



IEA GMBH & Co. KG • HAUPTSTRASSE 4 • D-70563 STUTTGART
ELIGEHAUSEN - ASMUS – HOFMANN

Pfeifer Seil- und Hebeteknik GmbH & Co.
z. H. Herrn Neef
Postfach 1754

D – 87687 Memmingen

IEA GMBH & Co. KG
ELIGEHAUSEN - ASMUS - HOFMANN
HAUPTSTRASSE 4
70563 STUTTGART

TELEFON 0711 677 19 08
TELEFAX 0711 677 19 27
INTERNET: WWW.I-EA.DE
E-MAIL: INFO@I-EA.DE



VALID FOR ACTIVITIES ACCORDING TO
THE SCOPE OF ACCREDITATION. .

Stuttgart August 28, 2015

Summary of evaluation of Pfeifer DB-Anchor-System type Foot-Mounted anchor (cast-in anchor with internal threaded socket) under seismic actions according to ETAG 001, Annex E (Category C1)

Dear Mr. Neef,

company Pfeifer applies for the assessment of the DB-Anchor-System type Foot-Mounted anchor DB 682 for seismic applications (Category C1) according to ETAG 001, Annex E ([G2]). IEA was commissioned by company Pfeifer to assess the Foot-Mounted anchor DB 682 in an Evaluation Report ([G7]).

The Pfeifer DB Anchor System is a cast-in anchor system that has a European Technical Approval for static or quasi-static loading (ETA-11/0288; [G6]) for the sizes Rd12, Rd16, Rd20, Rd24 and Rd30 for use in uncracked and cracked concrete of strength classes C20/25 to C50/60.


For post-installed metal anchors (including undercut anchors) for use in concrete regulations for the assessment of seismic applications are defined in Annex E of ETAG 001 ([G2]). Therefore, in the report [G7] the required tests and the assessment are derived on the basis of [G2] due to the same load transfer mechanism (mechanical interlock). In [G7] the characteristic resistances for seismic Category C1 of [G2] for the Pfeifer Foot-Mounted anchor DB 682 are derived by theoretical considerations and tension tests at company Pfeifer with supervision of IEA.

In the evaluation it was shown that the characteristic resistances of the Pfeifer Foot-Mounted anchor DB 682 under tension loading for pullout and steel failure valid for static and quasi-static loading (ETA-11/0288; [G6]) are also recommended under seismic tension loading in Category C1 according to [G2] (factor $\alpha_{N,seis,C1} = 1,0$). The characteristic resistances and the corresponding material safety factors are summarized in Table 1 (pullout and concrete cone failure) and Table 2 (steel failure).

Under shear loading the seismic shear capacity for Category C1 for steel failure must be reduced. The characteristic seismic steel shear capacities for Category C1 and the corresponding material safety factors of the different anchor types and combination applied for are given in Table 3. They are valid for fastenings with single anchors.

The design of fastenings under seismic loading must be performed according to the ETAG Technical Report EOTA TR 45 [G4] or in the future according to the harmonized European Standard EN 1992-4 (see draft edition [G5]). The characteristic values given in Table 1 to Table 3 are to be used as values $R_{k,seis}^0$ according to [G4]. The regulations of TR 45 [G4] valid for Foot-Mounted anchors are given in the report [G2].

Kind regards



Dr.-Ing. J. Asmus



Dr.-Ing. G. Welz

Recommended characteristic values and partial safety factors:

Failure mode	Pullout failure		Concrete cone failure	
Size	$N_{Rk,p,seis}(C20/25)$	$\gamma_{Mp,seis}^{2)}$	$N_{Rk,c,seis}(C20/25)^{1)}$	$\gamma_{Mc,seis}^{2)}$
	kN	-	kN	-
Rd12	40	1,5	27,4	1,5
Rd16	75		49,7	
Rd20	140		69,5	
Rd24	140		92,1	
Rd30	200		125,5	

1) Calculated according to [G5] with $N_{Rk,c} = 8,9 \cdot h_{ef}^{1,5} \cdot f_{ck,cyl}^{0,5}$

2) Partial material safety factors according to [G1] and [G4]

Table 1: Recommended characteristic resistances for pullout failure $N_{Rk,p,seis}$ and concrete cone failure $N_{Rk,c,seis}$ and material safety factors under seismic tension load for seismic Category C1 in cracked concrete C20/25 for Foot-Mounted anchor DB 682

Size	$N_{Rk,s}$	$\gamma_{Ms,seis}^{1)}$
	kN	-
Sleeve gvz; reinforcement bar Bst 500; screw 5.6 gvz		
Rd12	31,2	1,66
Rd16	78,3	2,00
Rd20	122,4	2,00
Rd24	110,6	1,40
Rd30	172,8	1,40
Sleeve gvz; reinforcement bar Bst 500; screw 8.8 gvz		
Rd12	31,2	1,66
Rd16	71,2	1,66
Rd20	130,8	1,66
Rd24	110,6	1,40
Rd30	172,8	1,40
Sleeve A4-50; reinforcement bar Bst 500; screw A4-50		
Rd12	29,4	2,93
Rd16	78,3	2,93
Rd20	122,4	2,93
Rd24	151,1	2,93
Rd30	259,2	2,93
Sleeve A4-50; reinforcement bar Bst 500; screw A4-70		
Rd12	29,4	2,93
Rd16	82,6	2,93
Rd20	133,4	2,93
Rd24	151,1	2,93
Rd30	259,2	2,93

1) Partial material safety factors according to [G1] and [G4]

Table 2: Recommended characteristic resistances for steel failure $N_{Rk,s,seis}$ and material safety factors under seismic tension load for seismic Category C1 for Foot-Mounted anchor DB 682

Size	Combination		$V_{Rk,s,seis}$	$\gamma_{Ms,seis}$ ¹⁾
	Sleeve	Screw	[kN]	[-]
Rd12	gvz	gvz; 5.6	9,4	1,38
Rd16			21,4	1,38
Rd20			42,8	1,67
Rd24			44,5	1,38
Rd30			76,2	1,38
Rd12	gvz	gvz; 8.8	9,4	1,38
Rd16			21,4	1,38
Rd20			39,2	1,38
Rd24			44,5	1,38
Rd30			76,2	1,38
Rd12	A4-50	A4-50	8,8	2,44
Rd16			24,8	2,44
Rd20			40,0	2,44
Rd24			45,4	2,44
Rd30			77,8	2,44
Rd12	A4-50	A4-70	8,8	2,44
Rd16			24,8	2,44
Rd20			40,0	2,44
Rd24			45,4	2,44
Rd30			77,8	2,44

1) Partial material safety factor for steel shear failure according to [G1] and [G4]

Table 3: Recommended characteristic resistances under seismic shear load for seismic Category C1 $V_{Rk,s,seis}$ and material safety factors for Pfeifer Foot-Mounted anchor DB 682

References:

- [G1] EOTA: ETAG 001-1, Guideline for European Technical Approval of Metal Anchors for Use in Concrete. Part one: Anchors in general. Edition 1997, 2nd amended April 2013.
- [G2] EOTA: ETAG 001 - Annex E, Guideline for European Technical Approval of Metal Anchors for Use in Concrete, Annex E: Assessment of metal anchors under seismic conditions, April 2013.
- [G3] EOTA: Draft EAD 330012-00-0601 "Cast-in anchors with internal threaded socket", Version 2015-04, TAB DIBt, Berlin, April 28, 2015.
- [G4] EOTA TR 45 "Design of Metal Anchors For Use in Concrete Under Seismic Actions"; Edition February 2013.
- [G5] FprEN 1992-4: 2015: Eurocode 2: Design of concrete structures – Part 4: Design of Fastenings for use in concrete, April 2015.
- [G6] European Technical Approval ETA-11/0288, Pfeifer DB-Anchor-System; Generic type and use of construction product: Cast-in anchors with internal threaded socket, Deutsches Institut für Bautechnik, Berlin; dated December 11, 2012 (valid until September 9, 2016).
- [G7] Basis of an EVALUATION REPORT for the assessment of Pfeifer DB-Anchor-System type Foot-Mounted anchor (cast-in anchor with internal threaded socket) under seismic actions according to ETAG 001, Annex E (Category C1). IEA GmbH & Co. KG, Stuttgart, Germany. Report dated 28.08.15.