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Project Number:	EBB 170019_3en
Purpose:	Assessment of resistance under fire exposure of the Injection System VMU plus
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1. General

The Technische Universität Kaiserslautern had been authorized by Metall- Kunststoff-Technik GmbH & Co.KG to evaluate the fire resistance of the Injection System VMU plus. This report is based on the test reports of MPA Braunschweig [3]. The fire tests and their evaluation were executed according to DIN EN 1363-1:2012 [2] and [1].

The fire resistances (listed in Table 1) are based on the test results of a one-sided fire exposure of a non-cracked concrete slab. The evaluation in this report is based on TR 020 [1].

2. References

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

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

[3] Test Report (3290/0966)-NB dd. 06/03/2008 ; iBMB Braunschweig; hinterlegt an der TU Kaiserslautern.

[4] ETA-11/0415 from 8. December 2017, Injection System VMU plus for concrete, Metall- Kunststoff-Technik GmbH & Co.KG.

3. Product Description

The Product is described in [4].

4. Evaluation Scope

The fire resistance evaluation of the Injection System VMU plus is based on the executed fire tests. The anchors were installed upside down to simulate the real situation of a ceiling and stressed by the uniform temperature curve fire test (UTC) according to [2]. In all tests, a fixture was used based on TR020 [1], therefore the following fire resistance evaluation applies only for anchors which are protected (in a comparable manner to the used fixture in the fire test) against the temperature increase during a fire case.

The fire tests were executed on a non-cracked concrete slab.

The evaluation was executed depending on TR020 [1].

Nut failures, fracture of the anchor rod and pull-out failures occurred in the tests.

5. Fire Resistances

The following tables show the decisive fire resistances $N_{Rk,fi}$ of a one side fire exposure in non-cracked concrete with tensile loading (minimum strength class C20/25). The given fire resistances $N_{Rk,fi}$ apply for a single anchor under tensile load with an edge distance greater than $c_{cr} = 2\ h_{ef}$ and a spacing of at least $s = 2\ c_{cr} = 4$ hef. to the adjacent anchor. By keeping the mentioned edge distances and spacing, a concrete cone failure is not relevant. The given values apply for anchor rods with a strength class of at least 5.8 (EN 1993-1-8:2005+AC:2009). The same fire resistances can be assumed for threaded rods of stainless steel (A4) and high corrosion resistant steel (HCR) with a strength class of 70 (EN ISO 3506-1:2009).

If the edge distance c is chosen in a way, that steel failure / pull-out is determined in the fire design, the following load values can be also applied on anchors under shear load.

Table 1: Fire resistance $N_{Rk,fi}$ of Injection System VMU plus in non-cracked concrete slab

Fire resistance $N_{Rk,fi}$ in [kN]	Anchors Sizes	M8	M10	M12	M16	M20	M24	M27	M30
	Minimum embedment depth $h_{ef,min}$ [mm]	≥ 80	≥ 90	≥ 110	≥ 125	≥ 170	≥ 210	≥ 250	≥ 280
Fire resistance duration t_u [min]	30	1,6	2,6	3,4	6,2	9,8	14,0	18,3	22,3
	60	1,1	1,8	2,6	4,8	7,5	10,8	14,1	17,2
	90	0,6	0,9	1,8	3,4	5,3	7,6	9,9	12,1
	120	0,3	0,5	1,4	2,7	4,2	6,0	7,9	9,6