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European Assessment Document for

Fasteners for fixing of external thermal insulation composite systems on timber constructions

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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) 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

The fasteners for fixing of external thermal insulation composite systems (ETICS) on timber constructions (in the following referred to as fasteners) are screws made of austenitic or austenitic-ferritic stainless or carbon steel with a plastic plate for fixing ETICS. The plastic plate is made of virgin or non-virgin material made of polyamide PA6 or PA6.6, polyethylene PE or polypropylene PP, may be with co-polymer. The screws can have an inorganic anticorrosive coating, but no organic coating.

The assessment methods covered by this EAD are based on experiences with the fasteners, screws and plastic plates within the given dimensions and further limitations. Other dimensions or conditions might cause different failure modes and might necessitate other assessment methods.

The outer thread diameter of the screws is

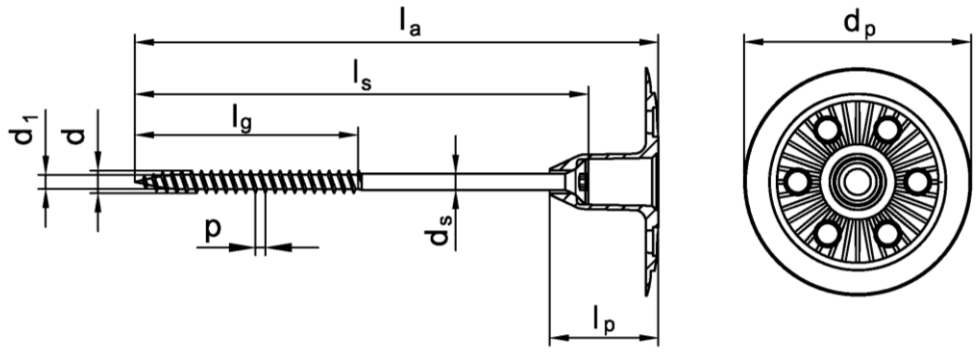
4.5 mm $\leq$ d $\leq$ 8.0 mm for screws made of austenitic or austenitic-ferritic stainless steel and

6 mm $\leq$ d $\leq$ 8.0 mm for screws made of carbon steel.

The inner thread diameter of the screws is $0{,}5 \cdot d \leq d_1 \leq 0{,}9 \cdot d$.

The length of the fastener is 40 mm $\leq l_a \leq$ 600 mm.

The length of the threaded part of the screw l_g is at least $6 \cdot d$.



l_a length of the fastener
l_S length of the screw
l_g length of the threaded part of the screw
l_p length of the plate
d_1 inner thread diameter of the screw
d outer thread diameter of the screw
d_s shank diameter of the screw
d_P diameter of the plastic plate
p pitch of the screw

Figure 1.1.1 Example for the geometry of a fastener

The product is not fully covered by the following harmonised technical specification: EN 14592[1]. Screws with plastic plate are not covered by EN 14592, hence further assessment methods regarding the plastic plate are added.

Because of the acting loads and the geometry of the fasteners the characteristics yield moment and head pull-through parameter are not relevant and therefore are not covered as essential characteristics in this EAD.

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

The EAD applies to fasteners which fulfil all of the following conditions:

- a bending angle of the screw of $\alpha_b \geq (45/d^{0,7} + 20)$ in accordance with EAD 130118-01-0603, clause 2.2.3, d in mm,
- a penetration length of the threaded part of the screw in structural timber products of $l_{ef} \geq 6 \cdot d$,
- a penetration length of the threaded part of the screw in wood-based panels or gypsum fibre boards of $l_{ef} \geq 12$ mm and in solid timber boards of $l_{ef} \geq 24$ mm, whereby the screw tip protrudes at least 10 mm outside the boards or panels,
- plates made of virgin or non-virgin plastics that fulfils the provisions of EAD 330196-01-0604, clause 2.2.2.12, regarding durability against high alkalinity,
- plates made of virgin or non-virgin plastics which are no longer than 6 weeks exposed to UV-radiation during installation and which in end use are protected by the rendering,
- plates made of non-virgin plastic with a reduction factor of lifetimes of plastics $\alpha_{lifetime,\ material}$ in accordance with EAD 330196-01-0604, clause 2.2.2.10 that is equal or greater than 0,9.
- plates, for which the coefficient of variation for the mean plate stiffness in accordance with clause 2.2.5.2 does not exceed 20 %.

The EAD covers screws with length, thread length, inner thread, outer thread, shank and head diameter and pitch with maximal tolerances given in Table 1 of EAD 130118-01-0603.

The EAD covers plastic plates with an outer diameter d_p of at least 30 mm and a plate length l_p with tolerances of $d_p \pm 1,5$ mm and $l_p \pm 1,5$ mm.

Drawings and all dimensions of the fasteners including the drill tip dimensions and/or secondary rough thread dimensions shall be given in the ETA.

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 fasteners are intended to be used for fixing ETICS with rendering on substructures made of timber without predrilling. The timber materials are solid timber in accordance with EN 14081-1, glued laminated timber and glued solid timber in accordance with EN 14080 and cross-laminated timber in accordance with EAD 130005-00-0304. The fasteners are intended to be used with a minimum penetration length of the screw in the timber member of $4 \cdot d$.

The fasteners are also intended to be used on a substructure made of wood-based panels in accordance with EN 13986 (except plywood and laminated veneer lumber (LVL)) that are suitable for internal (or protected external) use as structural components in humid conditions as specified in EN 13986. Gypsum fibre boards in accordance with EN 15283-2 can also be used as substructure. In the case that the fasteners are driven in wood-based panels or in gypsum fibre boards the screws are intended to be fully screwed through the panel. The screw tip protrudes at least 10 mm outside the boards or panels (see Figure 1.2.1.2).

The EAD includes the fastener resistance against axially loads resulting from wind suction only.

The use of the screws is limited to non-fatigue static and quasi-static actions.

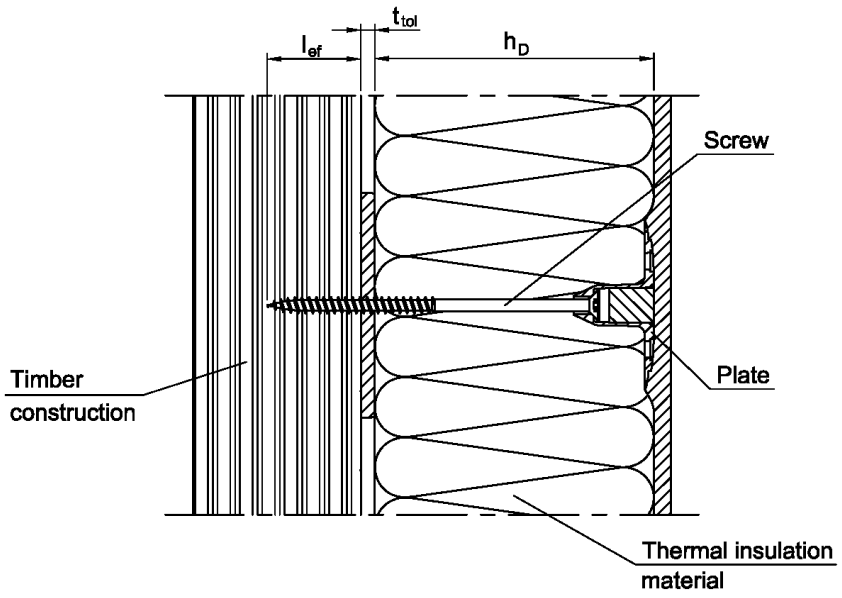


Figure 1.2.1.1 Example of the use of the fasteners – Substructure = timber construction

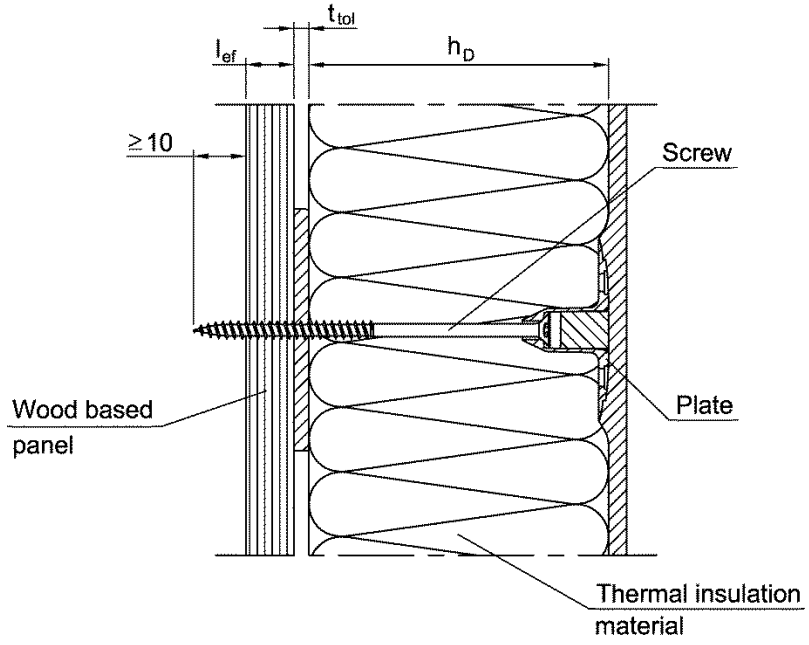


Figure 1.2.1.2 Example of the use of the fasteners – Substructure = Wood-based panel

The fasteners are only used as multiple fixings. Hence in the case of excessive slip or failure of a fixing point the load is transmitted to adjacent fixing points.

Depending on the durability of the fastener coating or of the stainless steel which the fasteners are made of they are intended to be used in constructions in service classes 1 and 2 conditions in accordance with EN 1995-1-1, clause 2.3.1.3, considering the admissible service conditions and the admissible corrosive category in accordance with EN ISO 12944-2. Fasteners made from carbon steel are intended to be used only for fixing ETICS consisting of factory-made wood fibre (WF) products in accordance with EN 13171.

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 fasteners for the intended use of 25 years when installed in the works (provided that the fasteners are 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.

1.3 Specific terms used in this EAD

1.3.1 Virgin plastic material

Material which has not been moulded before; in the moulding process only reworked material (e.g., sprue) is added received as waste material from the same moulding process; this regenerated material is of the same feedstock and identical with the rest of the material.

1.3.2 Non-virgin plastic material

Other than virgin plastic material.

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 referred to above.

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 fasteners 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 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class or description
Basic Works Requirement 4: Safety and accessibility in use			
2	Bending angle of the screw	EAD 130118-01-0603, clause 2.2.3	Description, level α_b [°]
3	Characteristic tensile strength of the screw	EAD 130118-01-0603, clause 2.2.6	Level $f_{tens,k}$ [kN]
4	Characteristic torsional strength	2.2.2	Level $f_{tor,k}$ [Nm]
5	Mean insertion moment	2.2.3	Level $R_{tor,mean}$ [Nm]
6	Characteristic withdrawal capacity related to the minimum penetration length of the fastener	2.2.4	Level $F_{ax,90,k}$ [N/mm²]
7	Characteristic load resistance of the plate	2.2.5.1	Level Characteristic load resistance of the anchor plate [kN]
8	Mean plate stiffness	2.2.5.2	Level Mean plate stiffness [kN/mm]
9	High alkalinity of plastic plate	EAD 330196-01-0604, clause 2.2.2.12	Description
Plastic plates made of non-virgin material			
10	Lifetime of non-virgin plastics	EAD 330196-01-0604, clause 2.2.2.10 Only the test method regarding the basic material applies.	Description, level Reduction factor of lifetimes of plastics $\alpha_{lifetime,material}$
Basic Works Requirement 6: Energy economy and heat retention			
11	Point thermal transmittance of a fastener to fix the external thermal insulation	2.2.6	Level χ [W/K]
Aspects of durability			
12	Durability against corrosion of the screw	EAD 130118-01-0603, clause 2.2.12	Description, level

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 Reaction to fire

Depending on the type of the parts of the fastener one of the following methods of assessment shall be used:

a) The metal screw of the fastener (made of austenitic or austenitic-ferritic stainless or carbon steel) is considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with 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 metal parts of the fasteners is class A1.

b) The plastic plate of the fastener fulfills all following conditions:
   - a mass ≤ 50 g,
   - a diameter of the visible surface (after fixing the fastener) of ≤ 57 mm (equal area size as for a rectangular size of ≤ 50 mm x ≤ 50 mm) and
   - a distance ≥ 200 mm to similar components when forming part of a composite product and being situated on the surface of a product made of material of classes B, C, D, or E
     or
     completely embedded all-round in non-melting material of class A1 when used as small connecting part of a composite product and without any possibility to ignite or to propagate fire.

   In this case the plastic plate of the fastener can be considered as a small component and its reaction to fire performance can be neglected and doesn't need to be tested and classified separately.

c) The reaction to fire performance of the material used for producing the plastic plate not fulfilling the requirements of sub-point "b)" shall be tested, using the test for the corresponding reaction to fire class in accordance with EN 13501-1. The material of the plastic plate of the fastener shall be classified in accordance with Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

   The following conditions and parameters shall be taken into account when preparing test specimens and conducting the tests:
   - Separate boards shall be produced from the same material as used for manufacturing the plastic plates of the fasteners and with the largest possible dimensions that can be produced.
   - The specimens for tests in accordance with EN ISO 11925-2 shall be cut from separately produced boards made of the same material as used for manufacturing the plastic plates of the fastener (specimen size as prescribed in the test standard).
   - The specimens shall be tested free-hanging without consideration of a substrate and exposed with surface flaming as well as with edge flaming.
   - The specimens for tests in accordance with EN 13823 (SBI) shall be built-up with the separately produced boards which are placed side by side with butt joints on a plywood standard substrate board in accordance with EN 13238 (considering the intended end use on substructures made of timber or wood-based panels – see clause 1.2). Each of the plastic boards shall be mechanically fixed on the standard substrate with four small metal nails or screws (one fixing means in each corner of the boards).
   - Each different type of a product family (as defined by a certain combination of raw materials and other additives and produced in a certain production process) of the virgin or non-virgin plastic material shall be tested in all relevant test methods. If the manufacturer provides sufficient information (e.g., on the basis of the composition of the products in question) this can allow the TAB to determine which material or material variants shall be submitted to testing in order to reduce the number of tests.

- The highest and lowest thickness of the plastic plates shall be considered when preparing and testing the specimens with the methods in accordance with EN ISO 11925-2 and EN 13823.
- If relevant, the highest and lowest density shall be considered within all relevant tests of the material of which the plastic plates are made.

The result of tests taking into account the aforementioned conditions and parameters are valid for:

- the performance of the fastener with a plastic plate as placed on the market (independent from the intended end-use application[3]),
- the tested product type of the virgin or non-virgin plastic material only or for all product types of the same defined product family (if the most onerous product type was tested),
- for any thickness between those values evaluated in the tests or the tested thickness only (if only one thickness was tested),
- for any density of the material of which the plastic plates are made between those values evaluated in the tests or the tested density only (± 10 %; if only one density was tested).

The reaction to fire classes obtained for screws and plastic material of the plates shall be stated in the ETA together with those conditions (see parameters above) for which the classifications are valid. It shall also be stated in the ETA when the plastic plates do not need to be tested because they are considered to be small components and their contribution to fire is negligible.

2.2.2 Characteristic torsional strength

The characteristic torsional strength of the fastener shall be determined in accordance with EAD 130118-01-0603, clause 2.2.8.

The test shall be carried out in such a way that the torque is transmitted as intended in the practical use. For example, the torque shall be transmitted to the plastic plate if the screw and the plate are tied together.

The characteristic torsional strength of the fastener $f_{tor,k}$ shall be given in the ETA.

2.2.3 Mean insertion moment

The insertion moment shall be determined for all materials in which the fasteners are intended to be screwed in by testing in accordance with EN 15737. The insertion moment determined for glued laminated timber made of softwood shall also be used for solid softwood and glued solid softwood.

The test shall be carried out in such a way that the torque is transmitted as intended in the practical use. For example, the torque shall be transmitted to the plastic plate if the screw and the plate are tied together.

At least 20 tests for each outer thread diameter of the fastener with the longest threaded part shall be carried out. If there are fasteners with anti-friction coating used in the tests this has to be recorded. That applies to special geometries of the fasteners such as drill tips and secondary rough threads, too.

The insertion moment of the fasteners R_{tor} in solid softwood wood (strength classes C16 up to C40 in accordance with EN 14081-1) and glued laminated timber (strength class GL24 up to GL32 in accordance with EN 14080) shall be multiplied with the factor $k_{\rho E} = (480/\rho)$, where ρ is the density of the test specimen.

The mean insertion moment $R_{tor,mean}$ shall be calculated in accordance with EN 14358.

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3 According to clause 1.2 the fasteners are used for discrete fixing of ETICS with rendering on substructures made of timber without predrilling. Depending from the specific type of ETICS and its components surrounding the fastener, an influence of the plastic plates on the reaction to fire performance of the ETICS cannot completely be ruled out. Thus, it is assumed that technical specifications for the assessment of ETICS will establish further rules on the influence of the fastener to the reaction to fire performance of the whole ETICS, depending, e.g., on the thermal insulation material and whether consideration of the fasteners is not necessary within testing and classification of the ETICS kit, if an influence of the plastic plates of the fasteners is not of concern.

The ratio of the characteristic torsional strength $f_{tor,k}$ in accordance with clause 2.2.2 to the mean insertion moment $R_{tor,mean}$ shall be at least 1,5[4].

The maximum penetration length of the threaded part of the screw $l_{ef,max}$ in the timber material, wood-based panel or gypsum fibre boards in accordance with the tests for the torsional strength shall be given in the ETA. The definition of the penetration length of the threaded part of the screw l_{ef} is given in Figure 1.2.1.1 and Figure 1.2.1.2.

2.2.4 Characteristic withdrawal capacity related to the minimum penetration length of the fastener

The characteristic withdrawal capacity of the fastener perpendicular to the grain $F_{ax,90,k}$ shall be determined for all materials in which the fasteners are intended to be screwed in.

Substructures made of structural timber materials

For fasteners in solid timber in accordance with EN 14081-1, glued solid or glued laminated timber in accordance with EN 14080and cross-laminated timber in accordance with EAD 130005-00-0304 the withdrawal capacity shall be determined in accordance with the test method given in EN 1382 using specimens in accordance with EN 1382, clause 6.3.1. 10 different timber pieces shall be used to produce the specimens. Half of the fasteners shall be inserted radially and half tangentially to the growth rings. The characteristic withdrawal capacity determined for glued laminated timber made of softwood shall also be used for solid softwood and glued solid softwood.

Substructures made of wood-based panels or gypsum fibre boards

For fasteners in wood-based panels in accordance with EN 13986 and gypsum fibre boards in accordance with EN 15283-2 the withdrawal capacity shall be determined as described in the following.

Regarding conditioning, test procedure and determination of the test result the provisions given in EN 1382, clauses 6.2, 6.4, 6.5 and 6.6 shall be followed.

The specimens shall be made of boards and panels with the minimum intended thickness. The minimum edge distances of the screws in accordance with EN 1382, clause 6.3.1, shall be considered. The screws shall be screwed through the boards or panels in such a way that the screw tip protrudes at least 10 mm outside the boards or panels. In the test procedure the clamping device in accordance with EN 13446, clause 6.3, shall be used. The smallest distance of the supports shall be chosen which allows cone failure of the panel. This distance shall be established by preliminary tests while observing that the influence of the supports of the clamping device is minimised. The construction principle of the clamping device is given in EN 13446, Figure 1 a).

Provisions for both types of substructures

At least 20 tests for every influencing parameter such as the outer thread diameter, drill tip and secondary rough thread shall be carried out. The tests shall be carried out with the shortest penetration length of the screw in the structural timber materials and with the lowest thickness of the wood-based panels or gypsum fibre boards. The test specimens shall be chosen in accordance with EN ISO 8970, clause 5, for specimens made of solid timber, glued laminated timber, glued solid timber and cross-laminated timber.

The withdrawal capacity $F_{ax,90}$ is the tested maximum withdrawal load F_{max} in accordance with EN 1382.

If equations (1) and (2) in EN ISO 8970, clause 5.2, are not fulfilled, the withdrawal capacity $F_{ax,90}$ of each test shall be corrected.

In case that the specimens are made of solid timber, glued laminated timber, glued solid timber, cross-laminated timber or wood-based panels the correction shall be done using a factor k_ρ. The factor k_ρ shall be calculated as:

$$k_\rho = \left(\frac{\rho_k}{\rho} \right)^{0,8} \qquad (2.2.5.1)$$

4 Note: This criterion is given in EN 14592, clause 6.3.4.6.

Where:

ρ_k characteristic density to which the test results shall be related,
- for solid timber, glued laminated timber, glued solid timber and cross laminated timber: characteristic density of the strength class of the timber product,
- for wood-based panels except cement-bonded particleboards: characteristic density in accordance with EN 12369-1 and -3,

ρ density of the test specimen.

Because of the homogeneous structure of gypsum fibre boards and cement-bonded particleboards only minimal variations of the density ρ occur within one product line of a manufacturer. Therefore, a correction of the withdrawal capacity in terms of density is not necessary for gypsum fibre boards and cement-bonded particleboards. The withdrawal capacity shall be stated for each gypsum fibre board and cement-bonded particleboard product.

From the possibly corrected withdrawal capacities of all test results in the respective material the characteristic value of the withdrawal capacity $F_{ax,90,k}$ shall be calculated in accordance with EN 14358 using a logarithmical normal distribution. This characteristic withdrawal capacity corresponds to the chosen characteristic density of the respective material.

The test report shall contain information in accordance with EN 1382, clause 6.6.

The characteristic withdrawal capacity of the fastener related to the characteristic density of the respective timber product or wood-based panel or gypsum fibre board and to the minimum penetration length of the threaded part of the fastener $l_{ef,min}$ in the timber product or wood-based panel or gypsum fibre board $F_{ax,90,k}$ shall be given in the ETA.

2.2.5 Characteristic load resistance of the plastic plate and mean plate stiffness

The failure load of the plastic plate shall be determined from at least 5 tests of the fastener. During the tests the plastic plate shall rest on a solid supporting ring with a clear inside diameter D at the top of the supporting ring considering the provisions given in Table 2.2.5.1. A preload shall be applied for determination of the stiffness for curved anchor plates in a way, that the tension load is transmitted at the inside edge of the supporting ring. If the plastic plate is stiffened by ribs, recesses shall be designed in the steel ring, that prevent a contact between the ribs and the supporting ring and the load transmission is not affected by the ribs. A principle test setup is shown in Figure 2.2.5.1

Table 2.2.5.1 Inside diameter of the supporting ring D

Diameter of the plastic plate d_p	Inside diameter D at the top of the supporting ring (see Figure 2.2.5.1)	Inside radius of the supporting ring (see Figure 2.2.5.1)
≥ 60 mm	30 mm	12 mm
30 mm ≤ d_p < 60 mm	20 mm	D/2 - 3 mm

For plastic anchor plates, which change their mechanical properties under influence of humidity (anchors made of polyamide), the tests shall be carried out using air-humid conditioned anchor plates but always in ambient temperature (standard conditions: equilibrium water content at T = +23 °C and 50 % relative humidity). Plastic parts shall be exposed to conditioning parameters in accordance with EN ISO 1110 for gaining standard conditioning state. Plastic plates made of polyethylene and polypropylene do not change their mechanical properties under influence of humidity.

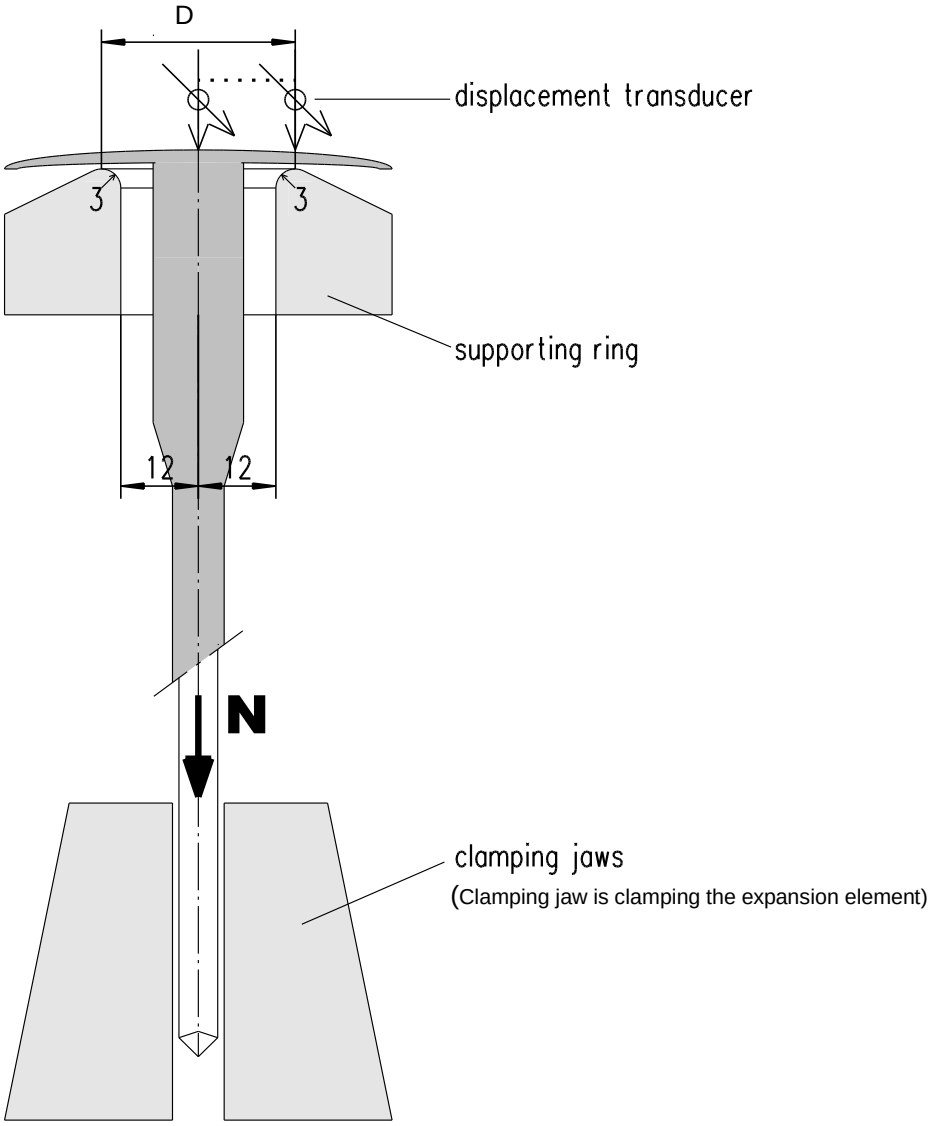

Figure 2.2.5.1 Principle description of the test for determination of the load resistance and plate stiffness

The tension load is transmitted over the anchor shaft with a loading rate of 1 kN/min ± 20 %.

2.2.5.1 Characteristic load resistance

The characteristic load resistance shall be determined from the 5%-quantile of the ultimate loads for a confidence level of 90 %. This value shall be given in the ETA.

2.2.5.2 Mean plate stiffness

For getting a comparable dimension for the plate stiffness, the tangent stiffness shall be determined for every test. This tangent stiffness states the gradient of an idealised straight line between the points s_u with the appropriate tension force N_u = 0 kN and s_o = 1 mm with the appropriate tension force N_o in the load-displacement-diagram (see Figure 2.2.5.2).

The assessed values shall be rounded upward expediently to $^1/_{10}$ kN and be stated related to 1 mm deformation (e.g., 0,3 kN/mm / 0,4 kN/mm / 0,5 kN/mm / 0,6 kN/mm / 0,7 kN/mm).

The mean plate stiffness and the diameter of the plate shall be given in the ETA.

Tangents stiffness:

$$\mathbf{c} = \frac{\mathbf{N_o} - \mathbf{N_u}}{\mathbf{s_o} - \mathbf{s_u}} = \frac{\mathbf{N_o}}{\mathbf{1\,mm} - \mathbf{s_u}} \qquad (2.2.5.1)$$

with $s_u \leq 0{,}3\ s_o$

Where:

c tangent stiffness [kN/mm],
N normal tension force [kN],
s displacement [mm].

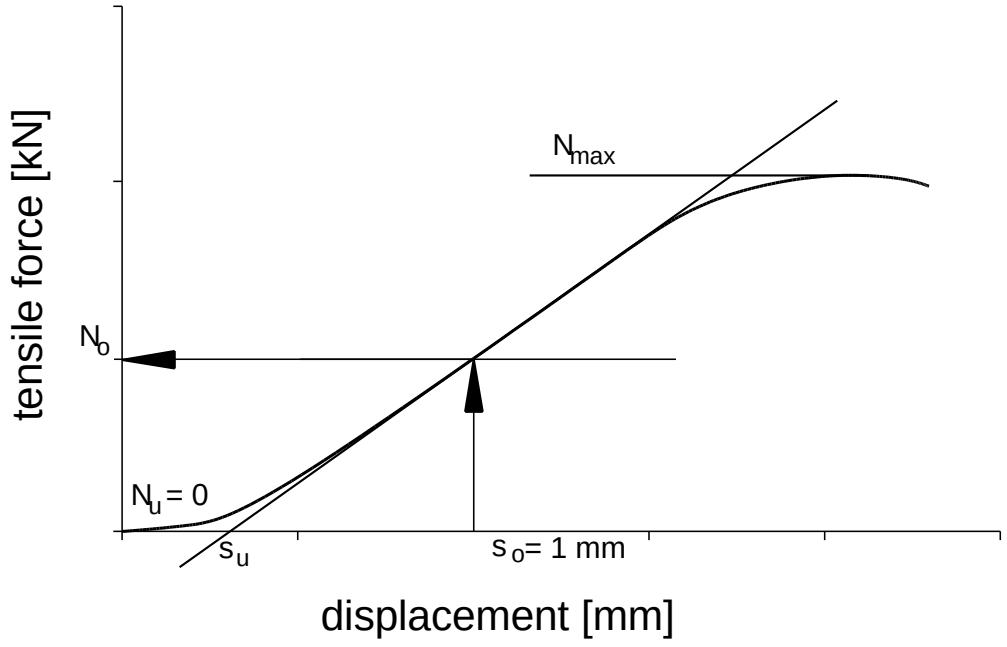

Figure 2.2.5.2 Load-displacement-diagram with the idealized straight line

2.2.6 Point thermal transmittance of fastener to fix the external thermal insulation

The point thermal transmittance χ of a fastener to fix the external thermal insulation shall be determined by numerical analysis by means of "finite-element"-method based on EN ISO 10211 and EN ISO 6946. Software shall be validated and calibrated beforehand by the TAB.

It is to be considered that

- the point thermal transmittance depends on the thickness and the thermal conductivity of the thermal insulation;
- the point thermal transmittance χ can increase or decrease with increasing thickness of the insulating material depending on the type of fastener. The behaviour is not linear;
- The higher the thermal resistance of the undisturbed structure, the higher the influence of the screw related to heat loss.

Therefore, the point thermal transmittance shall be determined with the most unfavourable substrate which the manufacturer wants to be covered by the ETA for the screw. In addition, the point thermal transmittance can be determined and stated for other substrates separately.

The fastener shall be arranged according to the installation situation indicated by the manufacturer. The determinations concerning the building component layers remain untouched.

Furthermore, the point thermal transmittance shall be determined considering the whole thickness range of thermal insulation covering by the ETA. The calculation shall be performed at least for the lowest, the medium and the highest insulation layer thickness.. The most unfavourable point thermal transmittance shall be stated in the ETA. It is also possible to give the point thermal transmittance for different groups of thickness.

The point thermal transmittance shall be determined for a thermal conductivity of λ_D = 0,035 W/mK or for the most unfavourable (= lowest) thermal conductivity of the insulation layer, which is intended to be covered by the ETA. Alternatively, the point thermal transmittance can be determined and stated for several variants of the thermal conductivity value of the insulation layer.

The thermal quantities given in Table 2.2.6.1 are used.

Table 2.2.6.1 Thermal quantities

Designation	**Sign**	**Unit**
Thermal conductivity	λ	W/(m · K)
Thermal resistance	R	m²· K/W
Internal surface resistance	R_{si}	m²· K/W
External surface resistance	R_{se}	
Heat flux	q	W/m²
Heat transfer coefficient of the wall with external insulation, without thermal bridges (screws)	U	W/(m² · K)
Heat flow	Q	W
Thermal coupling coefficient for three-dimensional calculation	L^{3d}	W/K
Modified heat transfer coefficient of the wall with external insulation, including thermal bridges (screws)	U_c	W/(m² · K)
Point thermal transmittance	χ	W/K
Internal temperature	θ_i	°C
External temperature	θ_e	°C

The following temperatures and surface resistances are used for the analysis:

θ_i = +20 °C R_{si} = 0,13 m² K/W

θ_e = -15 °C R_{se} = 0,04 m² K/W.

The edge surfaces of the test specimens are considered as adiabatic.

For the thermal insulation material, the thermal conductivity λ_D given in the Declaration of Performance, if available, shall be used for calculating. For other cases the thermal conductivity λ shall be taken from EN ISO 10456.

The following values shall be used preferably (reference structure):

External rendering: 15 mm lime-cement plaster, λ = 1,0 W/mK

External thermal insulation: λ_D = 0,035 W/mK

Solid soft wood: 80 mm, λ = 0,13 W/mK

As significant section for the calculation of the thermal bridge effect a cuboid-shaped section of the wall containing an anchor shall be assumed. The anchor shall be placed in the centre of the considered area. In case the anchor is rotationally symmetric in its shape, a partial circular section of the anchor which is placed in an edge of the area considered, can also be used for the calculation or the calculation can be done in polar coordinates. The dimensions of the area to be considered shall be chosen in accordance with

EN ISO 10211 so that the disturbance caused by the fastener has no effects on the edges. The thermal conductivity of potential cavities shall be determined in accordance with EN ISO 6946.

The subdivision of the system for calculation by means of the numerical method shall be accomplished in accordance with EN ISO 10211. Annex A of this standard determines that the subdivision shall be sufficiently fine, that if n subdivisions are chosen, the sum resulting from the heat flows does not deviate from the subdivisions more than 1 % which would result in the case of 2n subdivisions.

The numerical analysis shall be done by solving the three-dimensional temperature field by means of "Finite-Element"-method.

The point thermal transmittance χ per fastener shall be calculated from the comparison of thermal transmittance for the whole system with and without screw.

$$\chi = \frac{U_c - U}{n} \text{ [W/K] and } U_c = \frac{L^{3d}}{A} \qquad \text{(2.2.6.1 and 2.2.6.2)}$$

Where

A representative section of the system,

n number of screws per m².

Deviating from EN ISO 10211 the thermal transmittance shall be determined with five decimal places. This is necessary because the point thermal transmittance χ to be calculated shall be given rounded to four decimal places, e.g., 0,0012 W/K. The thermal transmittance U of the undisturbed wall shall be calculated in accordance with EN ISO 6946.

The reported point thermal transmittance χ shall then be rounded upwards and stated in the ETA in steps of 0,001 W/K.

If the calculated point thermal transmittance of the fastener is smaller than 0,0005 W/K, the point thermal transmittance χ can be assumed negligible and stated as 0 W/K.

The point thermal transmittance shall be given in the ETA in connection with the conditions to which the given point thermal transmittance applies (thermal conductivity and thickness of the insulation layer, kind and thermal conductivity of the substrate).

Requirements for FE-Models shall be used in accordance with EN ISO 10211, especially the size of the models shall be respected.

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 97/176/EC, as amended by Commission Decision 2001/596/EC.

The system is 3.

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 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]					
Screw					
1	Raw material specification	3.3	See control plan	-	Per material batch
2	Dimensions	Dimensions shall be taken on the fasteners using a calibrated device capable of achieving an accuracy of ± 1 % of the measure	See control plan	5 per production batch	Daily
3	Bending angle	EAD 130118-01-0603, clause 2.2.3	See control plan	5	Per production or heat treatment batch
4	Characteristic tensile strength	EAD 130118-01-0603, clause 2.2.6	See control plan	5 per screw type and outer thread diameter	Every 6 months
5	Characteristic torsional strength	2.2.2	See control plan	5	Per production or heat treatment batch
6	Mean insertion moment	2.2.3	2.23	10 (screws with the longest threaded part per screw type and outer thread diameter)	Every 6 months
7	Durability against corrosion	Inspection certificate 3.1 in accordance with EN 10204	See control plan	5	Per corrosion treatment batch
Plastic Plate					
8	Dimensions of the plate	Dimensions shall be taken on the fasteners using a calibrated device capable of achieving an accuracy of ± 1 % of the measure	See control plan	5 per production batch	Daily

No	Subject/type of control	Test or control method		Criteria, if any	Minimum number of samples	Minimum frequency of control
9	Material	DSC[5] in accordance with EN ISO 11357-1		Tolerance: ± 5 K	2	Twice a year or per material batch
10	Density	in accordance with EN ISO 1183-1 to -3		-	2	
11	Characteristic load resistance of the plate	2.2.5		See control plan	5	
12	Only for polyamide (PA) – Molecular weight	Viscosity number VZ in accordance with EN ISO 307		Tolerance: ± 10 %	2	
13	Only for polyethylene (PE) and polypropylene (PP) – Molecular weight	Melt mass-flow rate (MFR) or melt volume-flow rate (MVR) in accordance with EN ISO 1133-1 and -2		Tolerance: MFR ≤ 10: ± 1 % MFR > 10: ± 10 % MVR ≤ 10: ± 1 % MVR > 10: ± 10 %	2	
14	Only for non – virgin material (PE and PP) / process stabilization	Process stabilization OIT (oxidative induction time/ temperature) see control plan		Tolerance: -10%	2	
15	Only for non – virgin material (PA, PE and PP) / long-term stabilization	Long-term stabilization GC (gaschromatography)		Tolerance: -10%	2	
16	Only for non – virgin material (PA, PE and PP) / admissible contamination[1)]	Tensile tests in accordance with EN ISO 527-1 and impact tests in accordance with EN ISO 179-1 or EN ISO 180 with normed samples as given in EN ISO 3167	Tensile modulus	Tolerance: -10%	5	Twice a year or per material batch
			Stress at yield[2)]	Tolerance: -10%	5	
			Stress at break[2)]	Tolerance: -10%	5	
			Impact toughness	Tolerance: -10%	5	
17	Reaction to fire[3)]	2.2.1		See control plan	2	Once a year for test in accordance with EN ISO 11925-2
					1	Once per 2 years for test in accordance with EN 13823

[1)] Contaminations may influence mechanical performance thus mechanical performance has to be monitored.

[2)] Stress at yield for ductile plastics (e.g., PE, PE, PA) and stress at break for brittle plastics (e.g., PA-GF or PP-GF).

[3)] Only required in case of materials assessed in accordance with clause 2.2.1 sub-point "c)".

5 DSC Differential scanning calorimetry

3.3 Special methods of control and testing used for the verification of constancy of performance

The raw material of the screws supplied by another party than the assessment holder shall be confirmed by inspection certificate 3.1 in accordance with EN 10204. The raw material of the screws is given in the control plan.

4 REFERENCE DOCUMENTS

EN 1382:2016	Timber structures – Test methods – Withdrawal capacity of timber fasteners
EN 1995-1-1:2004/AC:2006+A1:2008+A2:2014	Design of timber structures – Part 1-1: General – Common rules and rules for buildings
EN 10204:2004	Metallic products – Types of inspection documents
EN 12369-1:2001	Wood-based panels – Characteristic values for structural design – Part 1: OSB, particleboards and fibreboards
EN 12369-3:2022	Wood-based panels – Characteristic values for structural design – Part 3: Solid wood panels
EN 13171:2012+A1:2015	Thermal insulation products for buildings – Factory made wood fibre (WF) products – Specification
EN 13238:2010+A1:2014	Reaction to fire tests for building products – Conditioning procedures and general rules for selection of substrates
EN 13446:2002	Wood-based panels – Determination of withdrawal capacity of fasteners
EN 13501-1:2018	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
EN 13823:2020+A1:2022	Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
EN 13986:2004+A1:2015	Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking
EN 14080:2013	Timber structures – Glued laminated timber and glued solid timber – Requirements
EN 14081-1:2005+A1:2011	Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements
EN 14358:2016	Timber structures – Calculation and verification of characteristic values
EN 14592:2008+A1:2012	Timber structures – Dowel-type fasteners – Requirements
EN 15283-2:2008+A1:2009	Gypsum boards with fibrous reinforcement – Definitions, requirements and test methods – Part 2: Gypsum fibre boards
EN 15737:2009	Timber structures – Test methods – Torsional resistance of driving in screws
EN ISO 1110:2019	Plastics – Polyamides – Accelerated conditioning of test specimens (ISO 1110:2019)
EN ISO 179-1:2010	Plastics – Determination of Charpy impact properties – Part 1: Non-instrumented impact test (ISO 179-1:2010)
EN ISO 180:2019	Plastics – Determination of Izod impact strength (ISO 180:2019)
EN ISO 307:2019	Plastics – Polyamides – Determination of viscosity number (ISO 307:2019)

EN ISO 527-1:2019	Plastics – Determination of tensile properties – Part 1: General principles (ISO 527-1:2019)
EN ISO 3167:2014	Plastics – Multipurpose test specimens (ISO 3167:2014)
EN ISO 1133-1:2022	Plastics – Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics – Part 1: Standard method (ISO 1133-1:2022)
EN ISO 1133-2:2011	Plastics – Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics – Part 2: Method for materials sensitive to time-temperature history and/or moisture (ISO 1133-2:2011)
EN ISO 1183-1:2019	Plastics – Methods for determining the density of non-cellular plastics – Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1:2019, Corrected version 2019-05)
EN ISO 1183-2:2019	Plastics – Methods for determining the density of non-cellular plastics – Part 2: Density gradient column method (ISO 1183-2:2019)
EN ISO 1183-3:1999	Plastics – Methods for determining the density of non-cellular plastics – Part 3: Gas pyknometer method (ISO 1183-3:1999)
EN ISO 6946:2017	Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods (ISO 6946:2017)
EN ISO 8970:2020	Timber structures – Testing of joints made with mechanical fasteners – Requirements for timber density (ISO 8970:2020)
EN ISO 10211:2017	Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations (ISO 10211:2017)
EN ISO 10456:2007+AC:2009	Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007+Cor.1:2009)
EN ISO 11357-1:2016	Plastics – Differential scanning calorimetry (DSC) – Part 1: General principles (ISO 11357-1:2016)
EN ISO 11925-2:2020	Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test (ISO 11925-2:2020)
EN ISO 12944-2:2017	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classifications of environments (ISO 12944-2:2017)
EAD 130005-00-0304	Solid wood slab element to be used as a structural element in buildings
EAD 130118-01-0603	Screws and threaded rods for use in timber constructions
EAD 330196-01-0604	Plastic anchors made of virgin or non-virgin material for fixing of external thermal insulation composite systems with rendering