the distance from the axis of reinforcement to the nearest facing

2. Simplified calculation models:

This method is similar than cold method. It also integrates the loss of resistance of the concrete and reinforcements as a function of their temperature.

3. Advanced calculation models:

Can be used on a case-by-case basis and needs sophisticated calculation programs and high-level knowledge.

Instructions and design methods given in EN 1992 Eurocode 2 (Design of concrete structures) and national norms shall be considered when using fire test data for PAROC FPS 17 or PAROC CGL 20.

PAROC FIRESAFE SYSTEM – PAROC FPS 17

Based on classification report PK2-16-16-001-E-1, technical approval PKO-22-066 and test report Pr-15-2.120-En

Design tools for prediction of thickness of single layer fire protection system with passive fire protection material PAROC FPS 17 applied to concrete members in a Standard Fire Exposure. Tested insulation thicknesses were 20 and 60mm. The concrete in the test specimens was of type C30/37 XC4 according to EN 206 and EN 1992-1-1. The steel reinforcement ribbed bars used were of grade B500B (to EN 10080) with fyk = 500 MPa.

Test method: EN 13381-3:2015 (E) Test methods for determining the contribution to the fire resistance of structural members – Part 3: Applied protection to concrete members

The results of the assessment from the fire protection system tested in horizontal orientation on **concrete slabs** are applicable to all concrete slabs and walls with fire exposure from one side only, in both horizontal and vertical orientation.

The results of the assessment from the fire protection system tested in horizontal orientation on **concrete beams** are applicable, as tested, to all beams and columns exposed to fire from more than one side, in use in both horizontal and vertical orientation provided that the method of fixing and application is the same as that tested.

The results of the assessment are applicable only to single layer fire protection systems with following boundaries:

- **Normal weight 2016 - 2769 kg/m3 slabs and walls;**
- **Normal weight 2026 - 2762 kg/m3 beams and columns.**
- **To the concrete strength which is equal to or one strength grade higher than that tested, i.e. C30/37 and C35/45 according to EN 206.**
- **applicable to pre-stressed structures provided that rules indicated in EN 1992-1-2 are respected.**
- **applicable to concrete members with concrete prepared from any type of aggregate (siliceous, non-siliceous).**
- **are applicable to all concrete beams with an equal or higher width as that tested and with an equal or higher height as that tested. It is possible to decrease the height provided the section surface remains the same or is higher, by increasing the width. Dimensions of tested beam, width 150 mm, height 450 mm.**
- **only applicable to fire protection systems where the fixing and jointing systems are the same as that tested.**
- **Valid for 19 mm – 63 mm PAROC FPS 17 thicknesses**

The assessment for insulation carried out according to EN 13381-3: 13.4 and EN 1363-1:

PAROC FPS 17		
Concrete slab	60 mm	360 min
	20 mm	360 min
Concrete beam	60 mm	240 min
	20 mm	180 min

(Insulation according to EN 13381-3: 14 i)

EQUIVALENT THICKNESS OF CONCRETE

The results of equivalent thickness of concrete versus fire protection thickness and fire resistance (test duration) for concrete slabs and beams were determined according to EN 13381-3: Annex C. Equivalent thickness of concrete can be calculated by comparing the temperature data from a fire test with fire protected concrete member and unprotected concrete member. In theory it means how thick concrete layer a given fire protection thickness is equivalent to.

Although concrete is a non-combustible material and provides inherent fire protection, it has limitations in load-bearing applications when it's exposed to fire. Especially for beams and floor slabs, the loadbearing capacity during a fire depends on the thickness of concrete over the steel reinforcement. In case of fire, reinforcement can not reach too high temperatures or it loses its strength.

Instead of adding a very thick layer of concrete over the reinforcement, which must be normally installed close to the bottom surface of a slab or beam to secure the tensile stress, it is beneficial to apply a fire protective insulating layer which is both less thick and much lighter than the load-bearing concrete slab or beam. If this layer is made of a suitable material like PAROC FPS 17, it provides additional benefits in thermal resistance and sound absorption.

Basic data relating to the temperature within an unprotected concrete slab or beam were derived by reference to EN 1992-1-2:

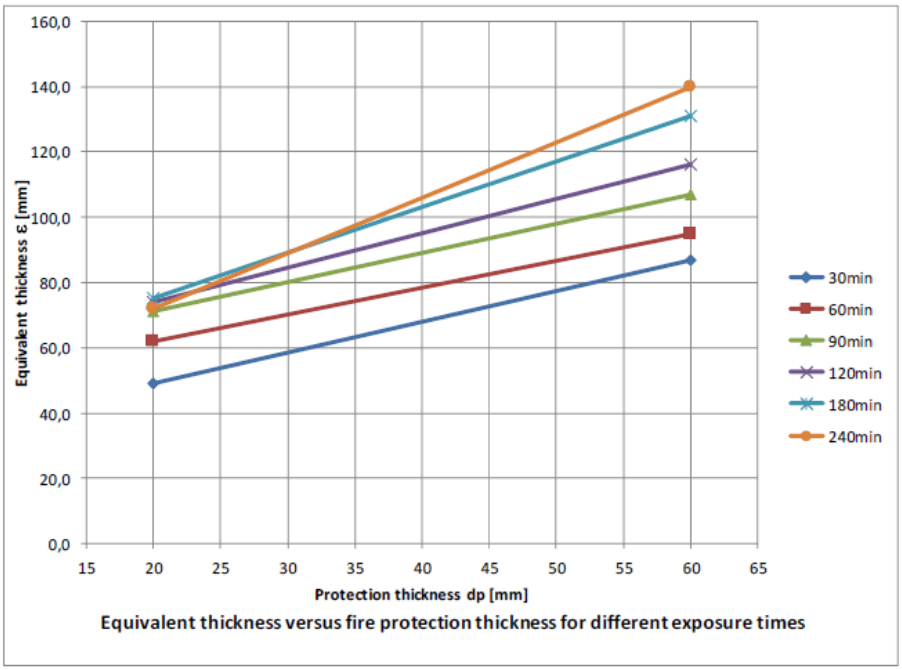
- **unprotected concrete slab with thickness of 200 mm**
  – temperature profiles given in EN 1992-1-2: Figure A.2;
- **unprotected concrete beam with section of 300 mm (w) x 600 mm (h)**
  – temperature profiles given in EN 1992-1-2: Figure A.7, A.8.

	Thickness of PAROC FPS 17	Equivalent thickness of concrete (mm)					
		Duration of exposure according to EN 1361-1					
		30 min	60 min	90 min	120 min	180 min	240 min
Concrete Slab	20 mm	49 mm	62 mm	71 mm	74 mm	75 mm	72 mm
	60 mm	87 mm	95 mm	107 mm	116 mm	131 mm	140 mm
Concrete Beam	20 mm	36 mm	52 mm	55 mm	54 mm	47 mm	34 mm
	60 mm	65 mm	77 mm	91 mm	102 mm	112 mm	116 mm

Based on classification report PK2-16-16-001-E-1

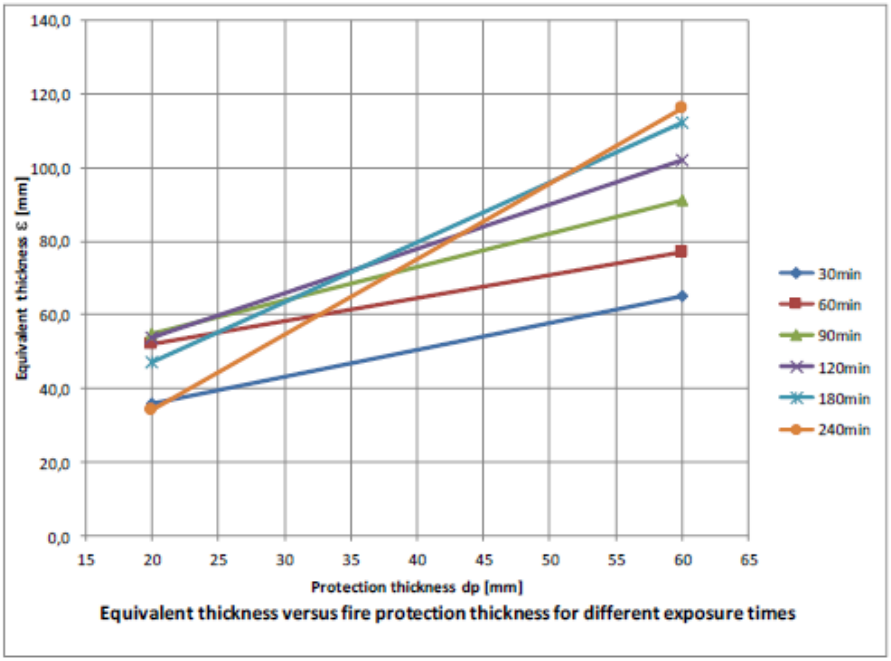
From the diagram you can find equivalent thickness of concrete according to EN 13381-3: 14 k). In practice this means that in 30 minutes fire exposure 49 mm thick layer of concrete is equal to 20 mm of fire protection. Values in diagrams shown below are interpolated based on above table.

Concrete slabs:



Based on classification report PK2-16-16-001-E-1

Concrete beams:



Based on classification report PK2-16-16-001-E-1

DESIGN TABLES OF CONCRETE SLABS AND WALLS

Critical temperature of steel of steel 300°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	20	20	20	20	20	20
15	20	20	20	20	20	20
20	20	20	20	20	20	20
25	0	20	20	20	20	20
30	0	20	20	20	20	20
35	0	20	20	20	20	20
40	0	20	20	20	20	20
45	0	0	20	20	20	20
50	0	0	20	20	20	20
55	0	0	0	20	20	20
60	0	0	0	20	20	20
65	0	0	0	0	20	20
70	0	0	0	0	20	20

Critical temperature of steel 350°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	20	20	20	20	20	20
15	20	20	20	20	20	20
20	0	20	20	20	20	20
25	0	20	20	20	20	20
30	0	20	20	20	20	20
35	0	0	20	20	20	20
40	0	0	20	20	20	20
45	0	0	20	20	20	20
50	0	0	0	20	20	20
55	0	0	0	20	20	20
60	0	0	0	0	20	20
65	0	0	0	0	20	20
70	0	0	0	0	20	20

Critical temperature of steel 400°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	20	20	20	20	20	20
15	20	20	20	20	20	20
20	0	20	20	20	20	20
25	0	20	20	20	20	20
30	0	0	20	20	20	20
35	0	0	20	20	20	20
40	0	0	0	20	20	20
45	0	0	0	20	20	20
50	0	0	0	0	20	20
55	0	0	0	0	20	20
60	0	0	0	0	20	20
65	0	0	0	0	0	20
70	0	0	0	0	0	20

Critical temperature of steel 450°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	20	20	20	20	20	20
15	0	20	20	20	20	20
20	0	20	20	20	20	20
25	0	20	20	20	20	20
30	0	0	20	20	20	20
35	0	0	0	20	20	20
40	0	0	0	20	20	20
45	0	0	0	0	20	20
50	0	0	0	0	20	20
55	0	0	0	0	20	20
60	0	0	0	0	0	20
65	0	0	0	0	0	20
70	0	0	0	0	0	0

Critical temperature of steel 500°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	20	20	20	20	20	20
15	0	20	20	20	20	20
20	0	20	20	20	20	20
25	0	0	20	20	20	20
30	0	0	0	20	20	20
35	0	0	0	20	20	20
40	0	0	0	0	20	20
45	0	0	0	0	20	20
50	0	0	0	0	0	20
55	0	0	0	0	0	20
60	0	0	0	0	0	0
65	0	0	0	0	0	0
70	0	0	0	0	0	0

Critical temperature of steel 550°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	0	20	20	20	20	20
15	0	20	20	20	20	20
20	0	0	20	20	20	20
25	0	0	20	20	20	20
30	0	0	0	20	20	20
35	0	0	0	0	20	20
40	0	0	0	0	20	20
45	0	0	0	0	0	20
50	0	0	0	0	0	20
55	0	0	0	0	0	0
60	0	0	0	0	0	0
65	0	0	0	0	0	0
70	0	0	0	0	0	0

Critical temperature of steel 600°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	0	20	20	20	20	20
15	0	20	20	20	20	20
20	0	0	20	20	20	20
25	0	0	0	20	20	20
30	0	0	0	0	20	20
35	0	0	0	0	20	20
40	0	0	0	0	0	20
45	0	0	0	0	0	20
50	0	0	0	0	0	0
55	0	0	0	0	0	0
60	0	0	0	0	0	0
65	0	0	0	0	0	0
70	0	0	0	0	0	0

Critical temperature of steel 650°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
10	0	20	20	20	20	20
15	0	0	20	20	20	20
20	0	0	0	20	20	20
25	0	0	0	0	20	20
30	0	0	0	0	20	20
35	0	0	0	0	0	20
40	0	0	0	0	0	20
45	0	0	0	0	0	0
50	0	0	0	0	0	0
55	0	0	0	0	0	0
60	0	0	0	0	0	0
65	0	0	0	0	0	0
70	0	0	0	0	0	0

*measured from the middle of the steel

*measured from the middle of the steel

DESIGN TABLES OF CONCRETE BEAMS AND COLUMNS

Critical temperature of steel 300°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	20	20	20	25	45	55
30	20	20	20	20	40	55
35	20	20	20	20	40	50
40	0	20	20	20	35	50
45	0	20	20	20	30	45
50	0	20	20	20	30	45
55	0	20	20	20	25	40
60	0	20	20	20	20	40
65	0	0	20	20	20	35
70	0	0	20	20	20	35
75	0	0	20	20	20	30
80	0	0	0	20	20	30
85	0	0	0	20	20	30

Critical temperature of steel 350°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	20	20	20	20	40	50
30	20	20	20	20	35	50
35	0	20	20	20	30	45
40	0	20	20	20	30	45
45	0	20	20	20	25	40
50	0	20	20	20	20	35
55	0	20	20	20	20	35
60	0	0	20	20	20	35
65	0	0	20	20	20	30
70	0	0	0	20	20	30
75	0	0	0	20	20	25
80	0	0	0	20	20	25
85	0	0	0	20	20	20

Critical temperature of steel 400°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	20	20	20	20	40	45
30	20	20	20	20	35	45
35	0	20	20	20	30	40
40	0	20	20	20	30	40
45	0	20	20	20	25	35
50	0	20	20	20	20	35
55	0	0	20	20	20	30
60	0	0	20	20	20	30
65	0	0	0	20	20	25
70	0	0	0	20	20	25
75	0	0	0	20	20	20
80	0	0	0	0	20	20
85	0	0	0	0	20	20

Critical temperature of steel 450°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	20	20	20	20	30	40
30	0	20	20	20	30	40
35	0	20	20	20	25	35
40	0	20	20	20	20	35
45	0	0	20	20	20	30
50	0	0	20	20	20	30
55	0	0	20	20	20	25
60	0	0	0	20	20	25
65	0	0	0	20	20	20
70	0	0	0	20	20	20
75	0	0	0	0	20	20
80	0	0	0	0	20	20
85	0	0	0	0	20	20

Critical temperature of steel 500°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	0	20	20	20	20	35
30	0	20	20	20	20	30
35	0	20	20	20	20	30
40	0	20	20	20	20	25
45	0	0	20	20	20	25
50	0	0	20	20	20	20
55	0	0	0	20	20	20
60	0	0	0	20	20	20
65	0	0	0	20	20	20
70	0	0	0	0	20	20
75	0	0	0	0	20	20
80	0	0	0	0	0	20
85	0	0	0	0	0	20

Critical temperature of steel 550°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	0	20	20	20	20	35
30	0	20	20	20	20	30
35	0	20	20	20	20	30
40	0	0	20	20	20	25
45	0	0	20	20	20	25
50	0	0	0	20	20	20
55	0	0	0	20	20	20
60	0	0	0	20	20	20
65	0	0	0	0	20	20
70	0	0	0	0	20	20
75	0	0	0	0	20	20
80	0	0	0	0	0	20
85	0	0	0	0	0	20

Critical temperature of steel 600°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	0	20	20	20	20	30
30	0	20	20	20	20	25
35	0	0	20	20	20	25
40	0	0	20	20	20	20
45	0	0	0	20	20	20
50	0	0	0	20	20	20
55	0	0	0	0	20	20
60	0	0	0	0	20	20
65	0	0	0	0	20	20
70	0	0	0	0	20	20
75	0	0	0	0	0	20
80	0	0	0	0	0	20
85	0	0	0	0	0	20

Critical temperature of steel 650°C

Minimum depth of protective concrete (mm)*	PAROC FPS 17, Fire protection thickness, mm					
	30 min	60 min	90 min	120 min	180 min	240 min
25	0	20	20	20	20	25
30	0	0	20	20	20	25
35	0	0	20	20	20	20
40	0	0	0	20	20	20
45	0	0	0	20	20	20
50	0	0	0	0	20	20
55	0	0	0	0	20	20
60	0	0	0	0	20	20
65	0	0	0	0	20	20
70	0	0	0	0	0	20
75	0	0	0	0	0	20
80	0	0	0	0	0	20
85	0	0	0	0	0	0

*measured from the middle of the steel

*measured from the middle of the steel

TEMPERATURE DATA FROM FIRE TESTS

Conrete slabs and walls

Measured from concrete slab surface (behind fire protection)

PAROC FPS 17, 20 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	181	275	375	477
Max. temperature °C	258	360	446	550

Measured from concrete slab reinforcement bars at 20 mm depth

PAROC FPS 17, 20 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	99	163	241	321
Max. temperature °C	103	171	257	340

Measured from concrete slab surface (behind fire protection)

PAROC FPS 17, 60 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	72	105	133	163
Max. temperature °C	92	129	158	185

Measured from concrete slab reinforcement bars at 20 mm depth

PAROC FPS 17, 60 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	49	81	105	128
Max. temperature °C	59	92	117	141

Concrete beams and columns

Measured from the bottom of concrete beam (behind fire protection)

PAROC FPS 17, 20 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	208	375	588	775
Max. temperature °C	242	405	594	809

Measured from stirrup bars in the bottom of the beam at 17 mm dept

PAROC FPS 17, 20 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	138	294	474	637
Max. temperature °C	143	300	483	655

Measured from the bottom of concrete beam (behind fire protection)

PAROC FPS 17, 60 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	110	163	218	291
Max. temperature °C	119	171	225	298

Measured from stirrup bars in the bottom of the beam at 17 mm depth

PAROC FPS 17, 60 mm	60 min	120 min	180 min	240 min
Avg. temperature °C	82	133	192	262
Max. temperature °C	84	135	195	264

PAROC FPS 17 INSTALLATION

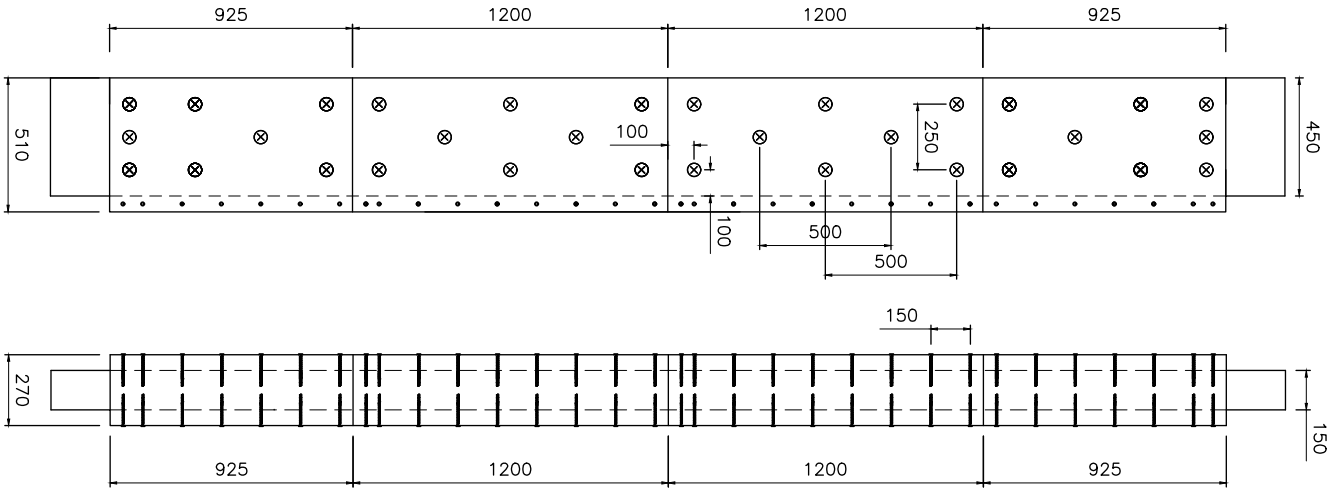
Concrete beams and columns

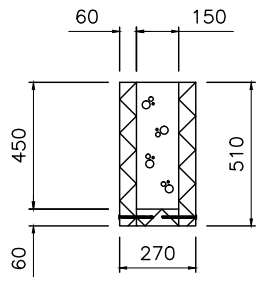
- Install the PAROC FPS 17 fire protection according to drawing below. In the picture you can see installation of 60 mm thick PAROC FPS 17 slab to concrete beam. Joints have to be tight – no gaps are allowed.

- Use at least 8 fasteners/slab (600 x 1200). Conrete slabs and walls. Notice, that fire protection slabs on sides of the beam have to cover the slab on the bottom surface.

- The PAROC FPS 17 slab on the bottom surface of the beam is connected to the the sides with PAROC XFS 001 fire springs (c 150 mm). The length of the fire spring is 2 x thickness of the fire protection slab. Fire spring distance from slab joint is 50 mm. Fire spring distance from slab edge depends on fire protection thickness. E.g for 60 mm fire protection thickness, fire spring is installed 30 mm in from slab edge (in the center of beam's bottom surface insulation).

Fire protected concrete beam.





Cross-section of concrete beam with fire protection.

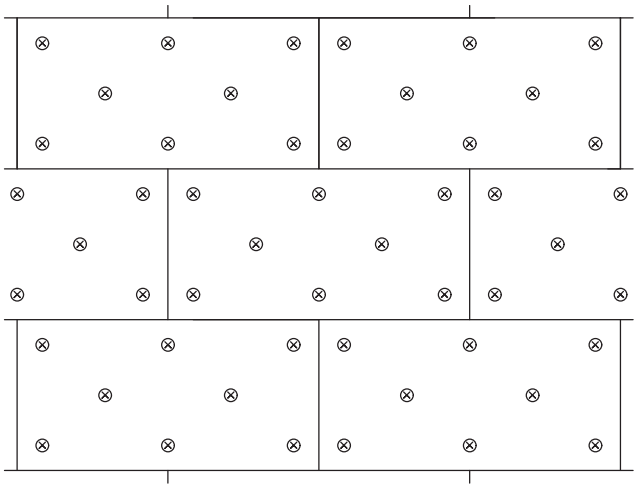
PAROC XFS 001 Fire spring.

Fire protection on the bottom surface of the beam.

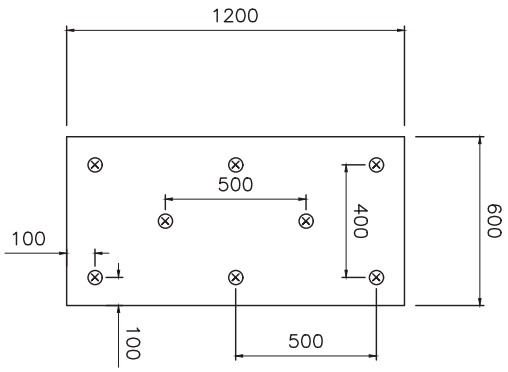
Concrete slabs and walls

- Install the PAROC FPS 17 slabs according to drawing. Joints have to be tight – no gaps are allowed.
- Use at least 8 fasteners / slab (600 x 1200). Minimum distance from the edges 100 mm.

Fire protected concrete slab.



Installation of PAROC FPS 17 fire protection to concrete slab. The joints are staggered.



Distance of fasteners.

Installation of Fastener

- Drill a 8 mm hole to the concrete through insulation. The hole should be 10 mm deeper actually needed considering fire protection thickness and length of the fastener.
- In case of 60 mm thick fire protection layer use 110 mm long PAROC Fire protection dowel concrete (XFS 003) with PAROC Fire protection washer (XFW 009). The depth of the hole is in this case normal installation depth 50 mm + 10 mm = 60 mm.
- Install fastener by using hammer.
- Joints between fire protection slabs have to be tight – no gaps are allowed.

Fastener + washer

PAROC Fire protection dowel concrete (XFS 003) + PAROC Fire protection washer (XFW 009)

PAROC FIRESAFE SYSTEM - PAROC CGL 20

Based on ETA 23-0539

PAROC CGL 20 is a fire protection system for passive fire protection of concrete slabs structures. ETA-approved system consists of PAROC CGL 20 lamellas and PAROC SW glue (XPG 001) for installation. It's possible to reach R(EI) 240 fire classification with only 50 mm thick CGL 20 lamellas.

DESIGN TABLE

Insulation thickness (50-400 mm) in resistance to fire classes REI 30-REI 240 in relation to design temperature. Desing table is valid for PAROC CGL 20 (c, cc, cy, cyc, y, yc).

Insulation thickness for REI 240 reinforced concrete structures

Design temperature [°C]	Fire resistance period 30-240 minutes							
	300	350	400	450	500	550	600	650
Protection time	Minimum thickness in mm of fire protection material to maintain concrete temperature below design temperature							
30	50	50	50	50	50	50	50	50
60	50	50	50	50	50	50	50	50
90	50	50	50	50	50	50	50	50
120	50	50	50	50	50	50	50	50
150	50	50	50	50	50	50	50	50
180	50	50	50	50	50	50	50	50
210	50	50	50	50	50	50	50	50
240	60	50	50	50	50	50	50	50

!!! NOTE !!! Design temperatures are measured inside the concrete slab, 15 mm from the bottom surtace of the slab.

Design table is valid for all concrete slabs and walls (including pre-stressed structures) in both horizontal and vertical orientation when concrete class is C20-C32 for massive concrete slabs or C40-C70 for hollow-core slabs. It is not valid for concrete beams or columns. See ETA 23-0539 for further information.

Temperature data from exposed surface when fire protected with PAROC CGL 20 (c, cc, cy, cyc, y, yc) 50 mm based on report EUFI29-22005574-T1.

TEMPERATURE DATA FROM FIRE TESTS

Measured from concrete slab surface (behind fire protection)

PAROC CGL 20cy, 50 mm	60 min	120 min	180 min	240 min
Avg. temperature	124	207	286	376
Max. temperature	130	214	296	389

Measured from reinforcement bars at 15 mm depth

PAROC CGL 20cy, 50 mm	60 min	120 min	180 min	240 min
Avg. temperature	97	160	226	301
Max. temperature	100	165	232	308

PAROC CGL 20 INSTALLATION

General instructions
PAROC CGL 20 (c, cc, cy, cyc, y, yc) lamellas are glued directly underneath the massive concrete slab or hollow core slab with PAROC SW glue (XPG 001), which is specially meant for this purpose. Paroc can only guarantee the functionality of recommended glue based on fire testing. Use of any other glue is on user's sole risk.

During the application and drying phase of the adhesive, the temperature of substrate and air should be between +5 °C - +30 °C.

The substrate must be firm, level, dry, load-bearing, and free from grease, mold oil and dust. It is installers responsibility to check whether the fixing is suitable for the substrate at the building site.

If you have any doubts of the substrate suitability for this method, you shall contact a specialist for proper estimation for example: considering longer drying/curing time, possible primer treatment of the ceiling, etc.

Preparations
Make sure you have reserved enough PAROC SW glue (XPG 001) for the entire area, where you plan to install the PAROC CGL 20 lamellas. You shall calculate min. 5 kg of dry material per each m^2.

Check the condition of the bags of glue. They should be dry and unbroken. Don't use glue that is outdated. All bags are marked with Best before date.

Make sure the water is clean and suitable for using it for mixing it with mineral mortar.

Mixing tools

- Strong electrical blender
- Clean trowels for applying the glue (with 10 x 10 mm teeth and solid edge)
- Clean trowels for pressing the lamellas against the ceiling
- Stone wool knife for cutting the lamellas around columns and walls

Material preparation
Decant water, then add the pre-blended dry mortar. Mixing ratio 4,6 liter of water per 20 kg of material. Mix for approx. 2 minutes. Allow to mature for approx. 3 minutes. Remix for approx. 30 seconds. Do not add water after this as it will weaken the adhesion heavily.

The open time for the glue varies a lot depending on temperature and ventilation. Typically glue should be used within 30 min from mixing. When the glue starts to dry in the bucket, the gloss of glue gets dimmer, and color gets lighter. It means the curing has already started. It's not recommended to use the glue after this as adhesion will be weaker.

Application of the glue
Apply the 1st layer of PAROC SW glue all over the back side of lamella using a rust-free steel trowel. Press the trowel's solid edge firmly against the lamella so that the glue infiltrates inside to the wool and leaves an even 1-2 mm thick layer of glue on the top of lamella (this is not required for lamellas with back side coating - CGL 20cc, cyc).

Apply the 2nd layer of glue crosswise all over the lamella length with the toothed edge (10 x 10 mm) of trowel keeping it on 45-degree inclined position. Consumption of glue shall be ~5 kg/m^2 (unmixed material).

Installation

Install the lamellas on the bottom of the concrete ceiling so that there is no glue or any gaps between the lamella joints. Lamellas shall be installed on rows having ½ lamella step between lamella's short end compared to the previous row (picture below).

Make sure the air is pressed out from the toothed channels of glue. To do this properly, use a clean steel trowel to press the lamella against the substrate. We recommend making a test installation to see, that at least 80 % of lamella surface is covered with glue so that there are no toothed channels in the glue anymore.

For the best possible adhesion strength, install lamellas immediately after spreading the glue. Use proper gear to avoid leaving fingerprints on the lamella.

Drying and curing

Drying and curing depends on the weather conditions and takes approx. 1 day/mm of layer thickness at a temperature (air and substrate) of +20 °C and relative humidity of 65 %. Before applying any additional coating or painting, wait at least 24 hours to be sure the glue has reached the needed adhesion strength.

Surface finishing

Painting or coating applied on the building site is not part of fire tested solution or ETA. National regulations shall be considered when planning any surface finishing.

In case of possible painting or any other coating, make sure, the coating material is breathable allowing the moisture from substrate and glue to dry out.

Cleaning the tools

Clean tools with water immediately after use.

PAROC® stands for energy-efficient and fire resilient insulation solutions of stone wool for new and renovated buildings, marine and offshore and other industrial applications. Behind the products, there is more than 80-year history of stone wool production, know-how backed by technical insulation expertise and innovation.

Building Insulation offering covers a wide range of products and solutions for all traditional building insulation. The building insulation products are mainly used for the thermal, fire and sound insulation of exterior walls, roofs, intermediate floors and partitions.

Technical Insulation offering includes thermal, fire and sound insulation in HVAC systems, industrial processes and pipework, industrial equipment as well as shipbuilding and offshore industry.

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