EAD **330284-00-0604-v02**

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European Assessment Document for

Variant: Plastic anchors for redundant non-structural systems in concrete and masonry, and for fixing façade claddings through angle brackets under seismic actions in concrete and masonry

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

EAD 330284-00-0604 [1] [1], clause 1.1 applies with the following clarifications.

This EAD is a variant to EAD 330284-00-0604 [1] due to the additional assessment of plastic anchors for fixing facade claddings through angle brackets in base material made of masonry and concrete under seismic action. The plastic anchors are consisting of a polymeric sleeve with an outside diameter of at least d_{nom} = 8 mm and a metal expansion element (screw) with an external diameter of at least 5 mm. The screw and the plastic sleeve are a unit named “fastener” hereinafter.

The thickness of the base material in which the fastener is installed is $h \geq 2\ h_{nom}$ and $h \geq 100$ mm for concrete and masonry. The fastener is intended to be installed in a pre-drilled hole perpendicular to the surface (maximum deviation 5°).

The product is not fully covered by the following harmonised technical specification: EAD 330284-00-0604 [1] which covers static and quasi-static loading only.

> *Note: The testing and assessment methods proposed in this EAD variant are specifically adapted for angle brackets for facade claddings and derived from existing dynamic testing protocols for façade cladding under seismic actions, capable to withstand a maximum seismic acceleration up to 16,5 m/s² resulting in tension and shear loads on the fasteners.*

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

1.2.1 Intended use(s)

EAD 330284-00-0604 [1], clause 1.2.1 applies with the following clarifications.

The fastener is intended to be used only as redundant non-structural system (statically indeterminate fixing with more than two supports as specified in clause 1.3.1 under seismic tension or shear loading, or both for the anchorage of facade claddings through angle brackets in concrete or masonry). Examples of arrangements for brackets to base material connection are reported in Figure 1.2.1.1 and Figure 1.2.1.2.

The fasteners subjected to seismic actions are intended to be submitted to tension, shear or combined tension and shear loading but not to bending. This EAD variant covers applications where the support in which the fasteners are embedded are subject to seismic actions.

This EAD variant covers fasteners that are intended to be used in areas of masonry structures, where cracks are not expected (e.g., out of areas along the diagonals of shear walls).

The assessments of performances presented in this variant can be used to determine characteristic values of the fastener. The fasteners may be designed in accordance with TR 080 [3].

This EAD variant applies to fasteners used to connect angle brackets with bending stiffness in the range (0,03 to 0,10) kN/mm and for claddings subjected to a maximum in plane acceleration equal to 16,5 m/s^2. These two conditions ensure that the couple “fastener + bracket + cladding” will be assessed while resonating (i.e. in conditions relevant for assessing the product’s behavior under seismic action).

The use of fasteners in base material group d) (autoclaved aerated concrete) in accordance with EAD 330284-00-0604 [1], Table 1.1 is not covered by this EAD variant.

The fasteners are intended to be used in concrete where the strength class is in the range C20/25 to C50/60 all in accordance with EN 206 [2].

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1 All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

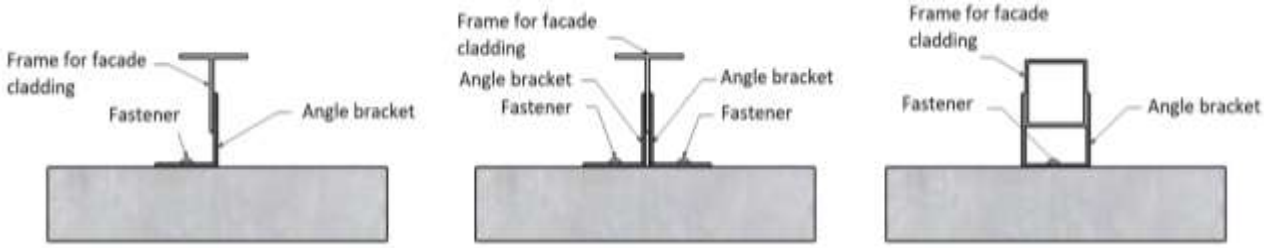

Figure 1.2.1.1: Examples of facade cladding to concrete or masonry connections

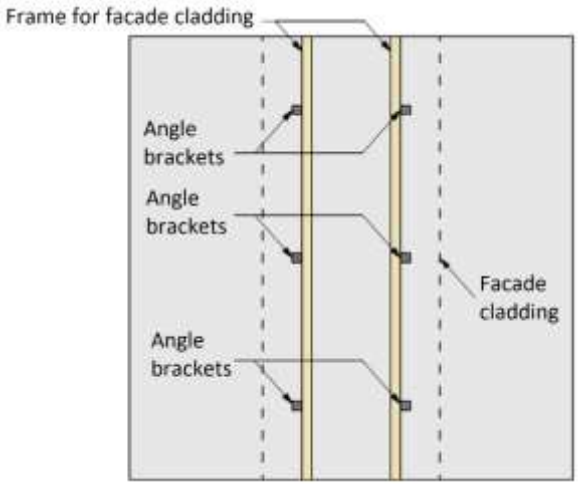

Figure 1.2.1.2: Example of statically indeterminate fixing for the anchorage of facade claddings

1.2.2 Working life/Durability

EAD 330284-00-0604 [1], clause 1.2.2 with the following clarifications.

Deviating to EAD 330284-00-0604 [1], the assessment methods included or referred to in this EAD variant applies to fasteners for fixing façade claddings through angle brackets under seismic actions in concrete and masonry. This EAD variant has been written based on the manufacturer's request to take into account a working life of the fastener for the intended use of 25 years when installed in the works (provided that the fastener is subject to appropriate installation (see clause 1.1)) These provisions are based upon the current state of the art and the available knowledge and experience.

1.3 Specific terms used in this EAD

1.3.1 Definitions

EAD 330284-00-0604 [1], clause 1.3.1 applies.

1.3.2 Notation for fasteners

EAD 330284-00-0604 [1], clause 1.3.2 with the following clarifications.

A_s = cross sectional area of the fastener

1.3.3 Notation for base materials

EAD 330284-00-0604 [1], clause 1.3.3 applies.

1.3.4 Notation for assessment of tests

EAD 330284-00-0604 [1], clause 1.3.4 with the following clarifications.

$F_{Rk,sf}$	=	characteristic resistance for single fastener under seismic loading
k_{alea}	=	coefficient taking account uncertainties in the load distribution
$N_{u,m,sf}$	=	mean ultimate tension load from residual tests after seismic cyclic loading
$N_{Rk,sf}$	=	characteristic resistance to tension loading for single fastener under seismic loading
V_{Rk}	=	characteristic resistance under shear force stated in ETA
$V_{u,m,sf}$	=	mean ultimate tension load from residual tests after seismic cyclic loading
$V_{Rk,sf}$	=	characteristic resistance to shear loading for single fastener under seismic
$\alpha_{sf,N}$	=	seismic reduction factor for tension resistance
$\alpha_{sf,V}$	=	seismic reduction factor for shear resistance
$\delta_{sf,N,DLS}$	=	displacement (movement) of the fastener at the surface of the base material relative to the surface of the base material in direction of the load (tension) outside the failure area at Damage Limitation State.
$\delta_{sf,V,DLS}$	=	displacement (movement) of the fastener at the surface of the base material relative to the surface of the base material in direction of the load (shear) outside the failure area at Damage Limitation State.

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 product 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			
1	Reaction to fire	EAD 330284-00-0604, clause 2.2.1	Class A1
2	Resistance to fire	EAD 330284-00-0604, clause 2.2.2	Level: $N_{Rk,s,fi}$, $N_{Rk,p,fi}$, $F_{Rk,fi,90}$ [kN]
Basic Works Requirement 2: Safety in case of fire			
3	Resistance to steel failure under tension loading	EAD 330284-00-0604, clause 2.2.3	Level: $N_{Rk,s}$ [kN]
4	Resistance to steel or polymer failure under shear loading	EAD 330284-00-0604, clause 2.2.4	Level: $V_{Rk,s}$ [kN], $M_{Rk,s}$ [Nm], $V_{Rk,pol}$ [kN]
5	Resistance to pull-out or concrete failure or polymer failure under tension loading (base material group a)	EAD 330284-00-0604, clause 2.2.5	Level: $N_{Rk,p}$ [kN] or $N_{Rk,pol}$ [kN]
6	Resistance in any load direction without lever arm (base material group b, c and d)	EAD 330284-00-0604, clause 2.2.6	Level: F_{Rk} [kN]
7	Edge distance and spacing (base material group a)	EAD 330284-00-0604, clause 2.2.7	Level: c_{cr}, s_{cr}, c_{min}, s_{min}, a, h_{min}-[mm]
8	Edge distance and spacing (base material group b, c and d)	EAD 330284-00-0604, clause 2.2.8	Level: c_{min}, s_{min}, h_{min} [mm]
9	Displacements under short-term and long-term loading	EAD 330284-00-0604, clause 2.2.9	Level: δ_0, δ_∞ [mm]
10	Characteristic seismic resistance to tension loading	2.2.1	Level: $N_{Rk,sf}$ [kN]
11	Displacement for serviceability limit state under seismic tension load	2.2.2	Level: $\delta_{sf,N,DLS}$ [mm]
12	Characteristic seismic resistance to shear loading	2.2.3	Level: $V_{Rk,sf}$ [kN]
13	Displacement for serviceability limit state under seismic shear	2.2.4	Level: $\delta_{sf,V,DLS}$ [mm]
Aspects of durability			
14	Durability	EAD 330284-00-0604, clause 2.2.10	Description

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

EAD 330284-00-0604 [1], clause 2.2 applies.

2.2.1 Characteristic seismic resistance to tension loading

The following method to assess the characteristic seismic resistances under tension loading relies on previously assessed resistances under static loading. Consequently, before starting the test programme under seismic actions, the following essential characteristics shall have been assessed:

- Mean ultimate tension resistance $N_{u,m,static}$ from admissible test in accordance with EAD 330284-00-0604 [1], Table A.1, line A1 [N] (base material group a)).
- Mean ultimate tension resistance $N_{u,m,static}$ from admissible test in accordance with EAD 330284-00-0604 [1], Table A.1, line A2 [N] (base material group b) and c)).
- Characteristic value of steel resistance for single fastener $N_{Rk,s}$ in accordance with EAD 330284-00-0604 [1], clause 2.2.3
- Characteristic value of resistance for single fasteners $F_{Rk,i}$ in accordance with EAD 330284-00-0604 [1], clause 2.2.5.11 for use category a) (concrete: $N_{Rk,p}$) or clause 2.2.6.13 for use categories b) and c) (solid and perforated bricks, respectively: with $F_{Rk,}$).

The same base material shall be used to assess both the characteristic static resistance and the seismic resistance.

Purpose of the test:

The test shall be performed in order to determine the performance of the fastener connection to the base material under seismic tension loading.

Test conditions:

General provisions regarding test specimens and test equipment included in EAD 330284-00-0604 [1] Annex A apply for tests in concrete or in other base materials, as defined in EAD 330284-00-0604 [1], clause 1.1. Special features, details and boundary conditions of the seismic tests are listed in Annex B.

Subject the fastener to the sinusoidal or triangular tension loading as specified in Table 2.2.1.1 and Figure 2.2.1.1 where N_{max} is given in Equation (2.2.1.1). The bottom of the tension load pulses shall be taken to be slightly greater than zero to avoid servo control problems but shall not exceed N_{min}, with N_{min} being the maximum of 2% of N_{max} and 200 N.

A total of 480 cycles shall be carried out following Table 2.2.1.1.

$$N_{max} = 0{,}90 \cdot N_{u,m,static} \cdot \left(\frac{f_{c,lineS1}}{f_{c,static}}\right)^{n} \qquad (2.2.1.1)$$

Where:

$N_{u,m,static}$ = [N] - mean tension capacity from admissible service condition tests in accordance with EAD 330284-00-0604 [1], Table A.1, line A1 for fasteners intended for concrete or line A2 for fasteners intended for solid masonry or for hollow or perforated masonry

$f_{c,static}$ = [N/mm²] – mean compressive strength of test member used for the determination of $N_{u,m,static}$

$f_{c,lineS1}$ = [N/mm²] – mean compressive strength of test member for test series according to Table A.1 Line S1

n = 0,5 for test in concrete
= 1,0 for tests in solid masonry and hollow or perforated masonry

Table 2.2.1.1 Load amplitudes for cyclic tension test

N/N_{max}	Frequency [Hz]	Number of cycles [-]
0,20	2	20
0,20	5	20
0,20	8	20
0,30	2	20
0,30	5	20
0,30	9	20
0,40	2	20
0,40	5	20
0,40	10	20
0,50	2	20
0,50	5	20
0,50	11	20
0,55	3	20
0,55	7	20
0,55	12	20
0,70	3	20
0,70	7	20
0,70	13	20
0,85	3	20
0,85	8	20
0,85	14	20
1,00	3	20
1,00	8	20
1,00	15	20

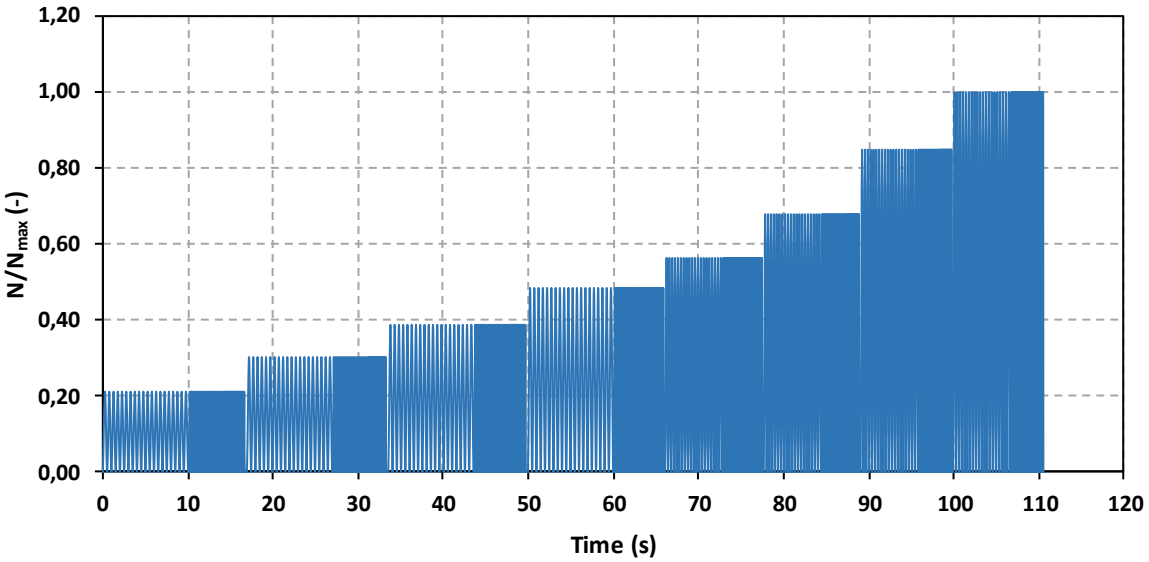

Figure 2.2.1.1*:* Pulsating tension schematic test procedure

The fastener displacement and the applied tension load shall be recorded continuously during the simulated seismic tension cycles. The maximum displacements $\delta_{sf,N,DLS}$ shall be continuously recorded during load cycles.

Following completion of the load cycles the fastener shall be unloaded, the displacement measured and a residual tension test to failure performed.

If the fastener fails during the application of load cycles, the test shall be carried out with a reduced load level by replacing N_{max} with $N_{max,red}$ in Table 2.2.1.1 and Figure 2.2.1.1.

At least 5 tests at the selected load level N_{max} or $N_{max,red}$ shall complete the load cycling protocol.

Assessment method:

The following conditions apply:

1. All fasteners in a test series shall complete the pulsating tension load history specified in Table 2.2.1.1 and Figure 2.2.1.1. Failure of a fastener to develop the resistance in any cycle prior to completing the loading history specified in Table 2.2.1.1 shall be recorded as an unsuccessful test.

   In case of an unsuccessful test, the test series shall be repeated with a reduced value $N_{max,red}$ until until the load cycling protocol is fulfilled. In this case the reduction factor $\alpha_{sf,N,a}$ shall be calculated according to Equation (2.2.1.2).

$$\alpha_{sf,N,a} = \frac{N_{max,red}}{N_{max}} \leq 1{,}0 \qquad (2.2.1.2)$$

   with

   N_{max} = maximum tension load as calculated according to Equation (2.2.1.1)

   $N_{max,red}$ = reduced tension load

2. Residual capacity tests (both conditions apply):

a. Ultimate load:

   If Equation (2.2.1.3) is fulfilled, $\alpha_{sf,N,b}$ = 1,0:

$$N_{u,m,sf} \geq 0{,}9 \cdot N_{u,m,static} \qquad (2.2.1.3)$$

   with

   $N_{u,m,sf}$ = mean ultimate tension load from residual loading tests to failure [N];

   $N_{u,m,static}$ = mean ultimate tension from admissible test in accordance with EAD 330284-00-0604 [1], Table A.1, line A1 [N] or in accordance with EAD 330284-00-0604 [1], Table A.1, line A2 [N].

   If this condition is not fulfilled:

   - Option 1 (reference option): The factor $\alpha_{sf,N,b}$ shall be determined according to Equation (2.2.1.4).

$$\alpha_{sf,N,b} = \frac{N_{u,m,sf}}{0{,}9 \cdot N_{u,m,static}} \leq 1{,}0 \qquad (2.2.1.4)$$

   In Equations (2.2.1.3) and (2.2.1.4) the resistance $N_{u,m,static}$ from test series A1 or test series A2 shall be normalized in accordance with EAD 330284-00-0604 [1], Annex A.3.1.

   - Option 2: The test series shall be repeated with a reduced value of N_{max} until Equation (2.2.1.3) is fulfilled.

b. Scatter of ultimate loads:

$$cv(N_u) \leq 20\% \qquad (2.2.1.5)$$

   If this condition is fulfilled, $\alpha_{v,sf,N}$ = 1,0. If this condition is not fulfilled, $\alpha_{v,sf,N}$ shall be determined in accordance with EAD 330284-00-0604 [1], Annex A, Equation (A.13).

The reduction factor $\alpha_{sf,N}$ resulting from the pulsating tension test series shall be determined according to Equation (2.2.1.6).

$$\alpha_{sf,N} = \alpha_{sf,N,a} \cdot \alpha_{sf,N,b} \qquad (2.2.1.6)$$

The characteristic resistance as determined below shall be applied only for the fasteners with the tested embedment depth. The characteristic resistance as given in the following shall be limited by the values for static and quasi-static loading as determined in accordance with EAD 330284-00-0604 [1], clause 2.2.5 for

material group a) or in accordance with EAD 330284-00-0604 [1], clause 2.2. for material group b) and material group c).

The characteristic resistances for a single fastener under seismic tension loading shall be determined as follows:

For steel failure in concrete:

$$N_{Rk,s,sf} = \alpha_{sf,N} \cdot \alpha_{v,sf,N} \cdot N_{Rk,s} / k_{alea} \text{[kN]} \quad (2.2.1.7)$$

For pull-out failure in concrete and all failure modes in masonry:

$$N_{Rk,sf} = \alpha_{sf,N} \cdot \alpha_{v,sf,N} \cdot F_{Rk,i} / k_{alea} \text{ [kN]} \quad (2.2.1.8)$$

where

$N_{Rk,s}$ = characteristic value of steel resistance for single fastener in accordance with EAD 330284-00-0604 [1], clause 2.2.3

$F_{Rk,i}$ = characteristic value of resistance for single fasteners in accordance with EAD 330284-00-0604 [1], clause 2.2.5.11 for use category a) (concrete: $N_{Rk,p}$) or clause 2.2.6.13 for use categories b) and c) (solid and perforated bricks, respectively: with $F_{Rk,}$).

$\alpha_{sf,N}$ = reduction factor as determined in Equation (2.2.1.4);

$\alpha_{v,sf,N}$ = reduction factor accounting for large scatter as determined in EAD 330284-00-0604 [1], Equation (A.13)

k_{alea} = *1,5.* Coefficient considering uncertainties in the load distribution

Expression of performance:

$N_{Rk,sf}$ in [kN] and $N_{Rk,s,sf}$ in [kN] shall be stated in the ETA

2.2.2 Displacement for serviceability limit state under seismic tension load

The displacement for serviceability limit state under seismic tension load $\delta_{sf,N,DLS}$, shall be expressed as the mean value of the maximum values of displacement after successful completion of the 20 last cycles (see Table 2.2.1.1 and Figure 2.2.1.1) for the load N_{max} (or $N_{max,red}$ in case the tests are repeated with a reduced load value, as applicable).

Note: In accordance with EAD 330284-00-0604 [1], clause A.2.4, displacements shall be recorded continuously during each tension test (e.g., by means of displacement electrical transducers) with a measuring error not greater than 0,02 mm.

Expression of performance:

$\delta_{sf,N,DLS}$ in [mm] shall be stated in the ETA.

2.2.3 Characteristic seismic resistance to shear loading

The following method to assess the characteristic seismic resistances under shear loading relies on previously assessed resistances under static loading. Consequently, before starting the test programme under seismic actions, the following essential characteristics shall have be assessed :

- Mean ultimate shear resistance $V_{u,m,static}$ from admissible test in accordance with EAD 330284-00-0604 [1], Table A.1, line A4 in base material group a) or, if no shear tests have been performed, $V_{u,m,static}$ = 0,6 ·A_s·f_{uk} [N].

- Characteristic value of resistance for single fasteners in accordance with EAD 330284-00-0604 [1], clause 2.2.4.1 for base material group a) or 2.2.6.12 for use base material group b) and c).

The same base material shall be used to assess both the characteristic static resistance and the seismic resistance.

Purpose of the test:

The tests are performed to determine the performance of the fastener connection to the base material under seismic shear loading.

Test conditions:

General provisions regarding test specimens and test equipment included in EAD 330284-00-0604 [1] Annex A apply for tests in concrete or in other base materials. Special features, details and boundary conditions of the seismic tests are listed in Annex B.

Subject the fastener to the sinusoidal or triangular shear loading specified in Table 2.2.3.1 and Figure 2.2.3.1, where V_{max} is given in Equation (2.2.3.1). To reduce the potential for uncontrolled slip during load reversal, an approximation by two half-sinusoidal load cycles at the frequency connected by a reduced speed, ramped load or simply triangular loading cycles may be used in place of sinusoidal cycles.

$$V_{max} = 0{,}90 \cdot V_{u,m,static} \cdot \left(\frac{f_{c,lineS2}}{f_{c,static}}\right)^{n} \qquad (2.2.3.1)$$

Where

$V_{u,m,static}$ = [N]- mean shear capacity from admissible service condition tests in accordance with EAD 330284-00-0604 [1], Table A.1, line A4 (base material group a)), or, if no shear tests have been performed (base material group b) and c)), $V_{u,m,static}$= 0,6 ·A_s·f_{uk}. In this case, the conversion via compressive strength with $f_{c,lineS2}/f_{static}$ does not apply.

$f_{c,static}$ = [N/mm²] – mean compressive strength of test member use for the determination of $V_{u,m,static}$

$f_{c,lineS2}$ = [N/mm²] – mean compressive strength of test member for test series according to Table A.1 Line S2

n = 0,5 for test in concrete
= 1,0 for tests is solid masonry and hollow or perforated masonry

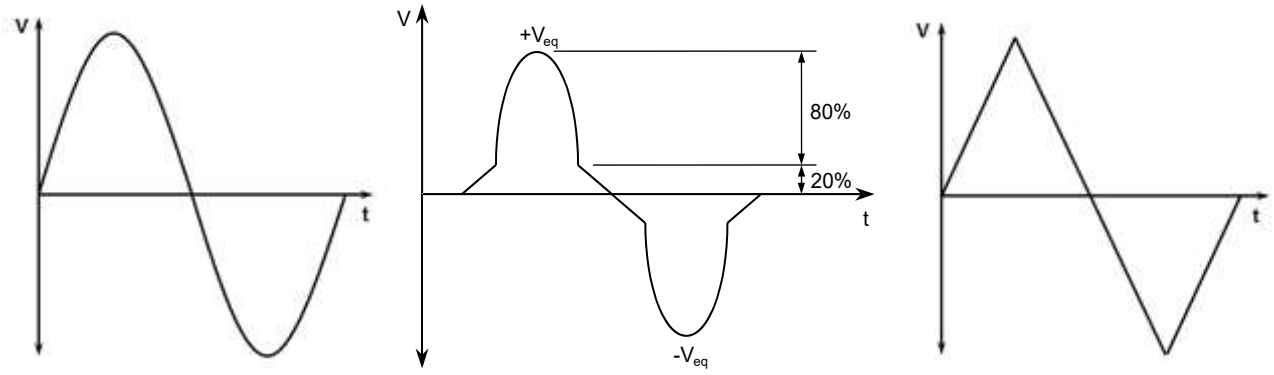

Figure 2.2.3.1 Permitted approximation of seismic shear

Cycles to be carried out at load values of V lower than 0,3 kN can be carried out at a value equal to 0,3 kN. A total of 480 cycles shall be carried out following Table 2.2.3.1

Table 2.2.3.1 Load amplitudes for alternating shear test.

V/V_{max}	Frequency [Hz]	Number of cycles [-]
0,20	2	20
0,20	5	20
0,20	8	20
0,30	2	20
0,30	5	20
0,30	9	20
0,40	2	20
0,40	5	20
0,40	10	20
0,50	2	20
0,50	5	20
0,50	11	20
0,55	3	20
0,55	7	20
0,55	12	20
0,70	3	20
0,70	7	20
0,70	13	20
0,85	3	20
0,85	8	20
0,85	14	20
1,00	3	20
1,00	8	20
1,00	15	20

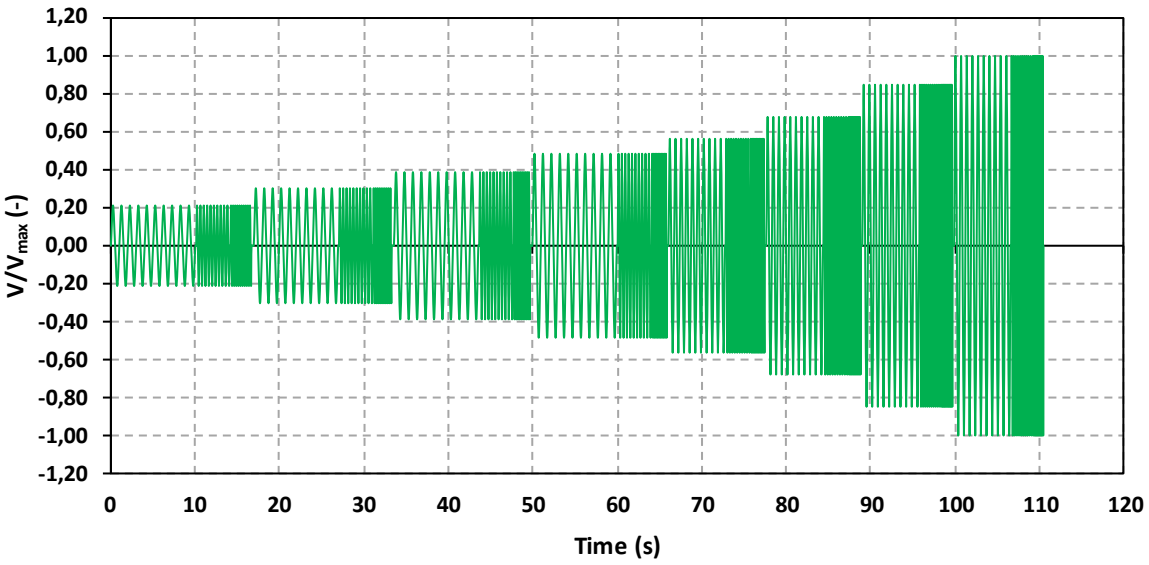

Figure 2.2.3.2*:* Alternating shear schematic test procedure

Record the fastener displacement and the applied shear load continuously during the simulated seismic shear cycles. The maximum displacements $\delta_{sf,V,DLS}$ shall be continuously recorded during load cycles.

Following completion of the load cycles the fastener shall be unloaded, the displacement measured and a residual shear test to failure performed.

If the fastener fails during the application of load cycles, the test shall be carried out with a reduced load level by replacing V_{max} with $V_{max,red}$ in Figure 2.2.3.2 and Table 2.2.3.1.

At least 5 tests at the selected load level V_{max} or $V_{max,red}$ shall complete the load cycling protocol.

Assessment method:

The following conditions apply:

All fasteners in a test series shall complete the alternating shear load history specified in Figure 2.2.3.2 and Table 2.2.3.1. Failure of a fastener to develop the resistance in any cycle prior to completing the loading history specified in Table 2.2.4.1 shall be recorded as an unsuccessful test.

In case of an unsuccessful test, the test series shall be repeated with a reduced value $V_{max,red}$ until the until the load cycling protocol is fulfilled. In this case the reduction factor $\alpha_{sf,V,a}$ shall be calculated according to Equation (2.2.3.2).

$$\alpha_{sf,V,a} = \frac{V_{max,red}}{V_{max}} \leq 1{,}0 \qquad (2.2.3.2)$$

with

V_{max} = maximum shear load calculated according to Equation (2.2.3.2)

$V_{max,red}$ = reduced shear load

1. Residual capacity tests (both conditions apply):
   a. Ultimate load:

If Equation (2.2.3.3) is fulfilled, $\alpha_{sf,V,b}$ = 1,0:

$$V_{u,m,sf} \geq 0{,}9 \cdot V_{u,m,static} \qquad (2.2.3.3)$$

with

$V_{u,m,sf}$ = mean ultimate shear load from residual loading tests to failure [N];

$V_{u,m,static}$ = mean ultimate shear capacity from admissible service condition tests in accordance with EAD 330284-00-0604 [1], Table A.1, line A4 (base material group a)), or, if no shear tests have been performed (base material group b) and c)), $V_{u,m,static} = 0{,}6 \cdot A_s \cdot f_{uk}$

If this condition is not fulfilled:

- Option 1 (reference option): The factor $\alpha_{sf,V,b}$ shall be determined according to Equation (2.2.3.4).

$$\alpha_{sf,V,b} = \frac{V_{u,m,sf}}{0{,}9 \cdot V_{u,m,static}} \leq 1{,}0 \qquad (2.2.3.4)$$

In Equations (2.2.3.3) and (2.2.3.4) the resistance $V_{u,m,static}$ shall be normalized in accordance with EAD 330284-00-0604 [1], Annex A.

- Option 2: The test series shall be repeated with a reduced value of N_{max} until Equation (2.2.1.3) is fulfilled.

   b. Scatter of ultimate loads:

$$\mathrm{cv}(V_u) \leq 20\% \qquad (2.2.3.5)$$

If this condition is fulfilled, $\alpha_{v,sf,V}$ = 1,0. If this condition is not fulfilled, $\alpha_{v,sf,V}$ shall be determined in accordance with EAD 330284-00-0604 [1], Annex A, Equation (A.13).

The reduction factor $\alpha_{sf,V}$ resulting from the alternating shear test series is determined according to Equation (2.2.3.6).

$$\alpha_{sf,V} = \alpha_{sf,V,a} \cdot \alpha_{sf,V,b} \qquad (2.2.3.6)$$

The characteristic resistance as determined below shall be applied only for fasteners with the tested embedment depth. The characteristic resistances for single fastener under seismic loading shall be limited

by the resistance under static and quasi-static loading determined in accordance with EAD 330284-00-0604 [1], clause 2.2.4.1.:

The characteristic resistance for a single fastener under shear seismic loading shall be determined as follows:

$$V_{Rk,sf} = \alpha_{sf,V} \cdot \alpha_{v,sf,V} \cdot V_{Rk} / k_{alea} \quad [\text{kN}] \qquad (2.2.3.7)$$

where

V_{Rk} = characteristic value of resistance for single fasteners in accordance with EAD 330284-00-0604 [1], clause 2.2.4.1 for use category a) (concrete) or 2.2.6.12 for use categories b) and c) (solid and perforated bricks, respectively).

$\alpha_{sf,V}$ = reduction factor as determined in Equation (2.2.3.6);

$\alpha_{v,sf,V}$ = reduction factor accounting for large scatter as determined in EAD 330284-00-0604 [1], Annex A, Equation (A.13);

k_{alea} = *1,5.* Coefficient considering uncertainties in the load distribution

Expression of performance

$V_{Rk,sf}$ in [N] shall be stated in the ETA.

2.2.4 Displacement for serviceability limit state under seismic shear

The displacement for serviceability limit state under seismic shear $\delta_{sf,V,DLS}$ shall be expressed as the mean of the maximum of absolute displacement values in the positive loading direction and the mean of the maximum of the absolute values in the negative loading direction, excluding displacements due to the annular gap, after successful completion of the cycles during the 20 last cycles at the load V_{max} (or $V_{max,red}$ in case the tests are repeated with a reduced load value, as applicable (see Figure 2.2.3.2 and Table 2.2.3.1)).

Note: In accordance with EAD 330284-00-0604 [1], clause A.2.4, displacements shall be recorded continuously during each shear test (e.g., by means of displacement electrical transducers) with a measuring error not greater than 0,02 mm.

Expression of performance:

$\delta_{sf,V,DLS}$ in [mm] shall be stated in the ETA

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

EAD 330284-00-0604 [1], clause 3.1 applies.

3.2 Tasks of the manufacturer

EAD 330284-00-0604 [1], clause 3.2 applies.

3.3 Tasks of the notified body

EAD 330284-00-0604 [1], clause 3.3 applies.

4 REFERENCE DOCUMENTS

EAD 330284-00-0604 [1], clause 4 with the following clarifications.

[1]	EAD 330284-00-0604	Plastic anchors for redundant non-structural systems in concrete and masonry, Edition June 2018
[2]	EN 206:2013+A2:2021	Concrete — Specification, performance, production and conformity
[3]	TR 080	Design of plastic anchors for fixing façade claddings through angle brackets in masonry and concrete under seismic action

ANNEX A: TEST PROGRAMME

EAD 330284-00-0604 [1], Annex A applies with the following clarifications.

Table A.1 Test programme of seismic tests

Line	Purpose of tests	Base material group	Crack width Δw [mm]	Drill bit	Temperature	Conditions of polymeric sleeve	Size	Number of tests	req. α	EAD clause
S1	Characteristic seismic resistance to tension loading	a,b,c	0	$d_{cut,m}$	Normal ambient temperature	Standard	All	5 [1) 2)]	≥ 0,9	2.2.1
S2	Characteristic seismic resistance to shear loading	a,b,c	0	$d_{cut,m}$	Normal ambient temperature	Standard	all	5 [1) 2)]	≥ 0,9	2.2.3

1) The tests shall be performed in each base material group applied for by the manufacturer.
2) In case of masonry, the tests shall be performed in uncracked masonry units or walls. It is considered that due to the intended use of this EAD variant (façade claddings) the number of fixing points is sufficient to ensure that the probability that the cracks cross all fasteners location is very low.