

# Evaluation

Project

**21716\_3 Rev.1**

**MKT Wedge anchor B in case of fire**

Fire resistance in non-cracked concrete

Employer

**MKT Metall-Kunststoff-Technik GmbH & Co.KG**

**Auf dem Immel 2**

**67685 Weilerbach**

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Author

INGENIEURBÜRO THIELE  
TRAGWERKSPLANUNG GMBH

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## 1. General

MKT GmbH & Co. KG has engaged the Ingenieurbüro Thiele to evaluate the fire resistance of the wedge anchor B. This evaluation is based on inspection reports of the MPA Braunschweig and the TU Kaiserslautern. The fire tests and evaluations described in the inspection reports were conducted with regard to DIN EN 1363-1:2012 [2] and referring to [1]

All fire resistances mentioned below consider solely a one-sided fire exposure. The assessment in this evaluation followed the TR 020 [1]. However, the premise for the application of the design concept following TR 020 is the use of an anchor which is suitable for cracked concrete. This premise is not fulfilled by the Wedge anchor B, respectively B A4 or B HCR. Depending on the design situation, the application of the design procedure following TR 020 must be verified and appraised.

## 2. Literature

- [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] Prüfung und Beurteilung von in ungerissenen Stahlbetonbauteilen gesetzte, auf zentrischen Zug belasteten MKT Bolzenankern B auf Brandverhalten zur Ermittlung des Feuerwiderstandes bei einseitiger Brandbeanspruchung; (3738/395/11) – CM vom 14.3.2012; MPA Braunschweig.
- [4] ETA-01/0013 vom 29 November 2018, MKT Wedge Anchor B
- [5] Bericht über Versuche mit MKT Bolzenankern M8 A4 und M12 A4 unter Brandbeanspruchung nach TR 020, Bericht 12035CT/15; TU Kaiserslautern; 11.11.2013.
- [6] 21716\_1 Gutachten MKT Bolzenanker B und BA4 im Brandfall, Ingenieurbüro Thiele GmbH, 26.4.2017.

## 3. Product description

The product is described in [4]

## 4. Extent of evaluation

The evaluation of the fire resistance of the wedge anchor B and B A4 or B HCR is based on fire tests. There, the anchors were fixed in a ceiling position and strained by the standard temperature fire curve (ETK) following [2]. In all tests a fixture regarding TR020 [1] was used, so that the following evaluation of the fire resistance is only valid for anchors that are correspondingly protected from the temperature by the fire.

The fire tests were conducted in non-cracked concrete.

The evaluation was conducted with regard to TR020 [1]. All tests resulted in a failure of the nut or a crack of the conical bolt in the thread area. Pullout failure has not been observed.

## 5. Fire resistance

The fire resistances for an wedge anchor B and B A4 or B HCR shown below were evaluated regarding TR 020 and the significant value resulting from the various failure modes is presented. In case of the failure mode concrete cone failure it was assumed that the concrete cone failure can be entirely completed. Influences of spacings and edge distances where not taken in account. An illustration of the fire resistance of the different failure modes is presented in [6]

The following tables show the most significant fire resistances  $N_{Rk,fi}$  for a one-sided fire exposure for tension in non-cracked concrete. The listed fire resistances are valid for single anchors with an edge distance of more than  $c_{cr}=2 h_{ef}$  and a spacing to the adjacent anchor of  $s= 2 c_{cr}= 4 h_{ef}$ .

For edge distances that result in steel failure, the following fire resistances can also be assumed for shear loads.

Table 1: fire resistance  $N_{Rk,fi}$  for B with reduced embedment depth

fire resistance $N_{Rk,fi}$ in [kN]							
zink plated	$h_{ef,red}$	M6	M8	M10	M12	M16	M20
[min]	[mm]	30	35	42	50	64	78
30		0,6	0,8	1,8	3,2	4,6	6,2
60		0,5	0,7	1,5	2,8	4,6	6,2
90		0,3	0,6	1,0	1,7	3,2	5,0
120		0,3	0,5	0,8	1,2	2,3	3,6

Table 2: fire resistance  $N_{Rk,fi}$  for B with standard embedment depth

fire resistance $N_{Rk,fi}$ in [kN]							
zink plated	$h_{ef}$	M6	M8	M10	M12	M16	M20
[min]	[mm]	40	44	48	65	82	100
30		0,6	0,8	1,8	3,4	6,3	9,0
60		0,5	0,7	1,5	2,8	5,2	8,2
90		0,3	0,6	1,0	1,7	3,2	5,0
120		0,3	0,5	0,8	1,2	2,3	3,6

Table 3: fire resistance  $N_{Rk,fi}$  for B A4 + HCR with reduced embedment depth

fire resistance $N_{Rk,fi}$ in [kN]							
A4 + HCR	$h_{ef,red}$	M6	M8	M10	M12	M16	M20
[min]	[mm]	30	35	42	50	64	78
30		0,9	1,3	2,1	3,2	4,6	6,2
60		0,9	1,3	2,1	3,2	4,6	6,2
90		0,9	1,3	2,1	3,2	4,6	6,2
120		0,7	1,0	1,6	2,5	3,7	5,0

Table 4: fire resistance  $N_{Rk,fi}$  for B A4 + HCR standard embedment depth

fire resistance $N_{Rk,fi}$ in [kN]							
A4 + HCR	$h_{ef}$	M6	M8	M10	M12	M16	M20
[min]	[mm]	40	44	48	65	80	100
30		1,8	2,3	2,9	6,1	6,4	9,0
60		1,4	2,3	2,9	6,1	6,4	9,0
90		0,9	2,1	2,9	4,8	6,4	9,0
120		0,7	1,0	2,2	3,9	5,2	7,2

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Dr.-Ing. Catherina Thiele