Assessment Report

Project

21843_2en – abridged version

Fire resistance of Injection system FIS V in masonry

Employer

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1 General

fischerwerke GmbH & Co.KG authorized the summary and new assessment of existing fire tests with the injection system FIS V in masonry under axial tension loading. The fischer injection system FIS V is designed for the use in masonry according to the European Technical Assessment ETA-10/0383 [4].

The evaluation has been done for steel failure and pull out together according to chapter 2.3 of Technical Report 020 [2].

This evaluation provides fire resistances which covers anchors with fire attack from one side only. In case of fire attack from more than one side the edge distance has to be $c \geq 300$ mm and $\geq 2\ h_{ef.}$

This report summarizes the results from [1].

2 Reference documents

[1] Gutachten 21843_2: Feuerwiderstand des Injektionssystems FIS V für Mauerwerk, 16.1.2018, Ingenieurbüro Thiele Tragwerksplanung GmbH

[2] Evaluation of Anchorages in Concrete Concerning Resistance to fire, EOTA TR 020, Edition May 2004

[3] Feuerwiderstandsprüfungen – Teil 1: Allgemeine Anforderungen, DIN EN 1363-1; Edition Oktober 2012

[4] ETA-10/0383: European Technical Approval from 6. Oktober 2017; fischer injection system FIS V for use in masonry, DIBT

3 Product description

The Injection system fischer FIS V is a bonded anchor (injection type) consisting of a mortar cartridge with fischer injection mortar FIS V, FIS VW or FIS VS, partly a perforated sleeve FIS HK, a threaded rod with hexagon nut and washer in the range of M6 to M16 or an internal threaded anchor in the range of M6 to M12.

Details for installation are given in ETA-10/0383 [4].

4 Scope of evaluation

The present evaluation of fire resistance for fischer injection system FIS V in masonry is assessed with respect to its fire resistance properties as anchor applications in walls and ceilings. Furthermore, the anchors were exposed to the standard temperature-time curve (ETK) [3]. In the tests a fixture according to TR020 was used, therefore the following fire resistances cover only anchors protected from fire by attachments similar to the fixture according to TR020 [2].

The assessment is carried out in dependence on TR020 [2].

Deviating from this the tests results with the failure modes steel failure and pullout have been evaluated together.

Additionally the following comments concerning the different failure modes have to be taken into account:

a. Steel failure:
   No special tests for determining steel failure are necessary, caused of the common evaluation the tests with steel and bond failure.
   The given values are valid for the use of carbon steel (minimum grade 5.8) and stainless steel (minimum grade 70) threaded rods. This requirements are also valid for threaded rods for the internal threaded anchors.

b. Bond failure:
   The majority of the tests showed the failure mode bond failure. This failure mode is sufficiently considered.

c. Brick failure:
   In the tests no brick failure occurred. It was assumed that this failure mode is not decisive for this anchor system. The spacing s_{crII} and $s_{cr\perp}$ have to be maintained.

It is assumed that the tests in perforated bricks have been performed in the unfavorable setting position, so the given fire resistances are valid for all setting positions in the stone. The given fire resistances (chapter 5) are valid for tension loads as well as for shear and diagonal tensile loads at angels between 0° and 90° with $c \geq c_{cr}$.

In this assessment report characteristic resistances in case of fire are given for the injection system FIS V for perforated clay bricks (3 DF) with a minimum compressive f_b of 12 N/mm² and sand lime bricks (EN 771-2, 3DF) with a minimum compressive f_b of 12 N/mm². The given resistances are also valid for solid clay bricks and solid sand lime bricks (≥3DF).
The validation of the base material for the different fire resistances is not part of this assessment.

5 Fire resistances for steel and bond failure under fire exposure for solid or perforated sand lime brick and clay brick

In the following tables the results of the evaluations for sand lime brick and clay brick were summarized.

Table 5-1: Fire resistance in perforated clay brick (3 DF) and perforated sand lime brick (3DF) as well as solid bricks (≥3DF) with perforated sleeves for anchor rods

Characteristic fire resistance concerning steel and bond failure							
Type of masonry	**Anchor rods**	**h_{ef}**	**Perforated sleeves**	**R30**	**R60**	**R90**	**R120**
[-]	**[mm]**	**[mm]**	**[-]**	**[kN]**	**[kN]**	**[kN]**	**[kN]**
Perforated clay brick (Hlz 3 DF) perforated sand lime brick (KSL 3DF), solid sand lime and clay brick (>3DF)	6	85	FIS H 12 x 85 K	0,19	0,13	0,08	0,05
	8	85	FIS H 16 x 85 K	0,22	0,17	0,13	0,10
	10	85	FIS H 16 x 85 K	0,33	0,24	0,15	0,11
	8	130	FIS H 16 x 130 K	0,40	0,34	0,29	0,26
	10	130	FIS H 16 x 130 K FIS H 18x130/200 K	0,40	0,34	0,29	0,26
	12	130	FIS H 20 x 130 K FIS H 18x130/200 K	0,40	0,34	0,29	0,26
	12	200	FIS H 20 x 200 K	1,87	1,38	0,88	0,63

Table 5-2: Fire resistance in perforated clay brick (3 DF) and perforated sand lime brick (3DF) as well as solid bricks with perforated sleeves for internal threaded anchors

Characteristic fire resistance concerning steel and bond failure							
Type of masonry	**Internal threaded anchor**	**h_{ef}**	**Perforated sleeves**	**R30**	**R60**	**R90**	**R120**
[-]	**[mm]**	**[mm]**	**[-]**	**[kN]**	**[kN]**	**[kN]**	**[kN]**
Perforated clay brick (Hlz 3 DF) perforated sand lime brick (KSL 3DF), solid sand lime and clay brick (>3DF)	FIS E 11 x 85 M6 / M8	85	FIS H 16 x 85 K	0,11	0,07	0,02	-
	FIS E 15x 85 M10 / M12	85	FIS H 20 x 85 K	0,11	0,07	0,02	-

Table 5-3: Fire resistance solid bricks (≥3DF) without perforated sleeves for threaded rods

Characteristic fire resistance concerning steel and bond failure						
Type of masonry	**Threaded rod**	**min h_{ef}**	**R30**	**R60**	**R90**	**R120**
[-]	**[mm]**	**[mm]**	**[kN]**	**[kN]**	**[kN]**	**[kN]**
solid clay brick and solid sand lime brick (≥3 DF)	6	85	0,19	0,13	0,08	0,05
	8	85	0,22	0,17	0,13	0,10
	10	85	0,33	0,24	0,15	0,11
	8	130	0,40	0,34	0,29	0,26
	10	130	0,40	0,34	0,29	0,26
	12	130	0,40	0,34	0,29	0,26
	12	200	1,87	1,38	0,88	0,63

Table 5-4: Fire resistance solid bricks (≥3DF) without perforated sleeves for internal threaded anchors

Characteristic fire resistance concerning steel and bond failure						
Type of masonry	**Internal threaded anchor**	**h_{ef}**	**R30**	**R60**	**R90**	**R120**
[-]	**[mm]**	**[mm]**	**[kN]**	**[kN]**	**[kN]**	**[kN]**
solid clay brick and solid sand lime brick (≥3 DF)	FIS E 11 x 85 M6 / M8	85	0,11	0,07	0,02	-
	FIS E 15x 85 M10 / M12	85	0,11	0,07	0,02	-

The given values are valid for the use of carbon steel (minimum grade 5.8) and stainless steel (minimum grade 70) anchor rods.

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C. Thiele

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