EAD **220169-00-0402**

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European Assessment Document for

Fastening screws with welded or cold-formed set screws

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).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD covers fastening screws with welded or cold formed set screws (in the following referred to as “fastening screw(s)”) for parallel or elevated solar and photovoltaic installations or support profiles of solar installations.

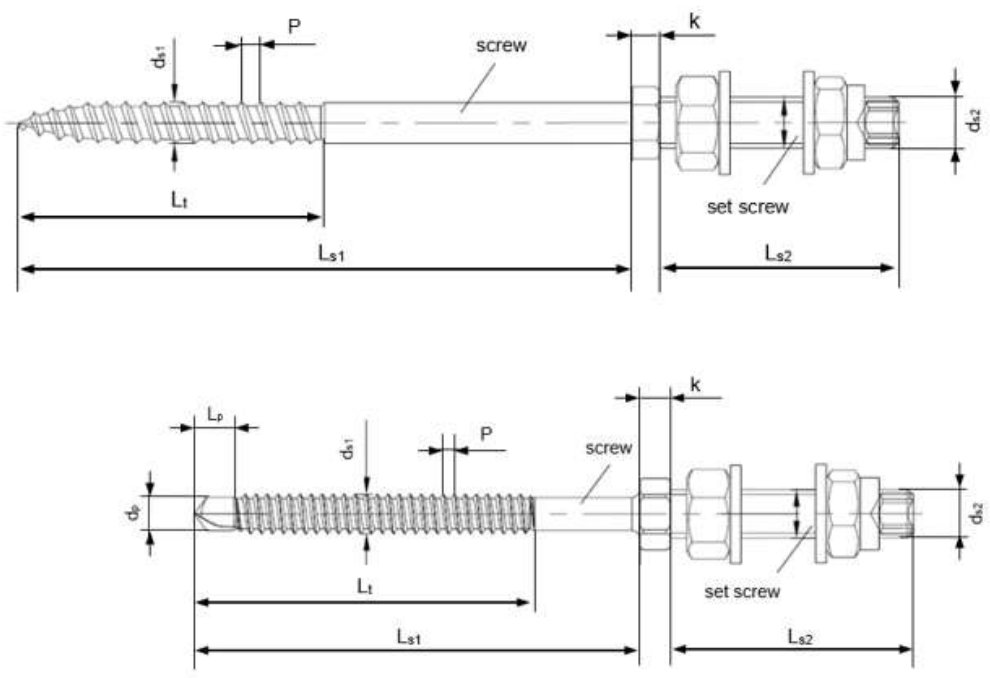
The fastening screw is threaded over part of its length and has a welded or cold formed set screw with nuts and washers for fastening the brackets of the solar or photovoltaic frame.

The drilling point or self-tapping tip/stud and the thread of the screw depends on the material of the supporting structure in which the screw is fixed, i.e., steel, concrete or timber.

This EAD covers fastening screws and set screws made of uncoated stainless steel or coated stainless steel provided that the coating is either inorganic or contains maximum 1,0% organic material by weight or volume, due to the assessment methods for the reaction to fire and durability. The stainless steel grades covered by this EAD are described in EN 1993-1-4 table A.3.

Examples of the fastening screws are shown in Figure 1.1.1, 1.1.2 and 1.1.3.

Figure 1.1.1: Example for the geometry of the fastening screws in timber supporting structure



L_{s1}	length of screw
L_{s2}	length of set screw
L_t	length of thread
L_p	length of drilling point
k	head height
d_{s1}	diameter of screw
d_{s2}	diameter of set screw
d_p	diameter of drilling point
P	pitch of the thread

Figure 1.1.2: Example for use of the fastening screw on steel supporting structure with trapezoidal sheeting

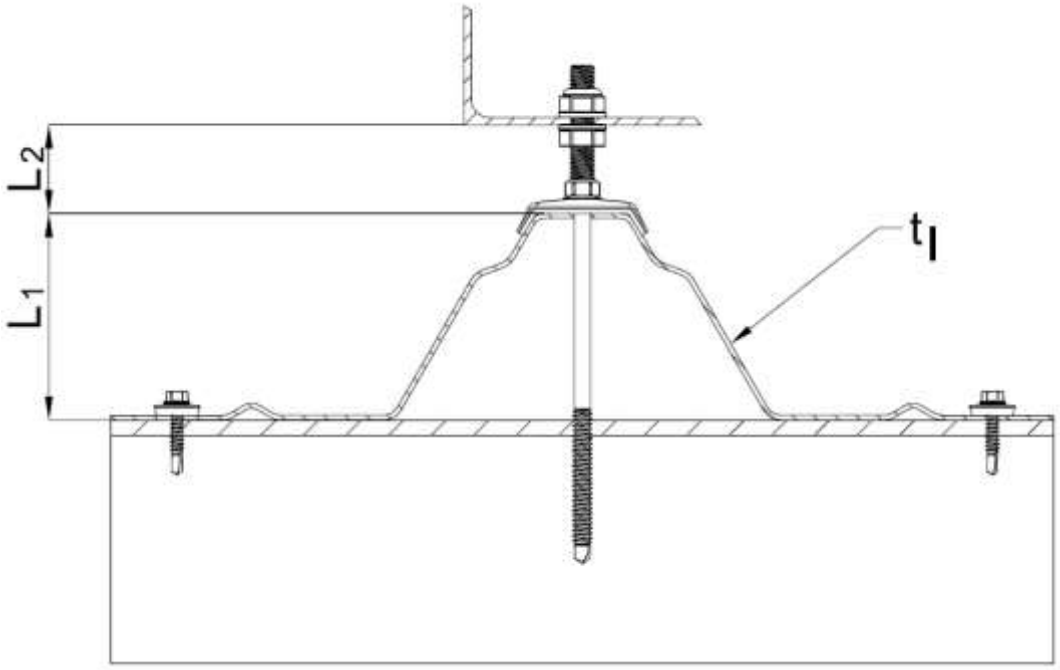
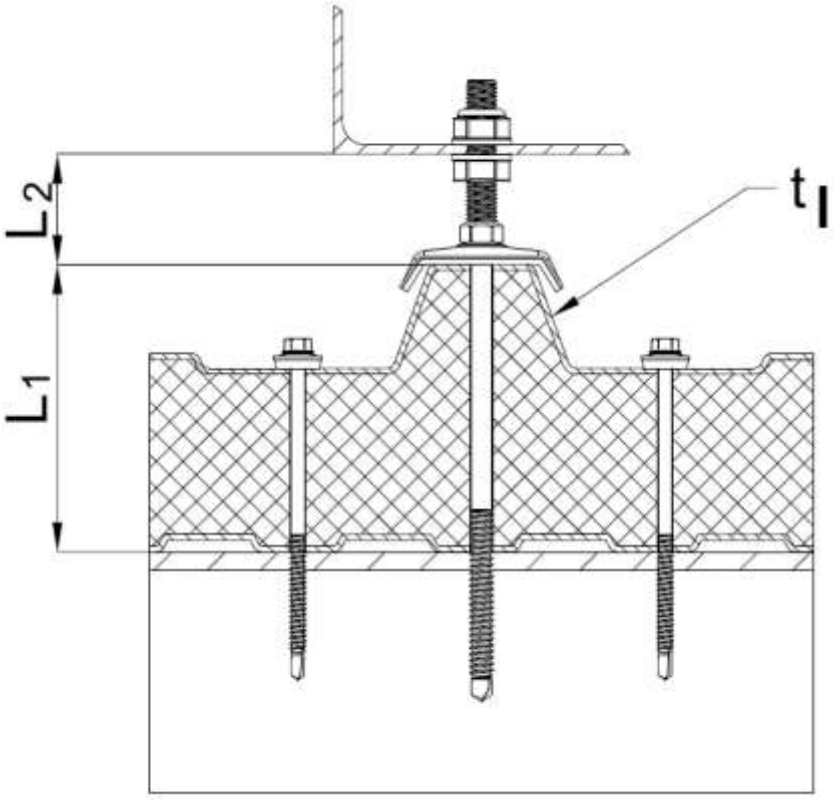


Figure 1.1.3: Example for use of the fastening screw on steel supporting structure with sandwich panel



The product is not covered by a harmonized European standard. The product is not covered by EADs 130118-01-0603, 330232-01-0601, 330046-01-0602 or 330047-01-0602 as the specific intended use of the fastening screws covered by this EAD is not covered and they do not include assessment of the characteristics and actions that are related to the specified intended use covered by this EAD, such as cyclic pull-through..

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise their clients on the transport, storage, maintenance, replacement and repair of the product, as the manufacturer 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, e.g., with regard to the intended end use conditions, 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 as long as the details of the assessment methods as laid down in this EAD are respected.

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

1.2.1 Intended use(s)

The fastening screws with welded or cold formed set screws are intended for the load-transferring connection of elevated solar and photovoltaic installations or support profiles of solar installations with supporting structures made from steel, concrete or timber. The fastening screws are screwed through the crest of sheeting panels made from steel or aluminium or of sandwich panels with steel or aluminium faces. In addition to the connection of elevated solar and photovoltaic installations or support profiles of solar installations the fastening screws also fulfill the requirements of fastening trapezoidal sheeting and sandwich panels to the supporting structure.

The fastening screws are subject to static and quasistatic loads in tension or compression, bending, bearing (lateral support of the fastener provided by the trapezoidal sheeting or the outer face of the sandwich panel) and a combination of tension or compression and bearing.

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 fastening screw for the intended use of 25 years when installed in the works (provided that the fastening screw is subject to appropriate installation and maintenance). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use and maintenance 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[1].

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.

[1] 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.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

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

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the fastening screws with welded or cold formed set screws is established 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	Characteristic pull-through resistance in tension Static pull-through tests Cyclic pull-through tests	 2.2.1.1 2.2.1.2	Level, $N_{Rk,I}$
2	Characteristic pull-out resistance	2.2.2	Level, $N_{Rk,II}$ and description
3	Bending capacity in case of thermal expansion of the outer face of sandwich panels	2.2.3	Level, u
4	Pull-through resistance in shear	2.2.4	Level, $F_{Rk,I}$, $F_{Rk,II}$ and description
5	Characteristic yield moment (bending strength of solar fastener)	2.2.5	Level, $M_{y,Rk}$
Basic Works Requirement 2: Safety in case of fire			
6	Reaction to fire	2.2.6	Class
Aspects of durability			
7	Durability	2.2.7	Description

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 Characteristic pull-through resistance in tension

2.2.1.1 Static pull-through tests

Regarding static pull-through resistance, EAD 330046-01-0602, clause 2.2.2.1 applies. The test set-up is shown in ANNEX A.

The performance shall be determined in accordance with EAD 330046-01-0602, clause 2.2.2.4 and stated in the ETA.

2.2.1.2 Cyclic pull-through tests

Regarding cyclic pull-through resistance, EAD 330046-01-0602, clause 2.2.2.2 applies. The test set-up is shown in ANNEX A. Note: The initial maximum load may be taken as 70% of the mean results from the static pull-through test.

The performance shall be determined in accordance with EAD 330046-01-0602, clause 2.2.2.4 and stated in the ETA. The part L_{s1} of the fastening screw transfers cyclic loads. The sealing washer respectively the storm washer is in contact with the test panel.

The characteristic cyclic pull-through resistance is defined as the normalised load level with 5000 load changes without failures of connections in accordance with annex 3 of EAD 330046-01-0602.

2.2.2 Characteristic pull-out resistance

Regarding static pull-out resistance in steel and aluminium EAD 330046-01-0602, clause 2.2.2.3 applies. The test set-up is shown in ANNEX B. The minimum thickness of the supporting structure $t_{II,min}$ shall be defined by the Manufacturers Product Installation Instructions (MPII). If no minimum thickness of the supporting structure is specified, the default value is $t_{II,min} = 1{,}5mm$.

The performance shall be determined in accordance with EAD 330046-01-0602, clause 2.2.2.4 and stated in the ETA.

Regarding static pull-out resistance (withdrawal parameter) in timber supporting structures EN 1382 applies. At least 10 tests for solid wood and 20 tests for wood-based materials shall be carried out, see ANNEX B. The penetration depth l_{ef} shall be defined by the manufacturer. If no value is given, the penetration depth shall be determined by $l_{ef} = 4 \cdot d$.

The characteristic pull-out resistance (in EAD 130118-01-0603 referred to as withdrawal capacity) shall be stated in the ETA in accordance with EAD 130118-01-0603, clause 2.2.4 together with information on the applicable timber species.
The width and thickness of the test specimen in the driving direction of the fastener must be at least $(l_{ef} + 4 \cdot d)$.

The appropriate distribution function (in accordance with EN 14358) can be obtained by statistical hypothesis testing, by a normal distribution plot or based on coefficient of variation.
Note: If the coefficient of variation is large, the use of a lognormal distribution is recommended.

Regarding static pull-out resistance in concrete supporting structures, EAD 330232-01-0601, table 1.1 and clause 2.2.2 applies.

The test conditions given in EAD 330232-02-0601 clause 2.2.2 apply.

The performance shall be determined in accordance with EAD 330232-01-0601, table 1.1 and clause 2.2.2 and shall be stated in the ETA.

The characteristic performance shall be stated in the ETA together with information about the material and thickness and minimum penetration depth of the supporting structure. For symmetrical threads, the withdrawal capacity applies regardless of the direction of loading.

2.2.3 Bending capacity in case of thermal expansion of the outer face of sandwich panels

For assessment of the bending capacity of the fastening screws in case of the thermal expansion of the outer face of the sandwich panel at least 10 bending tests shall be carried out for each relevant sandwich panel thickness (L1) and thickness t_{II} of the supporting structure.

The test conditions given in EAD 330047-01-0602, clause 2.2.4 apply. The u-value shall be taken from the MPII and as default u = 20,0 mm is used.

The performance shall be determined in accordance with EAD 330047-01-0602, clause 2.2.4 and the characteristic bending strength shall be stated in the ETA.

2.2.4 Characteristic pull-through resistance in shear

The bearing resistance of the outer sheet with thickness t_I to loads acting in the plane of the sheet shall be determined in accordance with the following test.

At least 10 tests shall be carried out for each material and material thickness t_I. The tests shall be conducted with corresponding equipment shown in ANNEX C.

The bearing resistance for t_{II} shall be determined as follows.

The performance for steel and aluminium components shall be determined in accordance with EAD 330046-01-0602, clause 2.2.1.3 and shall be stated in the ETA together with specification of the steel and aluminium components for which the performance applies.

For timber components, EN 1995-1-1, clause 8.7.1 applies.

The performance for concrete components is determined in accordance with EAD 330232-01-0601, clause 2.2.7 and 2.2.8 and shall be stated in the ETA together with specification of the concrete for which the performance applies.

2.2.5 Characteristic yield moment (bending strength of solar fastener)

For test-based determination of the yield moment, EN 409 applies.

The yield moment shall be determined in accordance with EAD 130118-01-0603, clause 2.2.2 (reference method).

The characteristic yield moment of the screws or threaded rod shall be determined by tests according to EN 409. The tests shall be carried out with a free length of the screw l_2 of 2•d. The minimum number of specimens is 10 for every outer thread diameter. The weakest point within the length of the screw or threaded rod has to be tested.

The yield moment is the value at the plastic bending angle $\alpha = 45/d^{0,7}$ degrees (where d is in mm). The characteristic value of the yield moment shall be calculated according to EN 14358 using a logarithmical normal distribution.

Alternatively, the yield moment may also be determined by calculation in accordance with EN 1995-1-1 clause 8.3.1.1, equation 8.14.

The yield moment shall be stated in the ETA.

2.2.6 Reaction to fire

The fastening screws, as defined in clause 1.1 are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the Commission Decision 96/603/EC, as amended by Commission Decisions 2000/605/EC and 2003/424/EC, without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

Therefore, the performance of the product is class A1.

2.2.7 Durability

The material number and corrosion resistance class (CRC) of the stainless steel shall be given in the ETA in accordance with EN 1993-1-4 table A.3.

The resistance of welded stainless steel against intergranular corrosion shall be tested in accordance with EN ISO 3651-2, method A with at least 10 specimens of the solar fastener.

It shall be stated in the ETA if any cracks or fissures are noted in the specimens after the test.

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 Commission Decision 98/214/EC as amended by 2001/596/EC.

The system is **2+**.

3.2 Tasks of the manufacturer

The corner stones of the actions to be undertaken by the manufacturer of the fastening screw in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

Table 3.2.1 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	Raw material specification	According to relevant specification	According to Control plan	-	Per material batch
2	Dimensions of the screws and set screws	Measurement	According to Control plan	5	Every production unit / material batch
3	Characteristic tensile or shear strength of fastener	Check according to control plan	According to Control plan	5	Every 6 Months
4	Characteristic yield moment	Check according to control plan	According to Control plan	5	Once a year
5	Thread-forming, drill-drive and torque test	Check according to control plan	According to Control plan	3	Every production unit
6	Bending test	Check according to control plan	According to Control plan	1	Every production unit

3.3 Tasks of 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 the fastening screws are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

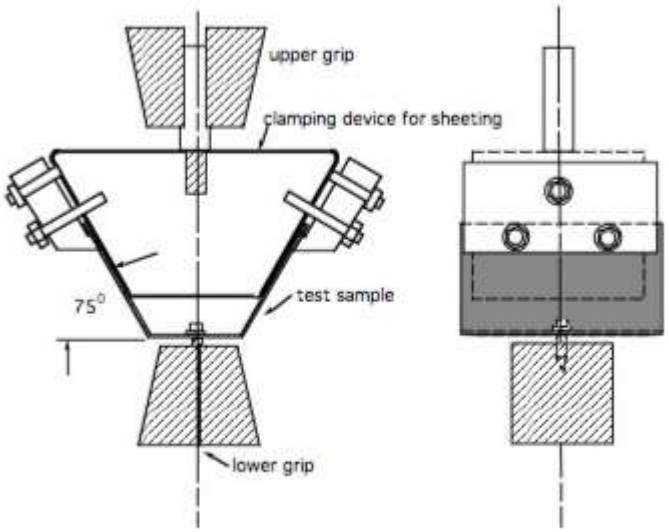
No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	The Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the fastening screws	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to Control plan	According to Control plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control					
2	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in table 3.2.1	According to Control plan	According to Control plan	1/year

4 REFERENCE DOCUMENTS

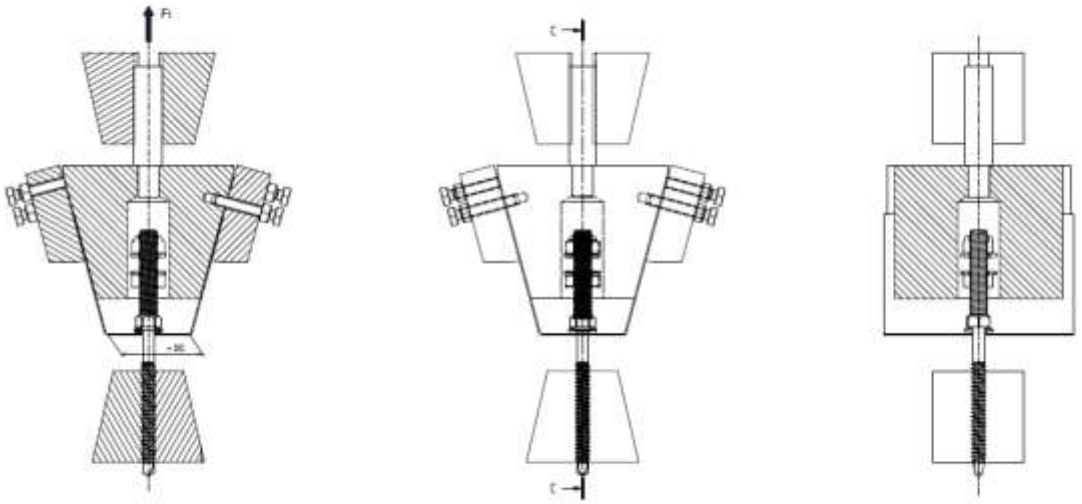
EN 1993-1-4:2025	Eurocode 3 – Design of steel structures – Part 1-4: Stainless steel structures
EN 1995-1-1:2004 + AC:2006 + A1:2008 + A2:2014	Eurocode 5 – Design of timber structures – Part 1-1: General – Common rules and rules for buildings
EN 409: 2009	Timber structures - Test methods - Determination of the yield moment of dowel type fasteners
EN 1382:2016	Timber Structures - Test methods - Withdrawal capacity of timber fasteners
EN 14358:2016	Timber structures – Calculation and verification of characteristic values
EN ISO 3651-2:1998	Determination of resistance to intergranular corrosion of stainless steels – Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels – Corrosion test in media containing sulfuric acid
EAD 330046-01-0602	Fastening Screws for Metal Members and Sheeting
EAD 330047-01-0602	Fastening Screws for Sandwich Panels
EAD 330232-02-0601	Mechanical fasteners for use in concrete
EAD 130118-01-0603	Screws and threaded rods for use in timber constructions

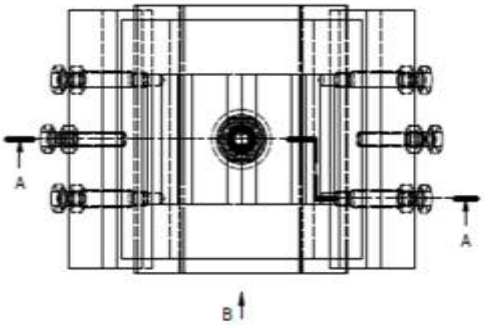
ANNEX A: TEST SET-UP FOR PULL-THROUGH TESTS IN TENSION

Figure A.1 Test set-up



A-A (1:1) B-B (1:1) C-C (1:1)





ANNEX B: TEST SET-UP FOR PULL-OUT TESTS

Figure B.1: Test set-up, steel substrate

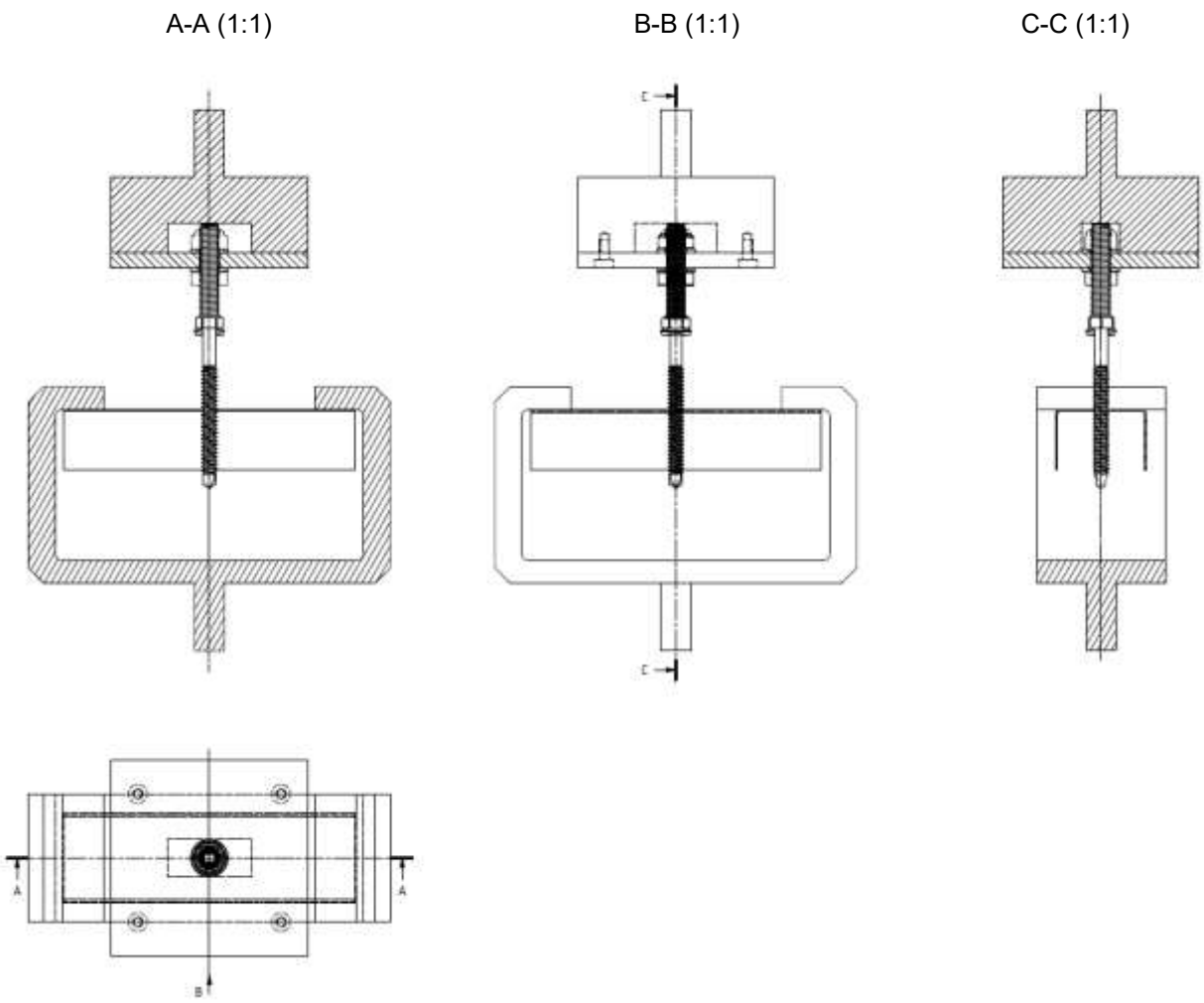
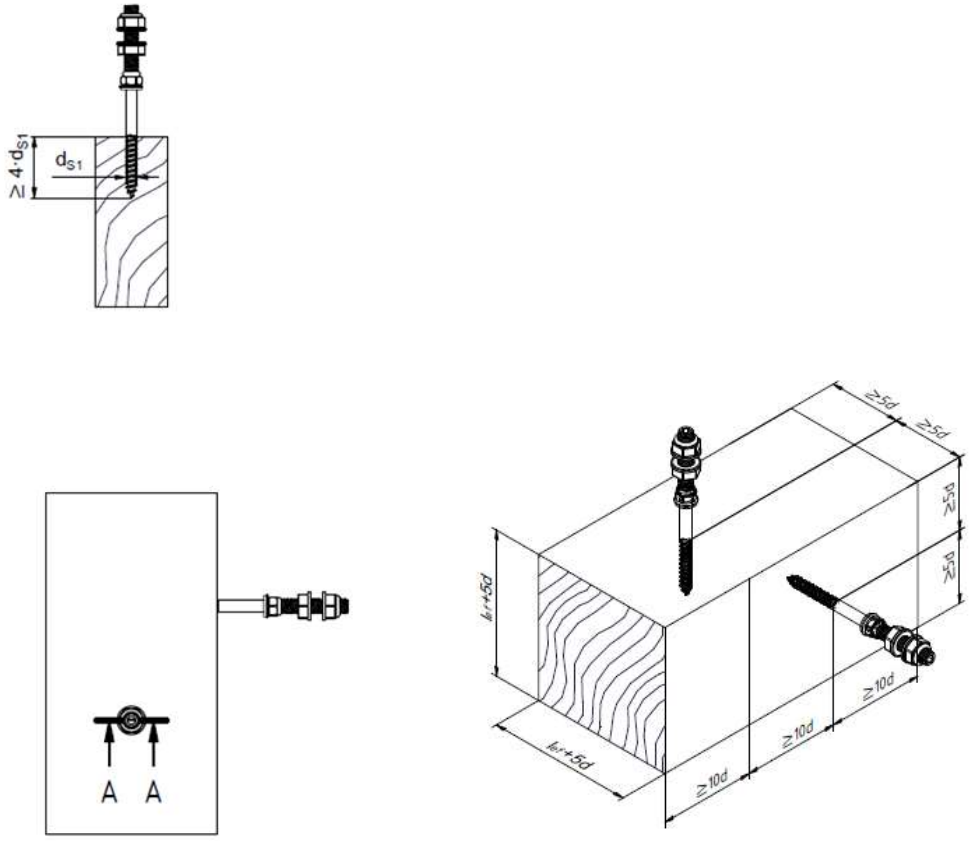


Figure B.2: Timber specimen



ANNEX C: TEST SET-UP FOR PULL THROUGH RESISTANCE IN SHEAR

Figure C.1: Specimen holder

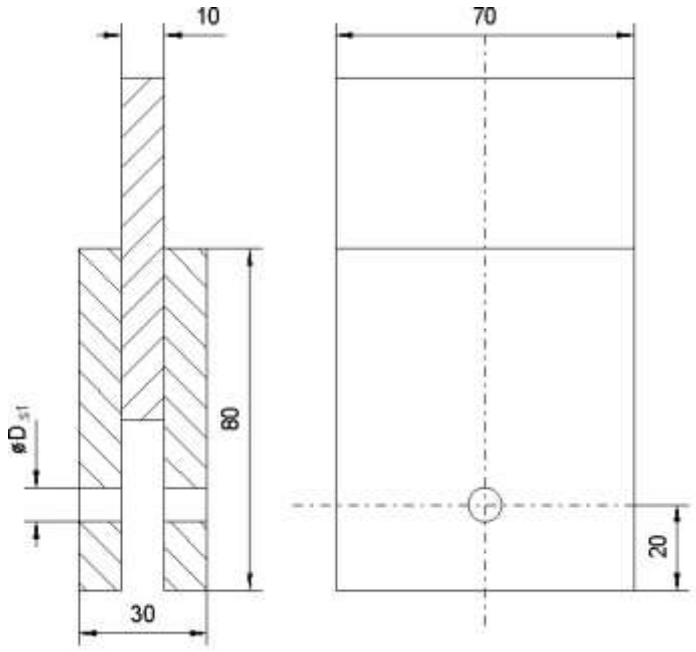


Figure C.2: Test set-up of pull-through resistance in shear test