



## Independent Expert Report

on the assessment of the post-installed rebar connection  
using the injection mortar fischer FIS EM Plus  
for a working life of 120 years  
based on EAD330087-02-0601-v01

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## **1 Introduction**

The injection system fischer FIS EM Plus of company fischerwerke GmbH & Co. KG is an epoxy-based structural adhesive used for establishing post-installed rebar connections consisting of different sizes of mortar cartridges of fischer FIS EM Plus and either a steel reinforcing bar or a fischer rebar anchor. The use of the fischer FIS EM Plus post-installed rebar system is already approved for steel reinforcing bars with diameters from  $\varnothing 8$  to  $\varnothing 40$  mm, for fischer rebar anchors FRA, FRA HCR with diameters from M12 to M24 [1] for a service life of 50 or 100 years according to EAD 330087-01-0601 [2].

The rebar connections using the injection system FIS EM Plus may be used in concrete of strength classes C12/15 to C50/60 under static and quasi static loading conditions and in C16/20 to C50/60 under seismic loading conditions based on [1]. The characteristic bond strength values are valid for temperature range T2: 50 °C/80 °C (temperature range from -40°C to +80°C, with a maximum long-term temperature of +50°C, and a maximum short-term temperature of +80°C) based on [1]. The allowable use conditions and characteristic strength values for steel, concrete and bond between steel parts and concrete are given in [1] based on EAD 330087-01-0601 [2].

The EAD 330087-01-0601 [2] regulates a working life of the rebar connections for 50 and 100 years. The next edition(s) of the EADs (EAD 330087-02-0601-v01 [3] in conjunction with the EAD 330087-02-0601 [4]) should cover also an extended working life of 120 years. Although ETAs based on [3] & [4] may no longer be issued under the new Construction Products Regulation as of the date of this report, these documents were used as a technical basis for this expert report, because these provisions are based upon the current state of the art and the available knowledge and experience and serve as basis for this expert report.

The FIS EM Plus injection system is further approved for fastening applications according to EAD 330499-02-0601-v02 (Bonded Fasteners and bonded expansion fasteners for use in concrete with a service life of 120 years) [5] and is regulated in the ETA-25/1097 [6]. The service life of 120 years for the injection system FIS EM plus for the use in fastening applications has already been assessed in [7].

The company fischerwerke GmbH & Co. KG has commissioned the Engineering Office IEA to derive the characteristic resistances and admissible service conditions of the rebar connection using the injection system FIS EM Plus as approved in [1] for a working life of 120 years on the basis of EAD 330087-01-0601 [3].

In the expert report [9], the following parameters based on [3] to provide design provisions for the use of the rebar connection using FIS EM Plus for a service life of 120 years were evaluated:

- *the design values of the bond strength  $f_{bd,PIR,120y}$  under static and quasi-static loading and  $f_{bd,PIR,seis,120y}$  under seismic loading*
- *the amplification factor  $\alpha_{lb,120y}$  under static and quasi-static loading;*
- *the bond efficiency factor  $k_{b,120y}$  under static and quasi-static loading,*
- *the bond efficiency factor  $k_{b,seis,120y}$  under seismic loading.*

For the assessment of the behaviour of the rebar connection for a design working life of 120 years, the findings of the previous expert reports ([7] ,[8] and [10]) and the corresponding background documents (e.g. test reports) were taken into account.

**This executive summary is derived from the evaluation presented in [9] and should be considered in conjunction with that document. This executive summary only provides a concise overview of the design-relevant parameters identified therein.**

## **2 Literature**

- [1] ETA-17/1056, 'Rebar connection with fischer injection system FIS EM Plus'. 22<sup>nd</sup> January 2026
- [2] EAD 330087-01-0601 'Systems for post-installed rebar connections with mortar', December 2020
- [3] EAD 330087-02-0601-v01 'Systems for post-installed rebar connections with mortar – 120 years working life', January 2025 (Status Pending for citation in OJEU)
- [4] EAD 330087-02-0601 'Systems for post-installed rebar connections with mortar', January 2022 (Status Pending for citation in OJEU)
- [5] EAD 330499-02-0601-v02 'Bonded fasteners and bonded expansion fasteners for use in concrete with a service life of 120 years', Status: cited
- [6] ETA-25/1097: 'fischer Injektionssystem FIS EM Plus für 120 Jahre Nutzungsdauer'. 16<sup>th</sup> December 2025
- [7] IEA GmbH & Co. KG: Expert Report 24-053-1 on the 'Assessment of the adhesive anchor fischer FIS EM Plus for anchoring in uncracked and cracked concrete for a working life of 120 years based on EAD 330499-02-0601, Stuttgart, October 1, 2025.
- [8] Fast 3 Solutions: 'Evaluation Report on fischer FIS EM Plus used as rebars for 100 years working life' 10<sup>th</sup> November 2020
- [9] IEA GmbH & Co. KG: Independent Expert Report 26-056 on the assessment of the post-installed rebar connection using the injection mortar fischer FIS EM Plus for a working life of 120 years based on EAD 330087-02-0601-v01, Stuttgart, May 19, 2026.
- [10] IEA GmbH & Co. KG: Evaluation Report 17-053 on the 'Upgrade of the fischer FIS EM PLUS adhesive anchors using additional tests for the assessment according to draft EAD 330499-00-0601 and ETAG 001, Part 5', Stuttgart, Oct. 10, 2017.

### 3 Design parameters based on [9] under static and quasi-static loading

#### 3.1 Bond efficiency factors and amplification factors

$k_{b,120y}$	Bond efficiency factor $k_{b,120y}$ [-]								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
<b>Hammer drilling / compressed air drilling / hollow drilling</b>									
Ø8- Ø40	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,98
<b>Diamond core drilling</b>									
Ø8- Ø12	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,95
Ø14- Ø25						1,00	1,00	1,00	0,95
Ø26- Ø40						0,95	0,87	0,81	0,76

Table 3.1 Summary of the bond efficiency factors  $k_{b,120y}$

$\alpha_{lb,120y}$	Amplification factor $\alpha_{lb,120y}$ [-]								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
<b>Hammer drilling / compressed air drilling / hollow drilling</b>									
Ø8- Ø40	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
<b>Diamond core drilling</b>									
Ø8- Ø12	1,00	1,00	1,00	1,00	1,04	1,08	1,17	1,21	1,25
Ø14- Ø25					1,04	1,08	1,17	1,21	1,25
Ø26- Ø40					1,08	1,17	1,33	1,42	1,50

Table 3.2 Summary of the amplification factors  $\alpha_{lb,120y}$

#### 3.2 Bond strength for 120 years working life – static and quasi static loading

$f_{bd,PIR,120y}$	Bond strength $f_{bd,PIR,120y}$ [N/mm <sup>2</sup> ]								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
<b>Hammer drilling / compressed air drilling / hollow drilling</b>									
Ø8- Ø32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,2
Ø34	1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,1
Ø36	1,5	1,9	2,2	2,6	2,9	3,3	3,6	3,8	4,0
Ø40	1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7	3,9
<b>Diamond core drilling</b>									
Ø8- Ø12	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,1
Ø14- Ø25						3,4	3,7	4,0	4,1
Ø26- Ø32						3,2	3,2	3,2	3,2
Ø34	1,6	2,0	2,3	2,6	2,9	3,1	3,1	3,1	3,1
Ø36	1,5	1,9	2,2	2,6	2,9	3,1	3,1	3,1	3,1
Ø36	1,5	1,8	2,1	2,5	2,8	2,9	2,9	2,9	2,9

Table 3.3 Summary of the design bond strengths  $f_{bd,PIR,120y}$  under static and quasi-static loading

## 4 Design parameters based on [9] under seismic loading

### 4.1 Bond efficiency factors and amplification factors

$k_{b,seis,120y}$	Bond efficiency factor $k_{b,seis,120y}$ [-]								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
<b>Hammer drilling / compressed air drilling / hollow drilling</b>									
$\emptyset 8$ - $\emptyset 40$	-	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,98

Table 4.1 Summary of the bond efficiency factors  $k_{b,seis,120y}$

$\alpha_{lb,120y}$	Amplification factor $\alpha_{lb,seis,120y}$ [-]								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
<b>Hammer drilling / compressed air drilling / hollow drilling</b>									
$\emptyset 8$ - $\emptyset 40$	-	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Table 4.2 Summary of the amplification factors  $\alpha_{lb,seis,120y}$

### 4.2 Bond strength for 120 years working life – seismic loading

$f_{bd,PIR,seis,120y}$	Bond strength $f_{bd,PIR,seis,120y}$ [N/mm <sup>2</sup> ]								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
<b>Hammer drilling / compressed air drilling / hollow drilling</b>									
$\emptyset 8$ - $\emptyset 32$		2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,2
$\emptyset 34$		1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9
$\emptyset 36$		1,5	1,9	2,2	2,6	2,9	3,3	3,6	3,8
$\emptyset 40$		1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7

Table 4.3 Summary of the design bond strengths  $f_{bd,PIR,seis,120y}$  under seismic loading

### 4.3 Minimum concrete cover under seismic loading

Based on [3], the assessment given in [2] for the minimum concrete cover is valid for assumed working life of 50 years, 100 years as well as 120 years.

## 5 Bond strength at simulated fire conditions for post-installed rebars assessed for assumed 120 years working life

The function  $k_{fi,120y}(\Theta)$  assessed for assumed 120 years working life is the same as  $k_{fi}(\Theta)$  for assumed 50/100 years working life:

$$k_{fi}(\Theta) = k_{fi,100y}(\Theta) = k_{fi,120y}(\Theta)$$

## 6 Summary

The company fischerwerke GmbH & Co. KG has a European Technical Approval for the rebar connection using FIS EM Plus [1]. The service life of the rebar connection in the current ETA-17/1056 [1] is regulated for up to 100 years. In this expert report, the essential design parameters for a working life of 120 years are given based on [9]. Based on the evaluation of the sustained load tests and freeze-thaw tests, no reduction factors were determined for 120 years of working life in comparison to the evaluation for 100 years of working life.

The evaluation shows that the rebar connections can be used for up to 120 years of working life. The design relevant parameters are given in Table 3.1-Table 4.3.



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