EUROPEAN ASSESSMENT DOCUMENT

EAD 332001-00-0602

June 2018

CLAMPING SYSTEM FOR CONNECTION OF PRECAST CONCRETE MEMBERS

©2020

www.eota.eu

The reference title and language for this EAD is English. The applicable rules of copyright refer to the document elaborated in and published by EOTA.

This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

©EOTA 2020

Contents

©EOTA 2020

1 SCOPE OF THE EAD

1.1 Description of the construction product

The clamping system consist of a turnbuckle with corresponding washers.

The turnbuckle is made from malleable iron or stainless steel.

The turnbuckle is fixed to the concrete element via a cast-in anchor with internal threaded socket. Alternatively, the connection can be done with anchor channels and hammer head screw, expansion anchors etc.

The assessment of the connection to the concrete element is not covered by this EAD.

Annex A shows a description of the product.

The assessment of the cast-in anchor with internal threaded socket, anchor channels and hammer head screw, expansion anchors etc in their own right is not part of this EAD

The product addressed in this EAD is not covered by a harmonized European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product, as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document, shall be considered for the determination of the performance and detailed in the ETA.

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

1.2.1 Intended use(s)

The clamping system is fastened to anchors embedded in concrete elements.

he clamping system is used for connecting either two or three concrete elements. The connection can be made between precast to precast structures, precast to situ concrete structures or between precast to already existing structures

The general use conditions for which this EAD is valid are given in EN 1992-1-1[1].

The assessment/testing required with respect to corrosion resistance will depend on the specification of the clamping system in relation to its use. Supporting evidence that corrosion will not occur is not required if the steel parts of the fastener are protected against corrosion, as set out below:

(1) Clamping systems intended for use in structures subject to dry, internal conditions: No special corrosion protection is necessary for steel parts as coatings provided for preventing corrosion during storage prior to use and for ensuring proper functioning zinc coating with a minimum thickness of 5 microns) is considered sufficient.

1 All undated references to standards or to EAD's in this document are to be understood as references to the dated versions listed in clause 4.

©EOTA 2020

(2) Clamping systems for use in structures subject to internal conditions with usual humidity (e.g. kitchen, bath- and laundry in residential buildings, exceptional permanently damp conditions and application under water): Metal parts of the anchor made of steel material 1.0038 or 1.0044 acc. EN 10025-2, 1.0976 or 1.0979 acc. EN 10149-1 and -2, 1.0213, 1.0214, 1.1132, 1.5525 or 1.5535 acc. to EN 10263-2, -3, and -4, 1.5523 acc. EN 10269 or 1.0401 acc. EN 10277-2 hot dip galvanized according EN ISO 1461 or EN ISO 10684 with at least 50 µm thickness can be used.

(3) Clamping systems for use in structures subject to external atmospheric exposure (including industrial and marine environments), or exposure in permanently damp internal condition, if no particular aggressive conditions according to (4) exists: Metal parts of the anchor made of stainless steel material 1.4401, 1.4404, 1.4571, 1.4578, 1.4362, 1.4062, 1.4162, 1.4662, 1.4439, 1.4462 or 1.4539 according to EN 10088-4 and 5 can be used.

(4) Clamping systems for use in structures subject to external atmospheric exposure or exposure in permanently damp internal conditions or particularly aggressive conditions such as permanent or alternate immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulfurization plants or road tunnels, where de-icing materials are used): Metal parts of the anchor made of stainless

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the clamping system for the intended use of 50 years when installed in the works (provided that the trapped gully is subject to appropriate installation (see 1.1)). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the assumed working life.

©EOTA 2020

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the clamping system for connection of precast concrete members is assessed in relation to the essential characteristics.

Table 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	Characteristic tensile strength	2.2.2	Level
2	Characteristic shear strength	2.2.3	Level
3	Characteristic strength of T-connection	2.2.4	Level
4	Durability against corrosion	2.2.5	Level
Basic Works Requirement 2: Safety in case of fire			
5	Reaction to fire	2.2.6	Class

2.2 Methods and criteria for assessing and classification of 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 General

In the following the reference to fasteners are referring to the fasteners specified by the manufacturer to covered by the ETA. The fasteners are cast in anchor with internal threaded socket assessed according to EAD 330012-01-0601, anchor channels assessed according to EAD 330008-02-0601 or expansion anchors according to EAD 330232-00-0601

2.2.2 Characteristic tensile strength

a) Test setup (see drawing 2.2.1-2)

The specimen is clamped into a tensile testing machine by means of threaded rods (with strength classification 8.8) and hexagon nuts (strength classification 8), the fasteners are to be placed in the two slotted holes of the specimen. Here, the washers that belong to the specimen need to be applied. If necessary, counter nuts with washers must be attached to the outside of the specimen so that the

©EOTA 2020

specimen does not slip before the load is applied. Due to the two slotted holes, the threaded rods are arranged differently with different expected failure loads. Please observe sections b) and c)

The specimen shall be subjected to a load application along the axis of the threaded rod until fracture.

b) Pilot test (critical bolt positon)

The specimen consists of two slotted holes – one horizontal and one vertical (see drawing 2.2.1-1). The arrangement of the threaded rods in these slotted holes can lead to different failure loads. For the tensile test, the arrangement with the lowest failure loads will be relevant. To determine the arrangement, the specimen with the possible bolt positions (see table 2.2.1-1) will be tested with the below mentioned setup. The measured values can be included in the evaluation of the tensile stress testing.

Drawing 2.2.1-1: Slotted holes

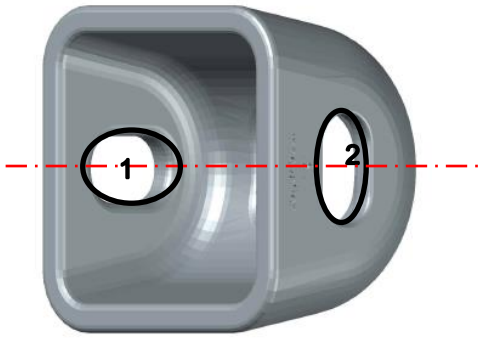


Table 2.2.1-1: Bolt position

1 - horizontal slotted hole	front
	centre
	rear
2 - vertical slotted hole	top*)
	centre
	bottom*)

*) Since the specimen has a mirror symmetry along the shown red line, the bolt positions "top" and "bottom" provide identical results. For this reason, 3x2=6 bolt positions can be taken into account.

Number of tests*):

Possible bolt positions	x	Minimum number of tests	=	**Total**
6		3		**18**

*) per material and size

c) Tensile stress testing

The setup according to section a) is to be assembled with the critical bolt position according to section b). Taking into account relevant results from the pilot tests, a total of at least 10 tests per material and size shall be carried out.

Number of tests*):

Minimum total number	-	Results from pilot test	=	**Total**
10		3		**7**

*) per material and size

d) Evaluation of results

The measured failure loads have to be recorded. From these values the 5 % fractile value with a confidence level of 90% (Acc. EAD 330232 section A2.3) is calculated:

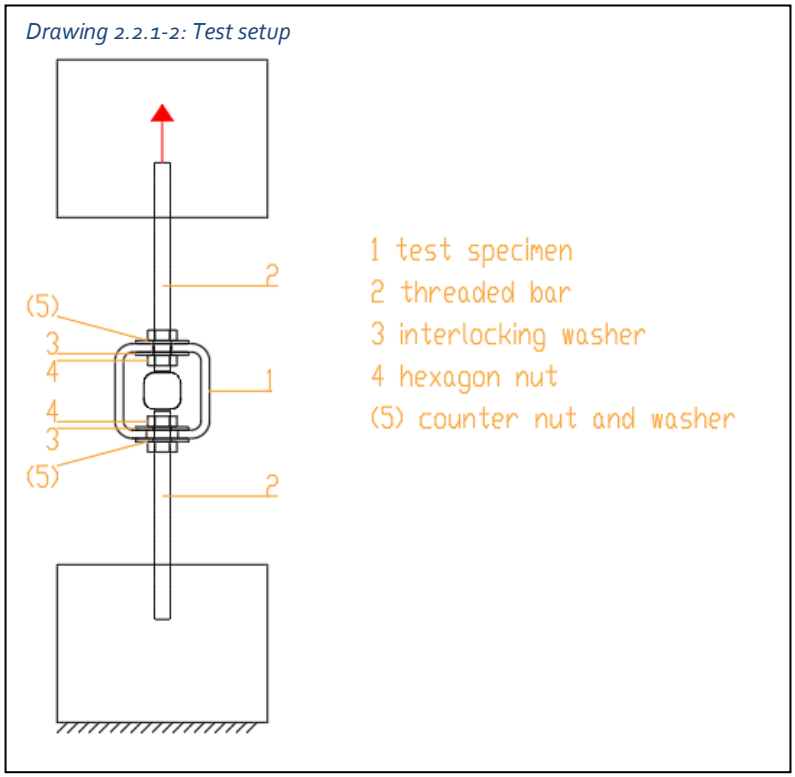
$$F_{u,5\%} = F_{u,m} \times (1 - k_S \times c_{vF}) \qquad \text{(equation 1.1)}$$

with $k_S = 2.57$ (for n = 10 tests)

©EOTA 2020

The characteristic value of the tensile strength is stated in the ETA.

Drawing 2.2.1-2: Test setup



2.2.3 Characteristic shear strength

a) Test setup (see drawing 2.2.2-2)

The specimen is connected to the test device with hexagon head bolts (strength classification 8.8), the fasteners are to be placed in the two slotted holes of the specimen. The specimen is attached on both sides of the test device. Here, the washers that belong to the specimen need to be applied.

The testing device consists of a rigid immovable part and a movable part. The movable part is provided with a guide rail to prevent undesirable torsion.

Due to the two slotted holes, different arrangements of the hexagon head bolts are arising with different expected failure loads. Please observe sections b) and c)!

Two different setups during shear stress testing:

1. Test setup: The opening of the specimen is directed forwards
2. Test setup: The opening of the specimen is directed downwards

The specimen shall be subjected to a load application perpendicular to the axis of the hexagon head bolts until fracture.

b) Pilot test (critical bolt positon)

The specimen consists of two slotted holes – one horizontal and one vertical (see drawing 2.2.2-1). The arrangement of the hexagon head bolts in these slotted holes can lead to different failure loads. For the shear stress testing, the arrangement with the lowest failure loads will be relevant. To determine this arrangement, the specimen with the possible bolt positions (see table 2.2.2-1) are to be tested with the below mentioned setup. The measured values can be included in the evaluation of the shear stress testing.

©EOTA 2020

Drawing 2.2.2-1: Slotted holes

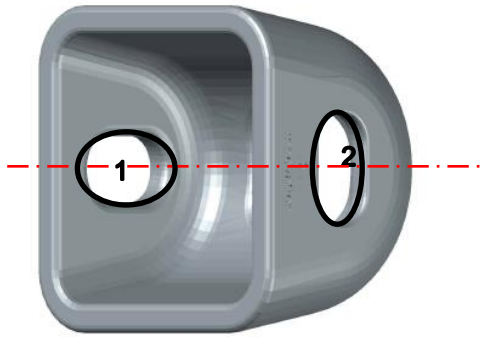


Table 2.2.2-1: Bolt positions

1 - horizontal slotted hole	front
	centre
	rear
2 - vertical slotted hole	top*)
	centre
	bottom*)

*) Since the specimen has a mirror symmetry along the shown red line, the bolt positions "top" and "bottom" provide identical results. For this reason, 3x2=6 bolt positions can be taken into account.

Number of tests*):

Test setups	x	Possible bolt positions	x	Minimum number of tests	=	**Total**
2		6		3		**36**

*) per material and size

c) Shear stress testing

The setup according to section a) is to be assembled with the critical bolt position according to section b). Taking into account relevant results from the pilot tests, a total of at least 10 tests per material and size shall be carried out.

Number of tests*):

Test setups	x	Minimum total number	-	Results from pilot tests	=	**Total**
2		10		2 x 3		**14**

*) per material and size

d) Evaluation of results

The measured failure loads have to be recorded. From these values the 5 % fractile value with a confidence level of 90% (Acc. EAD 330232 section A2.3) is calculated:

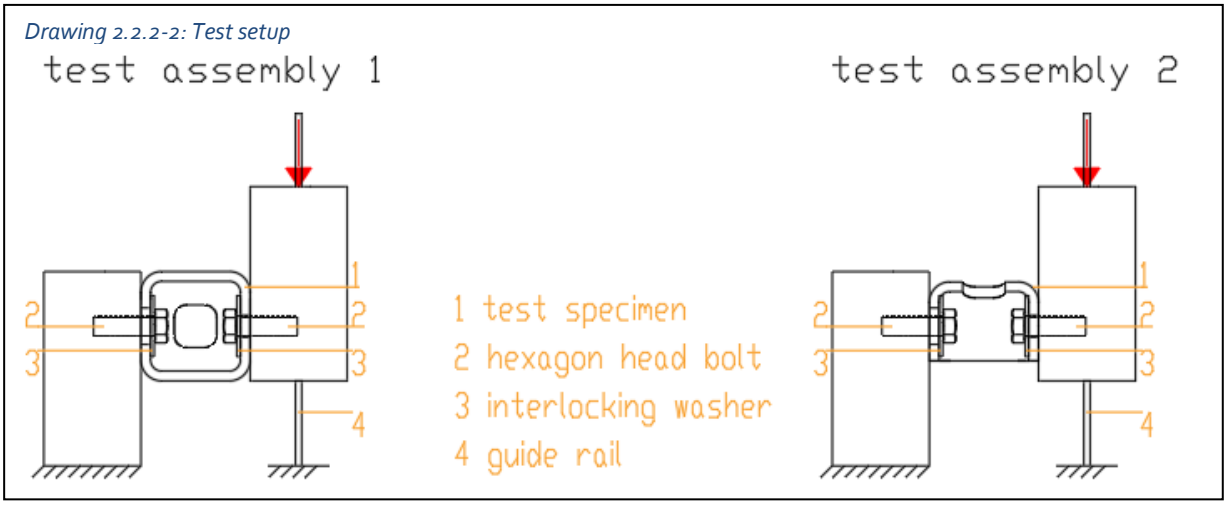
$$F_{u,5\%} = F_{u,m} \times (1 - k_S \times c_{vF}) \qquad \text{(equation 2.1)}$$

with $k_S = 2{,}57$ (for n = 10 tests)

The characteristic value of the shear strength is stated in the ETA.

©EOTA 2020

Drawing 2.2.2-2: Test setup



2.2.4 Characteristic strength of T-connection

a) Test setup (see drawing 2.2.3-2)

The specimen is connected to the lower part of the test device by means of hexagon head bolts (with strength classification mentioned in section b), the fasteners are to be placed in the two slotted holes of the specimen. The specimen is attached on both sides of the test device. Here, the washers that belong to the specimen need to be applied.

Due to the two slotted holes, different arrangements of the hexagon head bolts are arising with different expected failure loads. Please observe sections b) and c)!

The specimen is connected to the upper part of the test device by means of threaded rods and hexagon nuts (with strength classification mentioned in section b), the threaded rods are to be placed in the rearward bolt holes. Here, the washers and adapter plates that belong to the specimen need to be applied. If necessary, counter nuts with washers must be attached to the outside of the specimen so that the specimen does not slip before the load is applied.

The specimen shall be subjected to a load application along the axis of the threaded rod until fracture.

b) Pilot test (strength classification of fasteners)

The specimen is tested on steel failure. To prevent premature failure of the fasteners, it is necessary to determine which strength classification must be selected. Therefore, the below mentioned test setup is performed. During the first test, the fasteners of strength classification 8.8 and 8 must be used. Should these fasteners fail prematurely, the strength classification of the fasteners is to be increased in the next test, until their failure no longer occurs before the steel failure of the specimen itself. Here, all fasteners are to be arranged in the middle of the slotted holes.

c) Pilot test (critical bolt position)

The specimen consists of two slotted holes – one horizontal and one vertical (see drawing 2.2.3-1). By application of the adapter plate in the rearward bolt hole a second slotted hole is created. The arrangement of the hexagon head bolts and threaded rods in these slotted holes can lead to different failure loads.

For the shear stress testing, the arrangement with the lowest failure loads will be relevant. To determine this arrangement, the specimen with the possible bolt positions (see table 2.2.3-1) are to be tested with the below mentioned setup. The measured values can be included in the evaluation of the shear stress testing.

©EOTA 2020

Drawing 2.2.3-1: Slotted holes and adapter plate

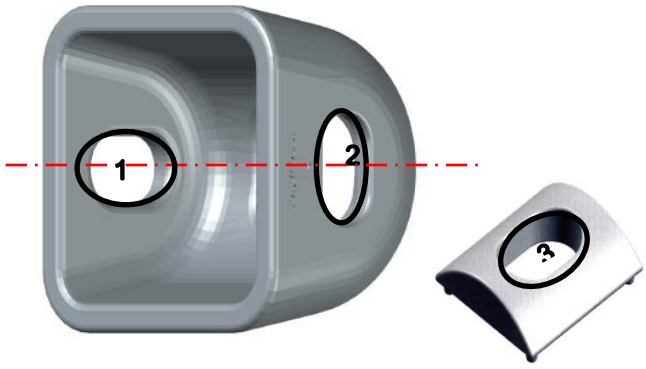


Table 2.2.3-1: Bolt positions

1 – horizontal slotted hole	front
	centre
	rear
2 - vertical slotted hole	top*)
	centre
	bottom*)
3 – rearward slotted hole	left
	centre
	right

*) Since the specimen has a mirror symmetry along the shown red line, the bolt positions "top" and "bottom" provide identical results. For this reason, 3x3x2=18 bolt positions can be taken into account.

Number of tests*):

Possible bolt positions	x	Minimum number of tests	=	**Total**
18		3		**54**

*) per material and size

d) Shear stress testing

The setup according to section a) is to be assembled with the critical bolt position according to section c) and strength classification according to section b). Taking into account relevant results from the pilot tests, a total of at least 10 tests per material and size shall be carried out.

Number of tests*):

Minimum total number	-	Results of pilot test	=	**Total**
10		3		**7**

*) per material and size

e) Evaluation of results

The measured failure loads have to be recorded. From these values the 5 % fractile value with a confidence level of 90% (Acc. EAD 330232 section A2.3) is calculated:

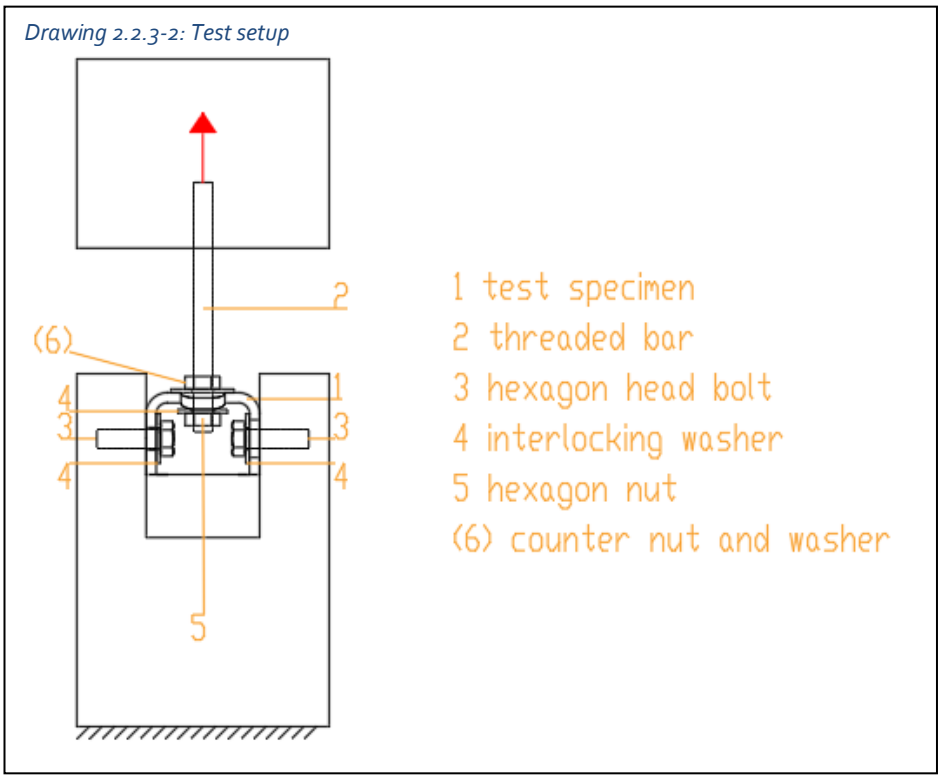
$$F_{u,5\%} = F_{u,m} \times (1 - k_S \times c_{vF}) \qquad \text{(equation 3.1)}$$

with $k_S = 2{,}57$ (for $n = 10$ tests)

The characteristic value for the strength of the T-connection is stated in the ETA.

©EOTA 2020

Drawing 2.2.3-2: Test setup



2.2.5 Durability against corrosion

For clamping systems made from hot dip galvanized malleable iron, the thickness of the coating shall be determined in accordance with EN 10346. The steel quality and thickness of the coating shall be stated in the ETA.

2.2.6 Reaction to fire

The clamping system is classified using EC Delegated Regulation 2016/364/EU and EN 13501-1. The class is given in the ETA.

This product is "No contribution to fire" because it is under Decision 96/603/EC as amended by Decision 2000/605/EC, so it is within the list of materials to be considered as reaction to fire Classes A1 as provided for in the Delegated Regulation 2016/364/EC (repealing Decision 2000/147/EC) without the need for testing.

©EOTA 2020

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

For the products covered by this EAD the applicable European legal act is: Decision 98/214/EC

The system(s) is: 2+

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 2.

Table 2 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Metal part / dimensions and tolerances	Measuring or optical	Laid down in control plan	3 samples for each size and for each material	Each batch/ production week 10000 anchors
2	Metal part / material properties e.g. tensile strength or hardness, elastic limit, elongation on rupture	e.g. tensile test, hardness testing Brinell or Vickers	Laid down in control plan	3 samples for each size and for each material	Each batch/ production week 10000 anchors
3	Metal part / coating	Measuring of thickness	Laid down in control plan	3 samples for each size and for each material	Each batch/ production week 10000 anchors
4	Final product	Tensile test	Laid down in control plan	3 samples for each size and for each material	Each batch/ production week 10000 anchors

©EOTA 2020

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for clamping system for connection of precast concrete members are laid down in Table 3.

Table 3 Control plan for the notified body; cornerstones

Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control				
Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer	As defined in the control plan	As defined in the control plan	As defined in the control plan	-
Continuous surveillance, assessment and evaluation of factory production control				
Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer	As defined in the control plan	As defined in the control plan	As defined in the control plan	1/year

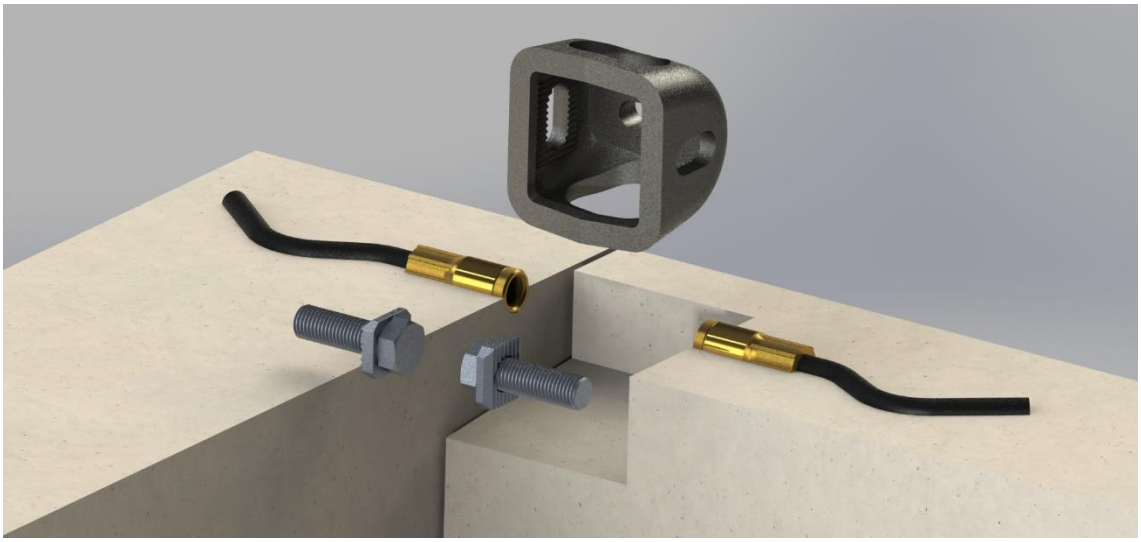
©EOTA 2020

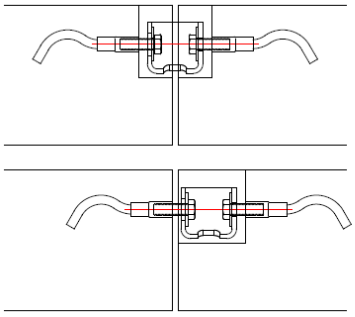
4 REFERENCE DOCUMENTS

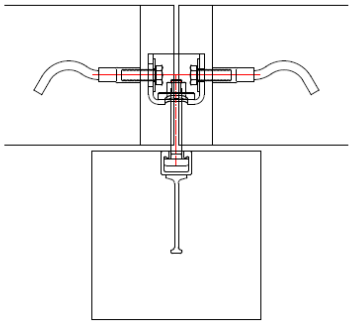
EN13501-1:2018	Fire classification of construction products and building elements - Part 1: Classification using test data from fire reaction to fire tests
EAD 330008-02-0601	Anchor channels
EAD 330012-01-0601	Cast-in anchor with internal threaded socket
EN 10025-1:2004 +2:2004	Hot rolled products of structural steels. Part 1: General technical delivery conditions; Part 2: Technical delivery conditions for non-alloy structural steels;
EN 10088-1:2014+3:2014	Stainless steels Part 1: List of stainless steels, Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes;
EN 10263-2:2017, -3:2017 + 4:2017	Steel rod, bars and wire for cold heading and cold extrusion Part 2: Technical delivery conditions for steels not intended for heat treatment after cold working Part 3: Technical delivery conditions for case hardening steels Part 4: Technical delivery conditions for quenching and tempering
EN 10149-1:2013+2:2013	Hot-rolled flat products made of high yield strength steels for cold forming. Part 1: General technical delivery conditions; Part 2: Technical delivery conditions for thermomechanically rolled steel
EN 10269:2013	Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties, including corrigendum
EN ISO 1461:2019	Hot dip galvanized coatings on fabricated iron and steel articles-Specifications and test methods
EN ISO 10684/AC:2009	Fasteners – Hot dip galvanized coatings;
EN 10277-2:2008	Bright steel products – Technical delivery conditions - Part 2: Steels for general engineering purposes;
EN 10346:2015	Continuously hot-dip coated steel flat products for cold forming – Technical delivery conditions

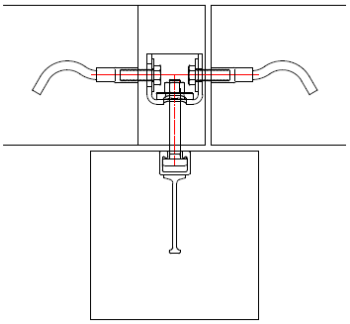
©EOTA 2020

ANNEX A DESCRIPTION OF THE PRODUCT









©EOTA 2020