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Statement on cementitious and fibrous weber floor screeds with or without fibreglass mesh as structural part corresponding to covering (having fire protection ability K)

1 Object and restrictions of the statement

In this statement conditions which cementitious and fibrous weber floor screeds with or without fibreglass mesh needs to fulfil to be assessed as structural part corresponding to covering (having fire protection ability K). Specifications of the floor screeds of concern are the following:

- weber 110 fine, weber 120 reno, weber 130 core and weber 140 nova cementitious and fibrous floor screeds ($A2_{FL}$-s1)
- weberfloor 4945 fibreglass mesh (mesh size 10 mm x 10 mm).

2 Background materials

As background information in this statement the following documents have been used:

1. Ministry of the Environment. Decrees on the fire safety of buildings 848/2017 and 927/2020.
2. Decree on the fire safety of buildings. Memorandum 28.11.2017 and 23.11.2020. Ministry of the Environment. Jorma Jantunen.
3. SFS-EN 13501-2. Fire classification of construction products and building elements. Part 2: Classification using data from fire resistance tests, excluding ventilation services. SFS 2016.
4. SFS-EN 14135: 2004. Coverings - Determination of fire protection ability. CEN 2004.
5. Fire test on nova 140 self-leveling concrete. Research report no. RAK/2631/2020. Tampere University, Civil Engineering, Fire laboratory. 19.8.2020.
6. Fire test on nova 140 self-leveling concrete. Research report no. RAK /2642/2021. Tampere University, Civil Engineering, Fire laboratory. 16.2.2021.
7. SFS-EN 1364-1:2015. Fire resistance tests for non-loadbearing elements. Part 1: Walls.

3 Protective performance of floor screed as covering

3.1 Purpose and requirements of covering or corresponding protection

Purpose of covering is to provide for the material behind the covering protection against ignition, charring and other damage for a specified period of time. [1]. In addition, effect of covering is described in the memorandum [2] as follows: *Covering is restricting development of fire in space*

of concern for a specified time in cases in which materials used in building parts could contribute significantly to fire and its development in a dangerous way.

Reaction to fire class requirement of covering is either A2-s1, d0 or is defined (specifically in the Degree) according to the class requirement of internal surfaces.

Following criteria for covering are defined in the classification standard SFS-EN 13501-2 [3]:

A covering designated K_2 is considered to give the prescribed protection for materials behind the covering if during a test in accordance with EN 14135 [4] *within the classification period (10 min, 30 min or 60 min) there is no collapse of the covering or parts of it and also if the following requirements are fulfilled:*

a) For a covering without a cavity or cavities behind it:

- *during the test the mean temperature measured on the lower side of the substrate shall not exceed the initial temperature by more than 250 °C and the maximum temperature measured at any point of this side shall not exceed the initial temperature by more than 270 °C, and*
- *after the test there shall be no burnt material or charred material at any point of the substrate.*

b) For a covering with a cavity or cavities behind it:

- *during the test the mean temperature measured on the lower side of the substrate and the mean temperature measured on the unexposed side of the covering shall not exceed the initial temperature by more than 250 °C and the maximum temperature measured at any point of these sides shall not exceed the initial temperature by more than 270 °C, and*
- *after the test there shall be no burnt material or charred material at any point of the substrate and at any point of the unexposed side of the covering.*

According to the memorandum [2] covering requirement can be fulfilled also as follows:
The required covering can be replaced by fire resistant part of a structure forming the inner surface and having at least corresponding fire resistance time as the covering, and fulfilling the required reaction to fire classification.

This means that $K_2$10 covering can be made with a structural part fulfilling fire separating class EI 15 and $K_2$30 covering with EI 30 class structural part.

Classification standard SFS-EN 13501-2 [3] defines the following criteria for classes E and I:

Integrity (E) is assessed based on the three following aspects:

- cracks or openings in excess of given dimensions
- ignition of a cotton pad
- sustained flaming on the unexposed side.

For a separating element/part the performance level used to define thermal insulation (I) the mean temperature rise on the unexposed face is limited to 140 °C above the initial mean temperature, and the maximum temperature rise at any point is limited to 180 °C above the initial mean temperature.

The same fire exposure time-temperature curve is used in the classification tests for coverings and separating EI elements/parts.

3.2 Results of fire resistance tests

Fire resistance tests have been made for cementitious and fibrous weber floor screed with fibreglass mesh [5, 6] applying methods EN 14135 [4] and SFS-EN 1364-1 [7] in testing arrangements. Thicknesses of the floor screeds in the tests were 25 mm and 42 mm. These tests have been made in wall exposure conditions, because there is no floor exposure conditions available in the classification system. Fire exposure to wall is at least same or more severe than for floor. Thus, fire separating test results made in wall conditions are also applicable for floor conditions in case of determination of a protection replacing covering.

In addition to the temperature measurements related to the determination of fire separating function (on the unexposed side) also temperatures according to the covering test method [4] were measured between the floor screed and particle board substrate (Figure 1). These tests were not totally according to the covering testing standard, because the test specimen were not in ceiling conditions. On the other hand, a test made in wall conditions is at least as demanding as a test made in floor conditions in respect to fire exposure and possible damage of the specimen.

In the fire separating measurements which were done without particle board substrate also air temperature in the air gap was measured (Figure 1). The aim of this was to record possible flaming on the unexposed side as sudden temperature peaks during test.

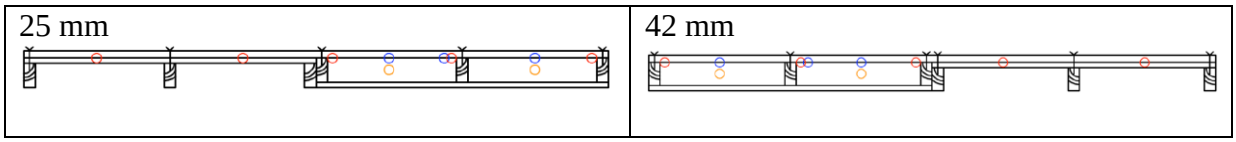

Figure 1. Structural principles of the tested specimen and temperature measurement points at the unexposed surface of the floor screed and in the air gap [5, 6].

Effect of thickness of the tested floor screed to the time when mean temperature rise on the unexposed face is limited to 140 °C above the initial mean temperature is shown in Figure 2. Measurement points in the figure are based on the shortest times to reach 140 °C temperature rise in the tests. Thus, they are safe side results. Based on the results it can be concluded that the minimum thicknesses corresponding to protection times of 15 and 30 minutes are about 24 mm and 35 mm.

It should be noted that the test with 42 mm thick floor screed was terminated after 40 minutes. Thus, in Figure 2 the test result has been given as at least 40 minutes / 140 °C rise even though actual time would have been somewhat longer if the test had been continued.

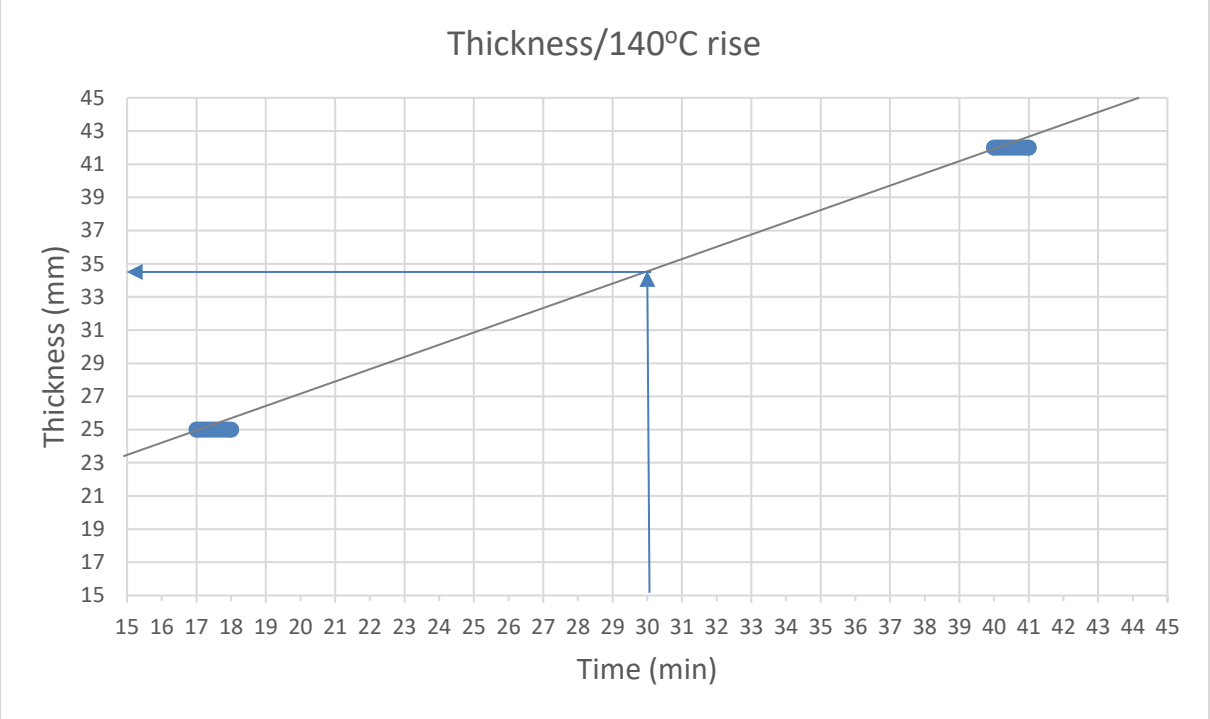

Figure 2. Effect of thickness of the tested floor screed to the time when mean temperature rise on the unexposed face is limited to 140 °C above the initial mean temperature (measurement points are the shortest times to reach 140 °C temperature rise in the tests).

The largest single temperature rises on the unexposed surface of the floor screed against the air gap and between the floor screed and particle board (measuring point corresponding to the covering method) were the following:

25 mm floor screed at 15 min	
Largest temperature rise between floor screed and particle board	121°C
Largest temperature rise on surface of floor screed against the air gap	125°C
42 mm floor screed at 30 min	
Largest temperature rise between floor screed and particle board	104°C
Largest temperature rise on surface of floor screed against the air gap	114°C

The temperature rises given above show that the measurements related to fire separating function are more critical and thus are used as criteria in this assessment.

The assessment of integrity (E) was not made directly during the tests, but there were temperature measurement points in the air gap at three heights: in the middle and in the middle points of lower and upper parts. No sudden or longer lasting temperature rises, caused by flashes (which could ignite cotton pad) or sustained flaming on the unexposed side of the floor screed, were recorded in the tests. Maximum temperatures in the air gap during 15/30 minutes were the following:

- 25 mm floor screed: below 105 °C (15 min from start of the test)
- 42 mm floor screed: below 75 °C (30 min from start of the test).

Forming of cracks or openings: According to pictures taken after the tests all cracks are clearly smaller than 6 mm which is allowed by the standard.

According to the above, it can be concluded that the tested floor screed is applicable as protective structural layer with following minimum thicknesses: EI 15 requirements are met with a layer thickness of 25 mm and EI 30 requirements with a layer thickness of 35 mm.

In addition to the tested weber 140 nova cementitious and fibrous floor screed ($A2_{FL}$-s1) the results are also applicable for the following products:

- weber 110 fine, weber 120 reno and weber 130 core cementitious and fibrous floor screeds which have the same or smaller grain size compared to weber 140 nova and have the same reaction to fire class $A2_{FL}$-s1 as weber 140 nova.

All the weber 110 fine, weber 120 reno, weber 130 core and weber 140 nova cementitious and fibrous floor screeds can be used with or without fibreglass mesh weberfloor 4945. This is because the tests were made with fibreglass mesh and the thermal conductivity of the floor screed is practically the same with the thin fibreglass mesh and without it.

These fire class $A2_{FL}$-s1 products can be assumed to fulfil also A2-s1, d0 requirements, because A2 and $A2_{FL}$ main-classes have the same requirements in non-combustibility tests. And smoke (***s*** sub-class) and burning droplets (***d*** sub-class) parameter requirements are not critical to meet for these mineral based products.

4 Summary

This statement is on performance of cementitious and fibrous weber floor screed with or without fibreglass mesh as structural part corresponding to covering (having fire protection ability K). When composition of the floor screed is the following

- weber 110 fine, weber 120 reno, weber 130 core or weber 140 nova cementitious and fibrous floor screed (all fulfilling $A2_{FL}$-s1 reaction to fire class)
- with or without weberfloor 4945 fibreglass mesh (mesh size 10 mm x 10 mm),

it can be used in floor as replacing K_210 covering, when the layer thickness is at least 25 mm, and as replacing K_230 covering, when the layer thickness is at least 35 mm. These floor screeds of concern are assessed to meet also the requirements of class A2-s1, d0.

In mounting of the floor screed instructions for use of the producer must be followed.

This statement is based on documents received by KK-Palokonsultti Oy and it covers only the use of cementitious and fibrous weber floor screeds with or without fibreglass mesh.

In Espoo, 8.11.2021

KK-Palokonsultti Oy

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