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European Assessment Document for

Fastening screws for fastening metal members and sheeting to metal or timber structures

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 products covered by this EAD are fastening screws (self-drilling and self-tapping screws) made of steel for fastening metal members and sheeting to metal or timber structures (in the following referred to as "fastening screws"). The fastening screws are normally completed with a sealing washer consisting of a combination of metal and seal made of plastic or rubber but this EAD also covers the screws without such washers.

The fastening screws are made of austenitic stainless steel, martensitic stainless steel, galvanised or painted carbon steel or a bimetal combination in which the drill tip and part of the threaded shank are made of carbon steel and the rest is made of stainless steel. Regarding the painted screws, the head and, where relevant, the washer are painted. These screws are assessed as painted construction products.

The fastening screws and the corresponding connections are subject to tension or shear forces or to both. This EAD covers the assessment of the load-bearing capacity of the fastening screws and the corresponding connections.

Examples of fastening screws are given in Figure 1.1.1 and an example for a corresponding connection is shown in Annex A.

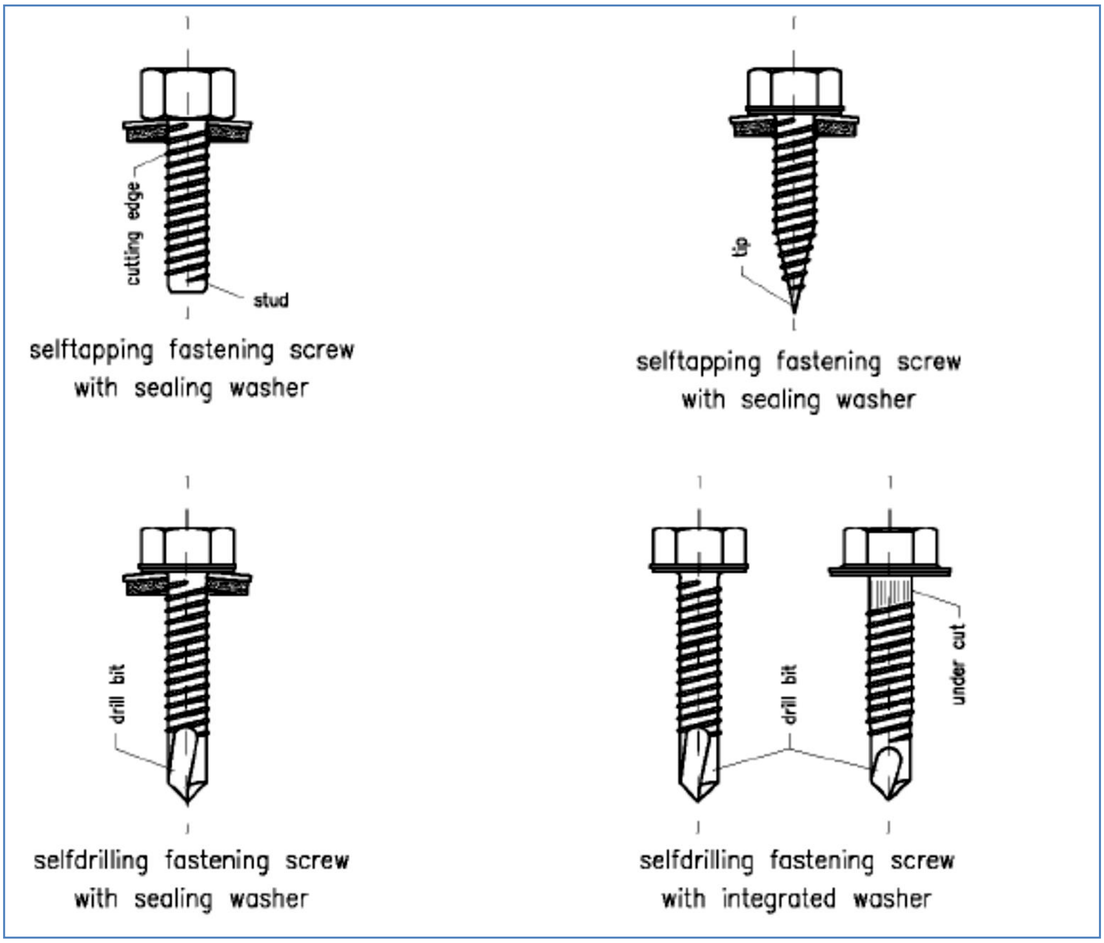


Figure 1.1.1: Examples of fastening screws

In this EAD the term "component I" is used for the component to be fixed to the substrate and "component II" for the substrate itself.

The product is not covered by a harmonised European standard (hEN).

The product is not fully covered by EAD 330046-01-0602. Compared to the previous version of the EAD, the following changes are introduced: EAD 330046-01-0602 does not include screws made from martensitic stainless steel. Test methods for the durability have been added for this material.

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, 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 are intended to be used for fastening metal members or sheeting to metal or timber supporting substructures. The sheeting can either be used as wall or roof cladding or as load-bearing wall or roof element. The fastening screws are also intended to be used for the fastening of any other thin gauge metal members. The intended use comprises fastening screws and connections for indoor and outdoor applications.

The fastening screws are not intended for re-use.

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 screws for the intended use of 25 years when installed in the works (provided that the fastening screws 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[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 referred to above.

1.3 Specific terms used in this EAD

V_{R,k_SL}	shear resistance of the connection (single layer)
V_{R,k_FL}	shear resistance of the connection (four layer)
$N_{R,k,static}$	tension resistance of the connection
$N_{R,cyclic\_5000}$	the cyclic tension resistance
ρ	nominal density of the timber
MPII	Manufacturer's Product Installation Instructions
t_I	thickness of the sheeting
t_{II}	thickness of the supporting substructure
$V_{u,min,3mm}$	minimum value of the shear resistance measured at 3,0 mm ± 0,1 mm deformation
$R_{m,min}$	minimum tensile strength of the relevant metallic components shall be taken from the relevant material standard (i.e., the component which has failed)
R_m	tensile strength of the relevant metallic components used for the tests (EN ISO 6892-1) (i.e., the component which has failed)
ρ_{test}	density of the timber used for the test (EN 384)
$t_{I,min}$	minimum thickness of component I, tI; given by standard configuration or, where relevant, in addition in accordance with EN 10346 and EN 10088-4
$t_{II,min}$	minimum thickness of component II, tII; given by standard configuration or, where relevant, in addition in accordance with EN 10346 and EN 10088-4
α	the correction factor
$\rho_{m,sel}$	mean density of all selected pieces
ρ_m	mean density of the wood to which the test results are applied

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 is assessed in relation to the essential characteristics.

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

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Shear resistance of the connection	2.2.1	Level V_{R,k_SL} [kN] V_{R,k_FL} [kN]
2	Tension resistance of the connection	2.2.2	Level $N_{R,k,static}$ and $N_{R,cyclic\_5000}$ [kN]
Basic Works Requirement 2: Safety in case of fire			
3	Reaction to fire	2.2.4	Class
Aspects of durability			
4	Corrosion protection	2.2.3	Class

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 Shear resistance of the connection

The substructures can be either metal or timber. The shear resistance shall be tested with the Single Layer Shear Test as well as with the Four Layer Shear Test, for both tests with at least 10 specimens, regardless if it concerns metal substructures or timber substructures. Both the Single Layer Shear Test (2.2.1.1) and the Four Layer Shear Test (2.2.1.2) shall be followed by the determination of the characteristic shear resistance (2.2.1.3).

2.2.1.1 Single Layer Shear Test

Purpose of the assessment

The purpose of the test herein presented is to receive the failure and/or the maximum loads for a single layer shear test.

Assessment method

At least 10 shear tests with single sheet layers shall be carried out for thicknesses of the sheeting (t_I) and the supporting substructure (t_{II}) each of $t_I = t_{II}$ = 1,0, 2,0 and 3,0 mm, each with a tolerance of ± 0,05 mm. In addition, when the manufacturer wishes to have another configuration be assessed such deviating test setup shall be used. In any case, the test setup(s) shall be given in the ETA together with the indication of the relevant product performance. The assembly shall be carried out according to MPII or, if this is not available, screws shall be screwed by hand (without automatic screwdrivers).

The test load shall be increased until shear failure of the fastening screw occurs or an inclination angle of 10° is reached. Therefore, the angle of inclination of the fastening screw shall be measured during loading. The angle is determined using an analogue angle meter (accuracy ±1°), measuring the rotation of the screw axis relative to the undeformed screw (see Annex D).

For all substructures the maximum load which shall be taken into account to determine the relevant characteristic resistance is the maximum load which corresponds to either a deformation capacity of 3,0 mm or to the load level where 10° angle of inclination is reached, whatever occurs first. The rate of deformation shall be 1 mm/min ± 10%.

The material properties of sheeting and supporting substructure shall be S280GD in accordance with EN 10346 in case of carbon steel or, in case of austenitic stainless steel or martensitic stainless steel, 1.4301 in accordance with EN 10088-4.

In addition, other metal material or timber can be used as specified by the manufacturer. The material properties of the sheeting and substructures used for the test shall be specified in the ETA (tensile, yield strength or density of the timber).

An example for the test setup is shown in Annex D.

The shear resistance is the minimum value of the test forces measured at 3,0 mm ± 0,1 mm deformation ($V_{u,min,3mm}$) or at 10° angle of inclination.

2.2.1.2 Four Layer Shear test

Purpose of the assessment

The purpose of the test herein presented is to receive the failure or the maximum loads or both for a four-layer shear test.

Assessment method

At least 10 shear tests with 4 sheet layers shall be carried out for each relevant supporting substructure thickness tII = 3,0 mm ± 0,1 mm. The test load shall be increased until shear failure of the fastening screw or angle of inclination of the fastening screw of 10°. Therefore, the angle of inclination of the fastening screw shall be measured during loading. The rate of deformation shall not exceed 1 mm/min. For supporting substructures the maximum load which shall be taken into account to determine the relevant characteristic resistance is the maximum load which corresponds to a deformation capacity within a range of 3,0 mm.

The material properties of sheeting are S280GD in accordance with EN 10346 in case of carbon steel or, in case of austenitic stainless steel or martensitic stainless steel, 1.4301 in accordance with EN 10088-4.

In addition, other metal material or timber can be used as specified by the manufacturer. The material properties of the sheeting and substructures used of the test shall be specified in the ETA (tensile, yield strength or density of the timber).

The tensile strength of the material of the component with the thickness tI (sheeting) shall be at the upper limit range in accordance with the relevant product standard (e.g., EN 10346). The maximum possible thickness of the sheeting (4 x tI) shall be used. This is the maximum thickness for sheeting fastenings where longitudinal and transverse lap joints coincide. An example for the test setup is shown in Annex D.

The shear resistance is the minimum value of the test forces measured at 3,0 mm ± 0,1 mm deformation ($V_{u,min,3mm}$) or at 10° angle of inclination .

2.2.1.3 Determination of characteristic shear resistance

Purpose of the assessment

The purpose of the test herein presented is to determine the characteristic values of the shear resistance of the connection.

Assessment method

The results of the tests according to 2.2.1.1 or 2.2.1.2 (failure loads or maximum loads) shall be multiplied by the correction factor α.

The correction factor α for normalisation is the minimum value of the following three values.

- Local bearing of sheeting: α = (Rm,min/Rm) × (tI,min/tI) ≤1,0
- Local bearing of metal substructure: α = (Rm,min/Rm) × (tII,min/tII) ≤1,0
- Local bearing of timber substructure: $\alpha = \rho/\rho_{test} \leq 1{,}0$

With:

Rm,min = minimum tensile strength of the relevant components shall be taken from the relevant material standard (i.e., the component which has failed)

Rm = tensile strength of the relevant components used for the tests (EN ISO 6892-1) (i.e., the component which has failed)

ρ = nominal density of the timber (EN 384)

ρ_{test} = density of the timber used for the test (the timber used for the test shall be conditioned in accordance with the relevant standards)

tI,min, tII,min = minimum thickness of components I and II, tI or tII; given by standard configuration or, where relevant, in addition in accordance with EN 10346 and EN 10088-4.

tI, tII = thickness of the components I and II, tI or tII used for the tests.

The wood shall be without localized defects such as knots and cracks that can influence the test results. The wood shall be at equilibrium at a relative humidity (RH) of (65 ± 5) % and a temperature of (20 ± 2) °C at the time of testing.

The density shall be determined. Density of all pieces shall be reported. This shall be done just after the mechanical testing on pieces selected close to volume tested.

The mean wood density, $\rho_{m,sel}$, of all selected pieces shall satisfy the condition given by equation 2.2.1.3.1.

$$0,9\rho_m \le \rho_{m,sel} \le 1,1\rho_m \qquad (2.2.1.3.1)$$

where

ρ_m mean density of the wood to which the test results are applied,

$\rho_{m,sel}$ mean density of all selected pieces.

The values shall be determined in accordance with EN 1990, Annex D, clause D7.2, for unknown V_X and a log-normal distribution.

Expression of results

The characteristic value $V_{R,k}$ of the shear resistance of the connection shall be given in the ETA for the Single Layer Shear Test V_{R,k_SL} as well as for the Four Layer Shear Test V_{R,k_FL}.

2.2.2 Tension resistance of the connection

2.2.2.1 Static test

Purpose of the assessment

The purpose of the test herein presented is to receive the loads for a static tension test. Within this test, all three possible failure modes (pull-out of the screw from substructure, pull-through from component I and fracture of the screw) can occur depending on the configuration of sheet, screw and substructure.

For the assessment of the tensile strength of the connection with the failure mode "pull-through failure": Taking into account the expected tensile strength of the screw, the material properties as well as the thickness of component II should be such that failure of this component is excluded.

For the assessment of the tensile strength of the connection with the failure mode "pull-out failure": Taking into account the expected tensile strength of the screw, the material properties of component I should be such that failure of this component is excluded.

For the assessment of the tensile strength of the connection with the failure mode "tensile failure of the screw": The material properties as well as the thicknesses of components I and II should be such that failure of those components is excluded.

Assessment method

At least 10 tests shall be carried out for each sheeting configuration in accordance with the test matrix given in table 2.2.2.1.1.

Table 2.2.2.1.1: Test matrix and expected failure

	t_I =1mm	t_I =2mm	t_I =3mm
t_{II} =1mm	expected failure "not predictable"	expected failure "pull-out failure"	expected failure "pull-out failure"
t_{II} =2mm	expected failure "pull through"	expected failure "not predictable"	expected failure " tensile failure of the screw"
t_{II} =3mm	expected failure "pull through"	expected failure "not predictable"	expected failure " tensile failure of the screw"

(tolerance ± 0,05 mm; four times multilayer sheet of t_{II}, see Annex C)

If other failure modes than the expected failure modes as described above occur, the whole test series with the 10 specimens as described in the following shall be repeated using other configurations of the test setup (material, thickness) in order to ensure the expected failure mode to occur.

In case the manufacturer wishes to have another configuration be assessed, taking also into account the preconditions to achieve the different failure modes, such deviating test setup shall be used.

The test load shall be increased until tension failure occurs. The rate of deformation shall be 5 mm/min ± 0,1 mm/min at jaws of the testing machine.

An example for the test setup is shown in Annex C. The material properties of sheeting are S280GD in accordance with EN 10346 in case of carbon steel or, in case of austenitic stainless steel or martensitic stainless steel, 1.4301 in accordance with EN 10088-4, or as specified by the manufacturer.

The results of the tests (failure loads or maximum loads) shall be multiplied by the correction factor α .The correction factor α is

correction factor: $\alpha = (Rm,min/Rm) \times (tmin/t) \leq 1,0$ (2.2.2.1.1)

With:

Rm,min = minimum tensile strength of the relevant metal components (i.e., the component which has failed)

Rm = tensile strength of the relevant metal components (i.e., the component which has failed)

tmin = minimum thickness of the relevant components (i.e., the component which has failed) t

t = thickness of the relevant components (i.e., the component which has failed) t used for the tests

In the event of failure of a timber substructure, the correction factor α is:

correction factor $\alpha = \rho/\rho_{test} \leq 1,0$

With:

ρ = nominal density of the timber

ρ_{test} = density of the timber used for the test (the timber used for the test shall be conditioned in accordance with the relevant standards)

The values $N_{R,k,static}$ shall be determined in accordance with EN 1990, Annex D, clause D7.2, for unknown V_X.

The wood shall be without localized defects such as knots and cracks that can influence the test results. The wood shall be at equilibrium at a relative humidity (RH) of (65 ± 5) % and a temperature of (20 ± 2) °C at the time of testing.

The density shall be determined. Density of all pieces shall be reported. This shall be done just after the mechanical testing on pieces selected close to volume tested.

The mean wood density, $\rho_{m,sel}$, of all selected pieces shall satisfy the condition given by equation 2.2.2.1.2.

$0,9\rho_m \leq \rho_{m,sel} \leq 1,1\rho_m$ (2.2.2.1.2)

where

ρ_m mean density of the wood to which the test results are applied,

$\rho_{m,sel}$ mean density of all selected pieces.

Expression of results

The characteristic value $N_{R,k,static}$ of the tension resistance of the connection for the failure mode "tensile failure of the screw, pull-through failure and pull-out failure" shall be given in the ETA together with the relevant information about component I and component II (i.e., thickness and, as relevant, density of the timber or tensile strength of the metal component). In addition, the performance can be given for other failure modes.

For each failure mode, sheeting and substrate relevant outputs shall be presented separately, taking into account table 2.2.2.1.1.

2.2.2.2 Cyclic test

Purpose of the assessment

The purpose of the test herein presented is to determine the $N_{R,cyclic\_5000}$ resistance pull-through or tensile resistance of the screw under pulsating load.

Assessment method

The $N_{R,cyclic\_5000}$ resistance shall be determined iteratively by increasing the maximum upper load through cyclic tests. The starting point of the upper load is 50% of the $N_{R,k,static}$ in accordance with 2.2.2.1. If the following cyclic test is passed, the upper load shall be increased by 10% using new test specimens. This shall be done until the following test is no longer passed, because a fracture failure or a pull-through failure has occurred and the cyclic load can no longer be applied.

At least 5 tests shall be carried out for sheeting thickness t_I = 1,0 mm; 2,0 mm; 3,0 mm ± 0,05 mm and t_{II} = 3,0 mm ± 0,05 mm. In case the manufacturer wishes to have another configuration be assessed such deviating test setup shall be used.

Following cyclic loads and parameters shall be applied:

- constant amplitude, with sinusoidal curve
- upper end of amplitude (maximum load, starting at 50% of $N_{R,k,static}$, increased by 10%),
- lower end of amplitude is constant 10% of maximum load.

The loading frequency shall be 5 Hz ± 10 %. Each test specimen shall undergo 5000 load cycles without any failure.

An example for the test setup is shown in Annex C.

The maximum upper load that passes all 5 cyclic tests multiplied by correction factor α is the cyclic tension resistance $N_{R,cyclic\_5000}$. The correction factor α is the same as calculated in accordance with clause 2.2.2.1 (see equation 2.2.2.1.1).

Expression of results

The value $N_{R,cyclic\_5000}$ of the tension resistance of the connection for each sheeting thickness of component I shall be given in the ETA together with the relevant information about component I (i.e., thickness and, as relevant, tensile strength of the metal component I).

2.2.3 Corrosion protection

The material number of the fastening screws shall be given in the ETA.

2.2.3.1 Austenitic stainless steel:

The corrosion resistance class (CRC) of the steel shall be assessed in accordance with EN 1993-1-4, Table A.3. For austenitic stainless steels which are not included in Table A.3, the assessment shall be carried out in accordance with Section 2.2.3.2.

2.2.3.2 Galvanised or painted carbon steel or a bimetal combination and martensitic stainless steel

Purpose of the assessment

The purpose of the tests herein presented is to assess the screws in accordance with EN ISO 12944-1, -2, -4, -5 and -6.

Assessment method

The tests shall be conducted in accordance with EN ISO 12944-6, table 1. It specifies the exposure period in hours for different corrosivity categories as shown in the following table. The lifetime of 25 years assumed in this EAD corresponds to durability range H (high) in accordance with EN ISO 12944-1, clause 5.5. Corrosivity categories and test methods are specified in EN ISO 12944-2.

Table 2.2.3.2.1: Corrosivity categories and the laboratory tests specified in accordance with EN ISO 12944-6.

To be specified in the ETA		
Corrosivity category	EN ISO 6270-1 (Water condensation) h	EN ISO 9227 (Neutral salt spray) h
C2	120	-
C3	240	480
C4	480	720

The test panels for the corrosion tests shall be prepared using 150 mm x 100 mm x 1 mm sheets S280GD in accordance with EN 10346. The assembly configuration of the 9 test screws is shown in Annex E. The assembly shall be carried out according to MPII or, if this is not available, screws shall be screwed by hand (without automatic screwdrivers). No additional scribes shall be made on the screws before the tests.

If the screws are painted, 4 test panels in 4 different colours with 9 screws per colour shall be tested for each relevant configuration of fastener and for each corrosion category to be tested (1-3). One colour on one panel. Proper tools shall be used and the assembly instructions of the manufacturer shall be taken into account in test panel preparation. The test panels shall be arranged together in one testing cabinet. During the execution of the test, sufficient conditioning in accordance with section 5.6 of EN 12944-6 together with EN ISO 9227 shall be ensured at least every 24 hours. One additional screw (the tenth) shall be picked up for the coating measurements.

After the test, before the evaluation of the condition of the painted screws, they shall be cleaned with a dish brush under running water.

The durability of the screws shall be assessed according to the maximum corrosivity category (Table 2.2.3.2.1) which has been achieved by at least 6 screws out of 9 (2/3) on the test panel for each of the characteristics in accordance with EN ISO 12944-6, table 4:

EN ISO 4628-2, Blistering 0 (S0),

EN ISO 4628-3, Rusting Ri 0,

EN ISO 4628-4, Cracking 0 (S0),

EN ISO 4628-5, Flaking 0 (S0).

Expression of results

For each characteristic in accordance with EN 12944-6, table 4, it shall be indicated in the ETA which corrosivity category according to table 2.2.3.2.1 has been achieved, together with the relevant information about coating type, layer thickness and number of coating layers.

2.2.4 Reaction to fire

One of the following options shall apply for the assessment of reaction to fire:

a) The uncoated or inorganic coated fastening screws and metal washers are considered to satisfy the requirements of class A1 of the reaction-to-fire characteristic 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 regarding uncoated or inorganic coated fastening screws as set out in that Decision and its intended use being covered by that Decision.

   Therefore, when the conditions referred to above are fulfilled, the performance of the products is class A1 which shall be given in the ETA.

b) The fastening screws and metal washers that have a polyester coating are analogously considered to satisfy the requirements of class A1 of the reaction-to-fire performance in accordance with the Commission Decision 2010/737/EU without the need for testing on the basis of it fulfilling the conditions regarding thickness, area weight and area-related PCS value (≤ 25 µm, ≤ 70 g/m² and ≤ 1,0 MJ/m²) as set out in that Decision and its intended use being covered by that Decision.

   Therefore, when the conditions referred to above are fulfilled, the performance of the products is class A1 which shall be given in the ETA.

c) The fastening screws and metal washers that have a plastisol coating are analogously considered to satisfy the requirements of class C-s3, d0 of the reaction-to-fire performance in accordance with the Commission Decision 2010/737/EU without the need for testing on the basis of it fulfilling the conditions regarding thickness, area weight and area-related PCS value (≤ 200 µm, ≤ 300 g/m² and ≤ 7,0 MJ/m²) as set out in that Decision and its intended use being covered by that Decision.

   Therefore, when the conditions referred to above are fulfilled, the performance of the products is class C-s3, d0 which shall be given in the ETA.

d) Fastening screws and metal washers that have an organic coating as well as EPDM sealing washers are considered to satisfy the requirements for small components not contributing to the growth and spread of fire if they satisfy all of the following requirements:

   – a total mass of the coated fastening screw, the coated metal washer or the EPDM sealing washer ≤ 50 g,
   – a size of the coated surface of the fastening screw: ≤ 2500 mm²
     or
     a size of the upper surface of the coated metal washer or the EPDM sealing washer ≤ 50 mm x ≤ 50 mm or a diameter of ≤ 57 mm (equal area size as for a rectangular size of ≤ 50 mm x ≤ 50 mm), without the area of the screw hole, 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 reaction to fire classes B, C, D, or E in accordance with EN 13501-1

     or

     when completely embedded all-round in non-melting material of class A1 when used as small connecting part of a product consisting of various components and without any possibility to ignite or to propagate fire.

In this case the screws, metal and/or sealing washer shall 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.

Where the conditions are not met regarding the distance to other similar components or the all-round covering by non-melting A1 materials, the screw shall be tested as part of the relevant composite product.

It shall be stated in the ETA which component does not need to be tested because it is considered to be a small component and its contribution to fire is negligible.

e) If none of the above cases a) to d) applies and testing of the organic coated fastening screws and metal washer or the EPDM sealing washers is required, they shall then be tested, using the test method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The products shall be classified in accordance with Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

For the execution of tests, the provisions concerning mounting and fixing of the test specimens as well as rules for the application of test results provided in Annex F shall be taken into account.

The reaction to fire class obtained for organic coated fastening screws and metal washers and/or the EPDM sealing washers shall be given in the ETA together with those conditions (see parameters addressed in Annex F) for which the classification is valid.

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 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

<table>
<tr><th>No</th><th>Subject/type of control</th><th>Test or control method</th><th>Criteria, if any</th><th>Minimum number of samples</th><th>Minimum frequency of control</th></tr>
<tr><td colspan="6">Factory production control (FPC)
[including testing of samples taken at the factory in accordance with a prescribed test plan]</td></tr>
<tr><td>1</td><td>Check of material properties and chemical composition</td><td>Inspection document 3.1. in accordance with EN 10204</td><td>According to control plan</td><td>-</td><td>Every production unit</td></tr>
<tr><td>2</td><td>Geometry and dimensions</td><td>Check of geometry, dimensions and tolerances</td><td>According to control plan</td><td>10</td><td>Every production unit</td></tr>
<tr><td>3</td><td>Tension resistance of fastening screws</td><td>Check according to control plan</td><td>According to control plan</td><td>10</td><td>Every production unit</td></tr>
<tr><td>4</td><td>Thread forming, drill-drive and torque tests</td><td>Check according to control plan</td><td>According to control plan</td><td>10</td><td>Every production unit</td></tr>
<tr><td>5</td><td>Check of initial raw material</td><td>Inspection document 3.1 in accordance with EN 10204</td><td>According to control plan</td><td>10</td><td>Every production unit</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Reaction to fire</td><td>Clause 2.2.4, option b) + c)
• solid content and applied quantity per unit area of the coatings
• thickness of coatings
• Q_{PCS} value in accordance with EN ISO 1716 of coatings</td><td rowspan="3">According to control plan</td><td rowspan="3">According to the control plan, taking into account the control method and the class to be verified</td><td>• Each batch (except the control of the Q_{PCS} value)
• Once per 2 years (for the Q_{PCS} value only</td></tr>
<tr><td>Clause 2.2.4, option d)
• weight
• dimensions</td><td>Once per week</td></tr>
<tr><td>Clause 2.2.4, option e)
• indirect tests, such as thickness, density / weight per unit area and solid or organic content
• direct tests</td><td>• indirect tests ⇨ each batch
• direct tests once per 2 years*)</td></tr>
<tr><td colspan="6">Initial type-testing of the product (ITT)</td></tr>
<tr><td>7</td><td>Geometry and dimension</td><td>Check of geometry, dimensions and tolerances</td><td>According to control plan</td><td>10</td><td>When starting the production or a new production line</td></tr>
<tr><td>8</td><td>Tension resistance of fastening screws</td><td>Check according to control plan</td><td>According to control plan</td><td>10</td><td>When starting the production or a new production line</td></tr>
<tr><td>9</td><td>Thread forming, drill-drive and torque tests</td><td>Check according to control plan</td><td>According to control plan</td><td>10</td><td>When starting the production or a new production line</td></tr>
<tr><td colspan="6">*) The frequency of direct tests in accordance with EN 13823 (SBI; only relevant for products of classes A2 to D) within the FPC on specimens randomly taken from the consecutive production process can be reduced to once per 5 years, if the other direct and indirect tests for the relevant reaction to fire class meet the criteria as laid down in the control plan.</td></tr>
</table>

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 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	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 for metal members and sheeting	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	one/year

4 REFERENCE DOCUMENTS

EN 384:2016+A2:2022	Structural timber - Determination of characteristic values of mechanical properties and density
EN 1990:2023	Eurocode: Basis of structural and geotechnical design
EN 1993-1-4:2025	Eurocode 3 - Design of steel structures – Part 1-4: Stainless steel structures
EN 10088-4:2009	Stainless steels – Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes
EN 10204:2004	Metallic products – Types of inspection documents
EN 10346:2015	Continuously hot-dip coated steel flat products for cold forming – Technical delivery conditions
EN 13238:2010	Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates
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 ISO 1182:2020	Reaction to fire tests for products – Non-combustibility test (EN ISO 1182:2020)
EN ISO 1716:2018	Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value) (ISO 1716:2018)
EN ISO 4628-2:2016	Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 2: Assessment of degree of blistering (ISO 4628-2:2016)
EN ISO 4628-3:2024	Paints and varnishes – Evaluation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting (ISO 4628-3:2024)
EN ISO 4628-4:2016	Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 4: Assessment of degree of cracking (ISO 4628-4:2016)
EN ISO 4628-5:2022	Paints and varnishes – Evaluation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 5: Assessment of degree of flaking (ISO 4628-5:2022)
EN ISO 6892-1:2019	Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1:2019)

EN ISO 9227:2022+A1:2024	Corrosion tests in artificial atmospheres – Salt spray tests (ISO 9227:2022+Amendment 1:2024)
EN ISO 11925-2:2020	Reaction to fire tests - Ignitability of building products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2:2020)
EN ISO 12944-1:2017	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 1: General introduction (ISO 12944-1:2017)
EN ISO 12944-2:2017	Paints and varnishes – Corrosion protection of steel structures by protective paint systems - Part 2: Classification of environments (ISO 12944-2:2017)
EN ISO 12944-4:2017	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 4: Types of surface and surface preparation (ISO 12944-4:2017)
EN ISO 12944-5:2019	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems (ISO 12944-5:2019)
EN ISO 12944-6:2018	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods (ISO 12944-6:2018)

ANNEX A EXAMPLE OF CONNECTIONS MADE WITH THE FASTENING SCREWS

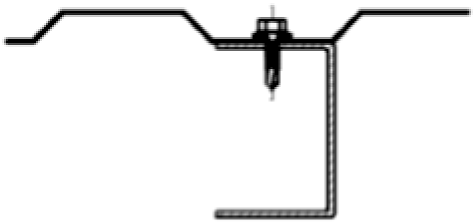


Figure A.1

ANNEX B POSSIBLE FAILURE MODES OF CONNECTIONS

Possible failure modes of connections

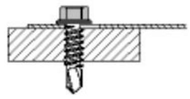
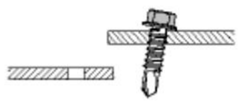
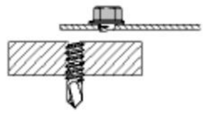
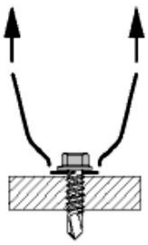
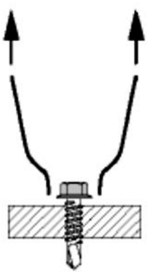
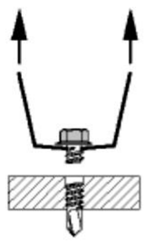
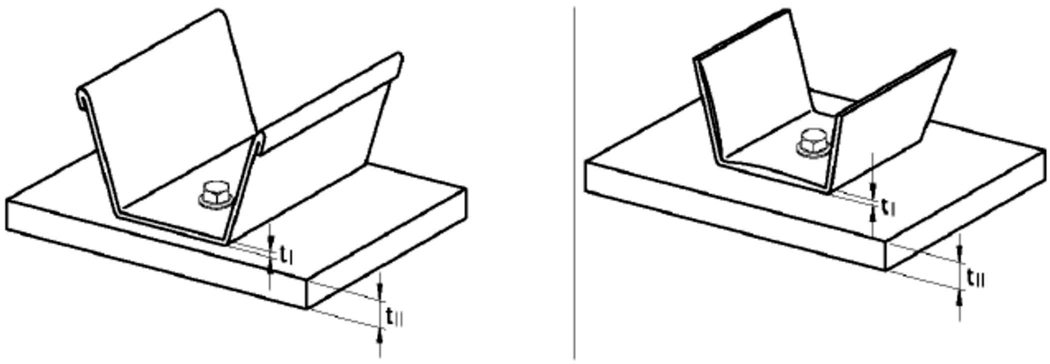
	Failing component		
Type of loading	sheeting	base material	cartridge fired pin
Lateral shear loading	 Slotted hole	 Slotted hole  Rotation of fastener  Pull-out of fastener	 Shear failure
Tensile loading	 Pull-through with punching shear failure  Pull-through	 Pull-out	 Tension failure of fastener

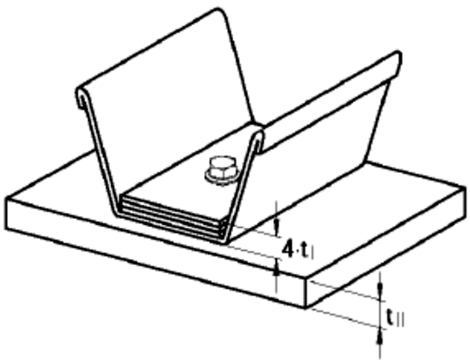
Figure B.1

ANNEX C TEST SET-UP FOR TENSION (PULL-THROUGH AND PULL-OUT) TESTS

Pull-through specimen (with or without folded lip)



Pull-out test with pull-through specimen



The sheet with thickness t_{II} is rigidly connected to the base of the testing machine; tension is applied to the sheet with thickness of t_I. The distance of the screw axis to the edges of the sheeting is at least 30,0 mm, i.e., the width of the sheeting is at least 60,0 mm, the height of the raised edge at least 100,0mm. As shown in Annex B, the drill tip shall pass through the material t_{II}.

ANNEX D SHEAR TEST SET-UP

-

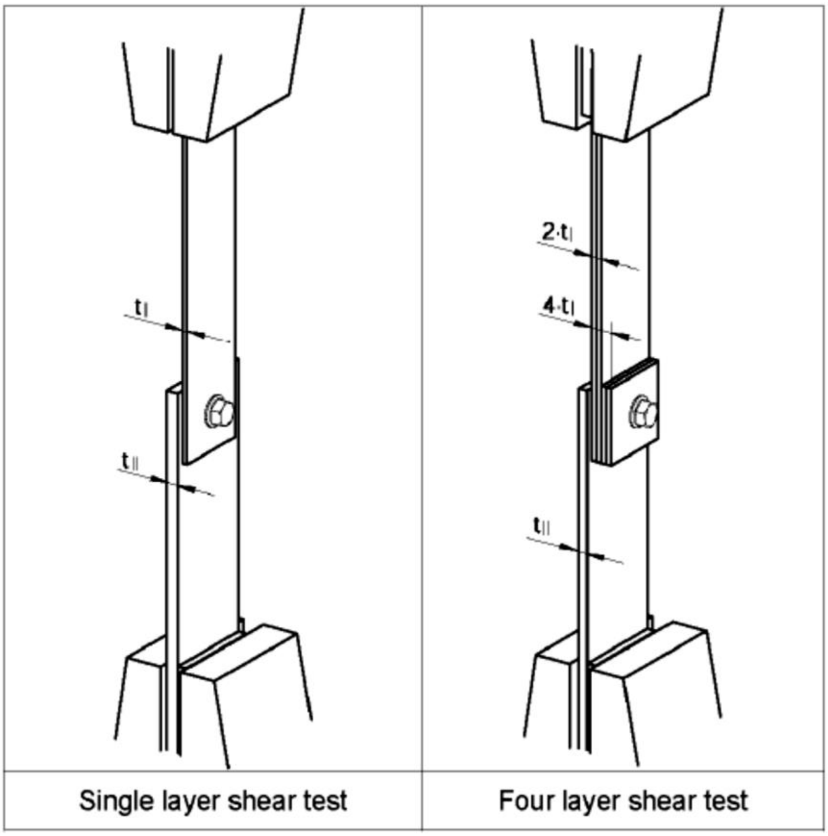


Figure D.1 **Figure D.2**

The distance of the screw axis to the edges of the sheeting is at least 30,0 mm, i.e., the width of the sheeting is at least 60,0 mm. The measuring points for measuring the deformation shall be located 60,0 mm above and 60,0 mm below the screw axis (120,0 mm distance).

Measuring the angle of inclination (Rotation of fastener)

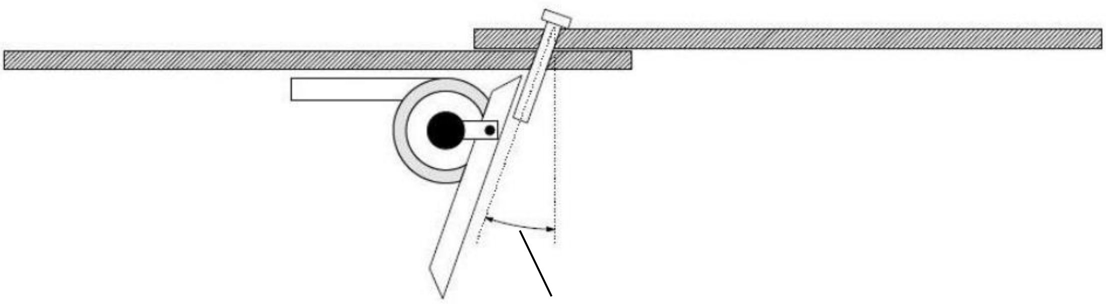


Figure D.3

ANNEX E CONFIGURATION OF THE TEST SCREWS ON THE TEST PANEL

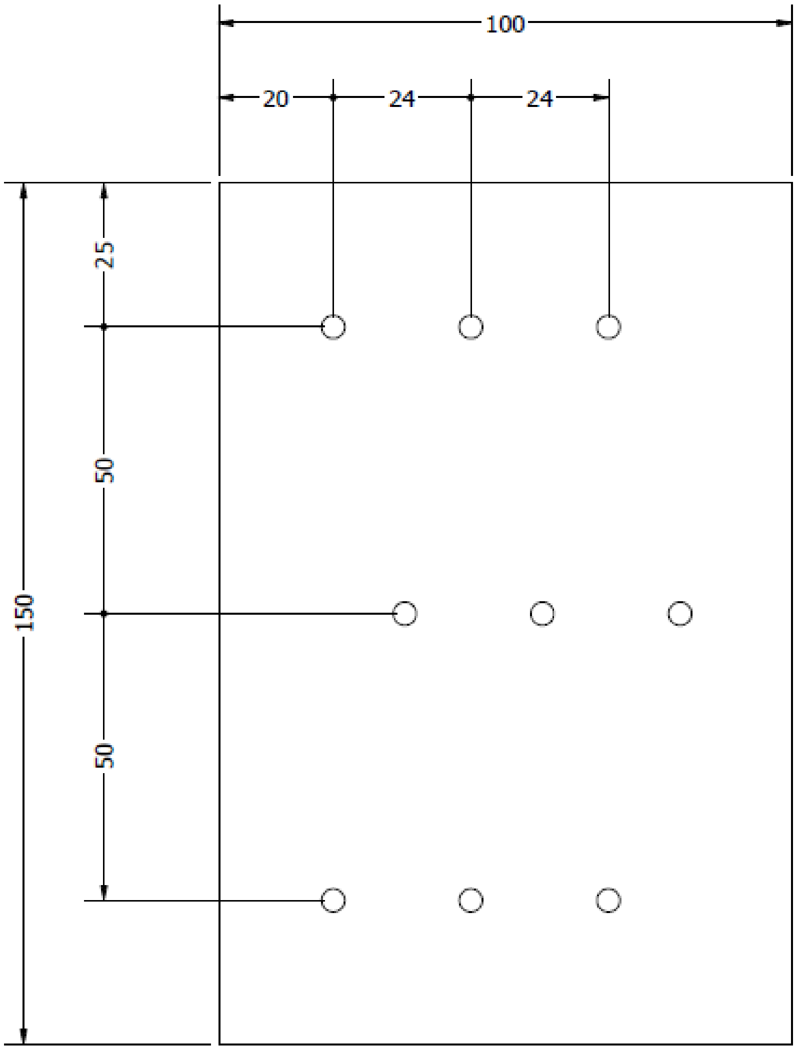


Figure E.1

ANNEX F MOUNTING AND FIXING OF TEST SPECIMEN AND APPLICATION RULES FOR REACTION TO FIRE TESTS

F.1 Provisions for testing of organic coated fastening screws and metal washers

The following conditions and parameters shall be taken into account when preparing test specimens of the organic coated fastening screws and, where relevant, washers and conducting the relevant tests:

For the purpose of testing in the relevant reaction to fire tests, the organic coated screws and washers shall be treated analogously either as a single-side coated steel sheet (for screws) or as a two-side coated steel sheet (for washers) and the organic coating as external layer (either substantial or non-substantial, depending on its thickness and weight per unit area – see definition in EN 13501-1).

EN ISO 1182 and EN ISO 1716

These test methods are relevant for reaction to fire classes A1 and/or A2 in accordance with Commission Delegated Regulation (EU) 206/364 and EN 13501-1.

The required tests shall be done in accordance with the provisions of these two test standards

The uncoated steel doesn't need to be tested separately in both test methods, since it is considered as a component which is deemed to satisfy the requirements for class A1 in accordance with Commission Decision 1996/603/EC, as amended by Commission Decisions 2000/605/EC and 2003/424/EC, without the need for testing. Its Q_{PCS} value in accordance with EN ISO 1716 is, therefore, set as zero for the further calculation of the total Q_{PCS} value of the entire organic coated product.

The following parameters of the organic coating of screws and washers shall be considered for choosing and preparing the test specimens and the execution of tests:

- product variations of a defined product family[2,3],
- density,
- highest organic content (in percentage per mass related to the dried condition),
- type and lowest amount of flame retardants (where relevant).

In addition, thickness and weight per unit area (in dried condition; based on highest and lowest density, where relevant) of each layer of the organic coated steel sheet shall be considered, when calculating the total Q_{PCS} value in accordance with EN ISO 1716 of the entire organic coated product.

The results of these tests considering the aforementioned parameters are valid for all product variations of the same product family of the organic coating

- with the same density (if only one was tested) or a density between highest and lowest density tested,
- with equal or lower organic content,
- with the same type and equal or higher amount of flame retardants,
- with any thickness in case of homogenous products, and
  - with the same thickness and weight per unit area of the layers of non-homogenous products used for calculating the total Q_{PCS} value of the entire product, or
  - with any thickness and weight per unit area between the highest and lowest values of these two parameters of the layers of non-homogenous products used for calculating the total Q_{PCS} value of the entire product.

2 as defined by a certain combination of raw materials and produced in a certain type of production process

3 In order to permit the TAB to apply rules for the extended application of test results within the assessment, it is recommended that the manufacturer should provide (but he is not obliged to do so) sufficient information (e.g., on the basis of the composition of the products in question), allowing the TAB to determine which products or product variants should be submitted to testing and so to reduce the number of tests required.

Furthermore, the results of these tests are valid for any higher thickness of the steel than that used for tests in accordance with EN ISO 1182 of the organic coating (if substantial and clause 5.2.3.4 of the test standard was applied) as well as for the calculation of the total Q_{PCS} value in accordance with EN ISO 1716 of the entire organic coated product.

EN 13823 and EN ISO 11925-2

These test methods are relevant for reaction to fire classes A2 to D (EN 13823) and classes B to E respectively (EN ISO 11925-2) in accordance with Commission Delegated Regulation (EU) 2016/364 and EN 13501-1.

The necessary tests according to both above test methods shall be performed on specimens either made of single-side coated steel sheets (if organic coated screws shall be assessed) or of two-side coated steel sheets (if organic coated washers shall be assessed). A standard steel sheet in accordance with EN 13238 shall be used for the application of the coating and the preparation of the test specimens.

Tests and test results for two-side coated steel sheets also cover single-side coated steel sheets.

For tests in accordance with EN 13823, the organic coated steel sheets shall be directly mounted onto a standard calcium-silicate board in accordance with EN 13238 and considering a standard joint configuration as prescribed in the test standard. These joints shall be executed as butt joints. Each of the pieces of the coated steel sheet shall be mechanically fixed to the standard calcium silicate substrate with four small metal nails or screws (one fixing mean in each corner of the sheets).

The tests in accordance with EN ISO 11925-2 shall be performed with edge exposure as well as with surface exposure on specimens mounted in a free-hanging test position without any additional substrate behind.

Relevant product parameters to be considered in the tests are:

- Variations of a product family of the coating (as defined by a combination of certain raw materials and certain type of production process),[2,3]
- highest thickness of the coating,
- highest applied quantity per unit area / weight per unit area (in dried condition) of the coating,
- highest solid content of a coating, if relevant,
- highest organic content (in percentage per mass related to the dried condition),
- lowest amount of each type of flame retardants of the coatings, if relevant. The results of tests considering the aforementioned parameters in fully are valid for:

- all variations of the defined product family,
- the use of any type of steel having a melting point equal to or higher than 1000 degrees,
- the equal or lower thickness of the coating than tested,
- the equal or lower applied quantity per unit area / weight per unit area (in dried condition) of the coating than tested,
- the equal or lower solid content of a coating than tested,
- the equal or lower organic content (in percentage per mass related to the dried condition) of the coating than tested,
- the same or higher amount of the same type of flame retardants of the coating.

F.2 Provisions for testing of sealing washers made of EPDM

The following conditions and parameters shall be taken into account when preparing test specimens of the sealing washers made of EPDM and conducting the relevant tests:

EN ISO 1182 and EN ISO 1716

These test methods are relevant for reaction to fire classes A1 and/or A2 in accordance with Commission Delegated Regulation (EU) 2016/364 and EN 13501-1.

Otherwise, the required tests shall be done in accordance with the provisions of these two test standards and the following parameters of the sealing washers shall be considered for choosing and preparing the test specimens and the execution of tests:

- product variations of a defined product family,[2,3]
- density (only in tests in accordance with EN ISO 1182),
- organic content,
- type and amount of flame retardants.

The results of these tests considering the aforementioned parameters are valid for all product variations of the same product family:

- with the same density (if only one was tested) or a density between highest and lowest density tested,
- with equal or lower organic content,
- with the same type and equal or higher amount of flame retardants,
- with any thickness of homogenous EPDM products.

EN 13823 and EN ISO 11925-2

These test methods are relevant for reaction to fire classes A2 to D (EN 13823) and classes B to E respectively (EN ISO 11925-2) in accordance with Commission Delegated Regulation (EU) 2016/364 and EN 13501-1.

The necessary tests in accordance with 13823 (SBI) shall be performed on specimens built-up with flat slabs or mats made from the EPDM material of which the sealing washers are made of. These slabs / mats shall directly be mounted side by side with butt joints on a standard steel sheet in accordance with EN 13238 and considering at least the standard joint configuration as prescribed in the test standard. Each single piece of the slabs / mats shall be mechanically fixed on the standard substrate with four small metal nails or screws (one fixing means in each corner of the slabs / mats).

The necessary tests in accordance with EN ISO 11925-2 shall be performed with edge exposure as well as with surface exposure on specimens taken from the EPDM material of which the sealing washers are made of as follows:

a) flat slabs / mats, mounted in a free-hanging test position without any substrate behind, or

b) flat slabs / mats, mechanically fixed on a standard steel sheet in accordance with EN 13238, if tests fail with a specimen configuration according to "a)".

For case "b)" the EPDM slabs / mats shall be mechanically fixed on the standard substrate by using the screws or clamps of the specimen holder as prescribed in the test standard.

The following parameters shall be considered within the tests:

- type of the EPDM material (as defined by a certain combination of raw materials and produced in a certain type of production process),[2,3]
- vulcanisation conditions/procedure, where relevant,
- thickness of the sealing washers,
- density of the EPDM material.

The results of tests are valid for sealing washers:

- made of the same type of the EPDM material,
- made using the same vulcanisation conditions/procedure, where relevant,
- with the same thickness or lower thickness than tested,
- with the same EPDM density (if only one was tested) or the range between highest and lowest density evaluated in the tests,
- with the intend use as sealing washers of fastening screws made of steel (see clause 1.1) or other metal with a melting point of at least 1000 °C.