European Assessment Document for

Variant: Anchor channels for controlled impact screwdrivers

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Contents

1   SCOPE OF THE EAD

1.1   Description of the construction product

This EAD is a variant to EAD 330008-04-0601 [1] due to extension in the intended use. EAD 330008-04-0601-v02 covers anchor channels for controlled impact screwdrivers, in the following referred to as "anchor channels".

EAD 330008-04-0601 [1] and EAD 33008-04-0601-v01 [2] apply.

1.2   Information on the intended use(s) of the construction product

1.2.1   Intended use(s)

EAD 330008-04-0601 [1] and EAD 33008-04-0601-v01 [2] apply.

In addition to EAD 330008-04-0601 [1] the controlled impact screwdriver, which is specified in the manufacturer´s product installation instructions (MPII), can be used as an additional setting method for general applications in accordance with EAD 330008-04-0601 [1], Figure 1.2.1.2 a).

1.2.2   Working life/Durability

EAD 330008-04-0601 [1] applies.

1.3   Specific terms used in this EAD

EAD 330008-04-0601 [1] and EAD 330008-04-0601-v01 [2] apply.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the anchor channels is assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
Characteristic resistance under static and quasi-static tension loading			
1	Characteristic resistance to steel failure of anchors under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.1	Level $N_{Rk,s,a}$ [N]
2	Characteristic resistance to steel failure of the connection between anchors and channel under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.2	Level $N_{Rk,s,c}$ [N]
3	Characteristic resistance to steel failure of channel lips and subsequently pull-out of channel bolt under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.3	Level $N_{Rk,s,l}^0$ [N]; $s_{l,N}$ [mm]
4	Characteristic resistance to steel failure of channel bolt under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.4	Level $N_{Rk,s}$ [N]
5	Characteristic resistance to steel failure by exceeding the bending strength of the channel under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.5	Level $M_{Rk,s,flex}$ [Nm]; s_{max} [mm]
6	Maximum installation torque to avoid damage during installation	2.2.1	Level, Description $T_{inst,g}$ [Nm]; $(T_{inst,s})$ [Nm]
7	Characteristic resistance to pull-out failure of the anchor under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.7	Level $N_{Rk,p}$ [N]
8	Characteristic resistance to concrete cone failure under static and quasi-static tension loading	EAD 330008-04-0601 [1]; Clause 2.2.8	Level $k_{cr,N}$ [-]; $k_{ucr,N}$ [-]; h_{ef} [mm]
9	Minimum edge distances, spacing and member thickness to avoid concrete splitting during installation	2.2.2	Level s_{min} [mm]; c_{min} [mm]; h_{min} [mm]
10	Characteristic edge distance and spacing to avoid splitting of concrete under load	EAD 330008-04-0601 [1]; Clause 2.2.10	Level $s_{cr,sp}$ [mm]; $c_{cr,sp}$ [mm]
11	Characteristic resistance to blowout failure - bearing area of anchor head	EAD 330008-04-0601 [1]; Clause 2.2.11	Level A_h [mm²]
Characteristic resistance under static and quasi-static shear loading			
12	Characteristic resistance to steel failure of channel bolt under static and quasi-static shear loading in transverse direction without lever arm	EAD 330008-04-0601 [1]; Clause 2.2.12	Level $V_{Rk,s}$ [N]
13	Characteristic resistance to steel failure by bending of the channel bolt under static and quasi-static shear loading in transverse direction with lever arm	EAD 330008-04-0601 [1]; Clause 2.2.13	Level $M_{Rk,s}^0$ [Nm]

No	Essential characteristic	Assessment method	Type of expression of product performance
14	Characteristic resistance to steel failure of channel lips, steel failure of connection between anchor and channel or steel failure of anchor under static and quasi-static shear loading in transverse direction	EAD 330008-04-0601 [1]; Clause 2.2.14	Level $V_{Rk,s,l,y}^0$ [N]; $s_{l,V}$ [mm]; $V_{Rk,s,c,y}$ [N]; $V_{Rk,s,a,y}$ [N]
15	Characteristic resistance to steel failure of connection between channel lips and channel bolt under static and quasi-static shear loading in transverse direction	EAD 330008-04-0601 [1]; Clause 2.2.15	Level $V_{Rk,s,l,x}$ [N]
16	Factor for sensitivity to installation (longitudinal shear)	EAD 330008-04-0601 [1]; Clause 2.2.16	Level γ_{inst} [-]
17	Characteristic resistance to steel failure of the anchor anchor under static and quasi-static loading in longitudinal channel axis	EAD 330008-04-0601 [1]; Clause 2.2.17	Level $V_{Rk,s,a,x}$ [N]
18	Characteristic resistance to steel failure of connection between anchor and channel under static and quasi-static loading in longitudinal channel axis	EAD 330008-04-0601 [1]; Clause 2.2.18	Level $V_{Rk,s,c,x}$ [N]
19	Characteristic resistance to concrete pry-out failure under static and quasi-static shear loading	EAD 330008-04-0601 [1]; Clause 2.2.19	Level k_8 [-]
20	Characteristic resistance to concrete edge failure under static and quasi-static shear loading (anchor channel parallel to the edge)	EAD 330008-04-0601 [1]; Clause 2.2.20	Level $k_{cr,V}$ [-]; $k_{ucr,V}$ [-]
Characteristic resistance under combined static and quasi-static tension and shear loading			
21	Resistance to steel failure of the anchor channel due to combined static and quasi-static tension and shear loads on anchor channels embedded in concrete	EAD 330008-04-0601 [1]; Clause 2.2.21	Level k_{13} [-]; k_{14} [-9
Characteristic resistance under fatigue tension loading			
22	Characteristic fatigue resistance to steel failure of the whole system (continuous or tri-linear function, assessment method A1, A2)	EAD 330008-04-0601 [1]; Clause 2.2.22	Level $\Delta N_{Rk,s,0,n}$ [N] (n = 1 to n = ∞)
23	Characteristic fatigue limit resistance to steel failure of the whole system (Assessment method B)	EAD 330008-04-0601 [1]; Clause 2.2.23	Level $\Delta N_{Rk,s,0,\infty}$ [N]
24	Characteristic fatigue resistance to steel failure of the whole system (linearized function, assessment method C)	EAD 330008-04-0601 [1]; Clause 2.2.24	Level $\Delta N_{Rk,s,lo,n}$ [N]; $N_{lok,s,n}$ [N] (n = 10^4 to n = ∞)
25	Characteristic fatigue resistance to concrete related failure of the whole system (exponential function, assessment method A1, A2)	EAD 330008-04-0601 [1]; Clause 2.2.25	Level $\Delta N_{Rk,c,0,n}$ [N]; $\Delta N_{Rk,p,0,n}$ [N] (n = 1 to n = ∞)
26	Characteristic fatigue limit resistance to concrete related failure of the whole system (Assessment method B)	EAD 330008-04-0601 [1]; Clause 2.2.26	Level $\Delta N_{Rk,c,0,\infty}$ [N]; $\Delta N_{Rk,p,0,\infty}$ [N]
27	Characteristic fatigue resistance to concrete related failure of the whole system (linearized function, assessment method C)	EAD 330008-04-0601 [1]; Clause 2.2.27	Level $\Delta N_{Rk,c,E,n}$ [N]; $\Delta N_{Rk,p,E,n}$ [N] (n = 10^4 to n = ∞)
Characteristic resistance under fatigue shear loading			
28	Fatigue resistance to steel failure of the whole system under shear load perpendicular to the longitudinal channel axis (bilinear function, assessment method C)	EAD 330008-04-0601-v01 [2]; Clause 2.2.1	Level $\Delta V_{Rk,s,y,lo,n}$ [N]; $V_{lok,s,y,n}$ [N] (n = 10^4 to n = ∞)

No	Essential characteristic	Assessment method	Type of expression of product performance
29	Fatigue resistance to steel failure of the whole system under shear load in the direction of the longitudinal channel axis (bilinear function, assessment method C)	EAD 330008-04-0601-v01 [2]; Clause 2.2.2	Level $\Delta V_{Rk,s,x,lo,n}$ [N]; $V_{lok,s,x,n}$ [N] ($n = 10^4$ to $n = \infty$)
30	Fatigue resistance to concrete pry-out failure perpendicular to the longitudinal channel axis and in the direction of the longitudinal	EAD 330008-04-0601-v01 [2]; Clause 2.2.3	Level $\Delta V_{Rk,cp,y,E,n}$ [N]; $\Delta V_{Rk,cp,x,E,n}$ [N] ($n = 10^4$ to $n = \infty$)
Characteristic resistance under combined fatigue tension and shear loading			
31	Fatigue resistance to steel failure of the whole system	EAD 330008-04-0601-v01 [2]; Clause 2.2.4	Level k_{sn} [-]
Characteristic resistance under seismic loading (seismic performance category C1)			
32	Resistance to steel failure under seismic tension loading (seismic performance category C1)	EAD 330008-04-0601 [1]; Clause 2.2.28	Level $N_{Rk,s,a,eq}$ [N]; $N_{Rk,s,c,eq}$ [N]; $N_{Rk,s,l,eq}^0$ [N]; $N_{Rk,s,eq}$ [N]; $M_{Rk,s,flex,eq}$ [Nm]
33	Resistance to steel failure under seismic shear loading for shear load in transverse direction (seismic performance category C1)	EAD 330008-04-0601 [1]; Clause 2.2.29	Level $V_{Rk,s,eq}$ [N]; $V_{Rk,s,l,y,eq}^0$ [N]; $V_{Rk,s,c,y,eq}$ [N]; $V_{Rk,s,a,y,eq}$ [N]
34	Resistance to steel failure under seismic shear loading for shear load in longitudinal channel axis (seismic performance category C1)	EAD 330008-04-0601 [1]; Clause 2.2.30	Level $V_{Rk,s,l,x,eq}$ [N]; $V_{Rk,s,a,x,eq}$ [N]; $V_{Rk,s,c,x,eq}$ [N]
Characteristic resistance under static and quasi-static tension and/ or shear loading			
35	Displacements	EAD 330008-04-0601 [1]; Clause 2.2.31	Level δ_{N0}; $\delta_{N\infty}$; $\delta_{V,y,0}$; $\delta_{V,y,\infty}$; $\delta_{V,x,0}$; $\delta_{V,x,\infty}$ [mm]
Basic Works Requirement 2: Safety in case of fire			
36	Reaction to fire	EAD 330008-04-0601 [1]; Clause 2.2.32	Class
37	Resistance to fire	EAD 330008-04-0601 [1]; Clause 2.2.33	Level $N_{Rk,s,fi}$ [N]; $V_{Rk,y,s,fi}$ [N]; $c_{min,fi}$ [mm]; $s_{min,fi}$ [mm]
Aspects of durability			
38	Durability	EAD 330008-04-0601 [1]; Clause 2.2.34	Description

EAD 330008-04-0601 [1] and EAD 330008-04-0601-v01 apply regarding the determination of characteristic fatigue resistances.

2.2.   Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as "shall be stated in the ETA" or "it has to be given in the ETA" shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer, and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

2.2.1 Maximum installation torque to avoid damage during installation

EAD 330008-04-0601 [1], clause 2.2.6 applies.

Additional to EAD 330008-04-0601 [1], torque tests with channel bolts of all sizes and materials and coatings shall be performed with the controlled impact screwdriver in accordance with Annex A, Table A.1, line S5b, in case of setting with a controlled impact screwdriver is given in the manufacturer´s product installation instructions (MPII).

Purpose of the assessment:

Comparison between maximum pre-tension by calibrated torque wrench with maximum pre-tension by controlled impact screwdriver, so that neither damage of the product and the anchorage appears nor the product performance differs to the installation with a torque wrench.

Test conditions:

The test conditions of EAD 330008-04-0601 [1], clause 2.2.6, for tests on anchor channels not cast or cast into concrete apply with following modification:

Instead of a calibrated torque wrench, the controlled impact screwdriver shall be applied according to the MPII. In case the controlled impact screwdriver does not stop automatically when the setting is complete, the controlled impact screwdriver shall be applied with the maximum output power for at least 5 seconds.

Assessment method:

The condition of equation (2.2.6.4) of EAD 330008-04-0601 [1] shall be fulfilled substituting $N_{95\%,test}(T = 1,3\,T_{inst})$ with $N_{95\%,test,isd}$.

In case tests on anchor channels not cast into concrete were performed with a calibrated torque wrench, equation (2.2.6.5) of EAD 330008-04-0601 [1] shall be fulfilled substituting $N_{95\%,test}(T = 1,0\,T_{inst,g})$ with $N_{95\%,test,isd}$.

In case tests on anchor channels cast into concrete were performed with a calibrated torque wrench, equation (2.2.6.6) of EAD 330008-04-0601 [1] is substituted with equation (2.2.1.1):

$$N_{95\%,test,isd} < N_{95\%,test}\,(T = 1,3\,T_{inst,g}) \qquad\qquad [\text{N}] \qquad (2.2.1.1)$$

with:

$N_{95\%,test,isd}$	=	95% fractile of pre-stressing tension force on channel bolt in a test series in accordance with Annex A, Table A.1.1, line S5b, with a controlled impact screwdriver	[N]
		with $N_{95\%,test,isd} = N_{m,test,isd} \cdot (1 + k_s \cdot v_{test})$	
		with k_s and v_{test} according to EAD 330008-04-0601 [1]	
$N_{m,test,isd}$	=	mean value of pre-stressing tension force on channel bolt in a test series in accordance with Annex A, Table A.1.1, line S5b, with a controlled impact screwdriver	[N]
$N_{95\%,test}$	=	95% fractile of pre-stressing tension force on channel bolt in a test series in accordance with EAD 330008-04-0601 [1], Annex A, Table A.1.1, line S5, with a calibrated torque wrench	[N]

In case equations (2.2.6.4) and/or (2.2.6.5) or equation (2.2.1.1) of EAD 330008-04-0601 [1] are not fulfilled, the power of the controlled impact screwdriver shall be reduced and tests with that power reduced controlled impact screwdriver in accordance with EAD 330008-04-0601 [1], clause 2.2.6, shall be repeated.

To show the equivalence with the torque wrench, at least the same level of pre-tension needs to be achieved. Therefore, the following conditions shall be fulfilled:

$$N_{95\%,test,isd} > 0,95\, N_{95\%,test}\left(T = 1,0\, T_{inst,g}\right) \qquad\qquad \text{[N]} \qquad (2.2.1.2)$$

$$N_{m,test,isd} > 0,95\, N_{m,test}\left(T = 1,0\, T_{inst,g}\right) \qquad\qquad \text{[N]} \qquad (2.2.1.3)$$

In case equations (2.2.1.2) and/or (2.2.1.3) are not fulfilled, a lower installation torque shall be specified and the tests with the calibrated torque wrench in accordance with EAD 330008-04-0601 [1], clauses 2.2.15 and 2.2.16, shall be repeated if resistance and factor in accordance with EAD 330008-04-0601 [1], Table 2.1.1, lines 15 and 16, already exist.

Expression of results:

For the assessed controlled impact screwdriver:

The manufacturer, the model including controlling module, the impact rate [IPM], the impact energy [J], $T_{inst,g}$ for controlled impact screwdriver is identical with $T_{inst,g}$ of the calibrated torque wrench.

2.2.2 Minimum edge distance, spacing and member thickness to avoid splitting of concrete during installation

EAD 330008-04-0601 [1], clause 2.2.9 applies.

Additional to EAD 330008-04-0601 [1], torque tests with channel bolts of all sizes and materials and coatings shall be performed with the controlled impact screwdriver in accordance with Annex A, Table A.1.1, line C1b. If for one channel size different anchors are specified, the anchor with the smallest head shall be used to generate the highest splitting forces.

Purpose of the assessment

Check if the controlled impact screwdriver causes damage of the anchors during installation.

Test conditions:

Test setup shall follow EAD 330008-04-0601 [1], Figure 2.2.9.1. Test conditions shall follow EAD 330008-04-0601 [1]. In addition, both channel bolts shall first be fully torqued one after each other according to the MPII. Following, the controlled impact screwdriver shall be applied on each channel bolt with the maximum output power for at least 5 seconds. If the controlled impact screwdriver does not allow to adjust the maximum output power, the controlled impact screwdriver shall be applied to the two channel bolts with the same setting for the specific channel bolt two additional times each according to the MPII (total of three times the setting process).

Assessment method:

No hairline cracks shall appear on the surface or the sides of the concrete member after the repeated applications of the controlled impact screwdriver for each of the tests. In case a hairline crack appears in any of the tests, the test series shall be repeated with a larger edge distance or spacing or in test members with a larger minimum member depth (or a combination of two or all three parameters). The larger value for c_{min}, s_{min}, h_{min} of tests with a calibrated torque wrench and a controlled impact screwdriver is decisive.

Expression of results:

c_{min}, s_{min}, h_{min}

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

EAD 330008-04-0601 [1], clause 3.1, applies.

3.2 Tasks of the manufacturer

EAD 330008-04-0601 [1] and EAD 330008-04-0601-v01 [2], clause 3.2, applies.

Table 3.2.1 Control plan for the manufacturer; cornerstones

EAD 330008-04-0601 [1], Table 3.2.1, applies.

3.3 Tasks of the notified body

EAD 330008-04-0601 [1], clause 3.3, applies.

Table 3.3.1 Control plan for the notified body; cornerstones

EAD 330008-04-0601 [1], Table 3.3.1, applies.

4   REFERENCE DOCUMENTS

EAD 330008-04-0601 [1] and EAD 330008-04-0601-v01 [2] apply.

[1] EAD 330008-04-0601	Anchor channels
[2] EAD 330008-04-0601-v01	Anchor channels - variant: under fatigue cyclic shear with different lower load level

ANNEX A: RESISTANCE UNDER STATIC AND QUASI-STATIC LOADING - GENERAL ASPECTS OF TESTS AND ASSESSMENT

330008-04-0601 [1] applies.

Table A.1.1   Additional tests under static or quasi-static actions (tension and shear) for controlled impact screwdriver

N°	Tests according to the following clauses	Concrete	Δw [mm]	Number of tests	Channel	Anchor	Material	Channel bolt Ø	Channel bolt Quality
Steel failure under tension load									
S5b	2.2.1 Torque tests with controlled impact screwdriver	see EAD 330008-04-0601 [1], clause 2.2.6	—	≥ 5	all	EAD 330008-04-0601 [1], clause 2.2.6	all	all	all
Concrete failure under tension load									
C1b	2.2.2 Splitting failure due to installation with controlled impact screwdriver [1] $c = c_{min}$, $s = s_{min}$, $h = h_{min}$	C20/25	0	≥ 5	all	EAD 330008-04-0601 [1], clause 2.2.9			

Footnote to Table A.1.1:

[1]   The test programme may be reduced, if the conditions in EAD 330008-04-06.01 [1], clause 2.2.9, are fulfilled.

ANNEX B   RESISTANCE UNDER FATIGUE CYCLIC TENSION LOADING – GENERAL ASPECTS OF TESTS

EAD 330008-04-0601 [1] and EAD 330008-04-0601-v01 [2] apply.

ANNEX C   RESISTANCE UNDER FATIGUE CYCLIC TENSION LOADING – ASSESSMENT: INTERACTIVE METHOD (METHOD A1)

EAD 330008-04-0601 [1] applies.

ANNEX D   RESISTANCE UNDER FATIGUE CYCLIC TENSION LOADING – ASSESSMENT: TRI-LINEAR FUNCTION (METHOD A2)

EAD 330008-04-0601 [1] applies.

ANNEX E   RESISTANCE UNDER FATIGUE CYCLIC TENSION LOADING – ASSESSMENT: CHARACTERISTIC FATIGUE LIMIT RESISTANCE (METHOD B)

EAD 330008-04-0601 [1] applies.

ANNEX F   TEST DETAILSAND ASSESSMENT OF ANCHOR CHANNELS IN CONCRETE CONCERNING RESISTANCE TO FIRE

EAD 330008-04-0601 [1] applies.

ANNEX G   TEST DETAILS AND ASSESSMENT OF ANCHOR CHANNELS IN CONCRETE CONCERNING RESISTANCE TO SEISMIC LOADING (SEISMIC PERFORMANCE CATEGORY C1)

EAD 330008-04-0601 [1] applies.

ANNEX H   RESISTANCE UNDER FATIGUE CYCLIC TENSION LOADING – ASSESSMENT: BI-LINEAR FUNCTION (METHOD C)

EAD 330008-04-0601 [1] applies for tension.

ANNEX I   RESISTANCE UNDER FATIGUE CYCLIC SHEAR LOADING – ASSESSMENT: BI-LINEAR FUNCTION (METHOD C)

EAD 330008-04-0601-v01 [2] applies.