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DAkkS Deutsche Akkreditierungsstelle D-ZE-18571-01-00 *

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Independent Expert Report

on the assessment of the adhesive injection anchor fischer FIS EM Plus for anchoring in uncracked and cracked concrete for a working life up to 120 years based on EAD 330499-02-0601

Client:	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen
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The injection system fischer FIS EM Plus of company fischerwerke GmbH & Co. KG is an adhesive anchor consisting of a cartridge with injection mortar fischer FIS EM Plus and steel elements. It received a Technical Assessment Document (ETA) in 2019 [1]. The ETA covers fastenings in uncracked and cracked concrete of strength classes C20/25 to C50/60 with threaded rods M8 to M30 of different strength classes and corrosion resistance classes and with deformed reinforcing bars ∅8 to ∅40. The allowable use conditions and characteristic strength values for steel, concrete and bond between steel parts and concrete were evaluated in [6] based on EAD 330499-00-0601 [3]. The characteristic bond strength values are given for temperature ranges T1: 35°C/60°C (maximum long- term temperature / maximum short- term temperature) and T_2: 50 °C/72 °C.

The EAD [3] is valid for a working life of fastenings up to 50 years. The next edition EAD 330499-01-0601 [4] covers also an extended working life of 100 years. The characteristic bond strength values of bonded anchors FIS EM Plus for a working life of 100 years were assessed in [7] based on [4]. These values are also given in the ETA [1].

To improve some service conditions and to cover an additional temperature range (24 °C/40 °C), additional tests were performed, which were evaluated in [9] based on EAD 330499-02-0601 [5]. The results are incorporated in [2]. Furthermore, fractional sizes of threaded rods and reinforcing bars are incorporated in [2] based on [8].

The company fischerwerke GmbH & Co. KG has commissioned the Engineering Office IEA to derive the characteristic resistances and admissible service conditions of the system fischer FIS EM Plus as approved in [2] for a working life up to 120 years based on EAD 330499-02-0601 [5].

For the assessment of the behaviour of bonded anchors FIS EM Plus for a working life of 120 years the results of sustained load tests [10] with a test duration of 6000 hours and tests in opening and closing cracks [11], [12] with 2400 crack opening cycles as well as information given in literature ([13] to[18]) on the behaviour of bonded anchors under sustained load and during crack cycling were taken into account. The tests [10] and [12] were performed by company fischerwerke. They were supervised by an

independent engineer on behalf of the engineering office IEA. Because [5] is valid for a working life of 100 years, the test conditions and assessment criteria given in [5] were adjusted to a design working life of 120 years. The evaluation of the test results and of the use conditions for a working life up to 120 years are described in detail in the Expert Report [19].

The bond strength $\tau_{Rk,120}$ for a working life of 120 years is calculated according to Equation (1)

$$\tau_{Rk,120} = \alpha_{120} \cdot \tau_{Rk,100} \quad (1)$$

where

$\tau_{Rk,100}$ = bond strength for a working life of 100 years given in [2]

α_{120} = reduction factor.

For bonded anchors FIS EM Plus in uncracked and cracked concrete the following reduction factors are recommended [19]:

α_{120} = 0,8 Temperature range T1 (24 ^{0}C/40 ^{0}C),

α_{120} = 0,9 Temperature ranges T2 (35 ^{0}C/60 ^{0}C) and T3 (50 ^{0}C/72 ^{0}C).

The factors ψ^0_{sus} given in [2] may also be used for a working life of 120 years:

T1: ψ^0_{sus} =0,77, T2: ψ^0_{sus} = 0,60, T3: ψ^0_{sus} = 0,71.

Note, that indications given on the working life cannot be interpreted as a guarantee given by the producer but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

All other design provisions given in [2] are valid for a working life up to 120 years.

Prof. Dr. Ing. R. Eligehausen

Literature

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