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European Assessment Document for

Point fastening kits for roof panels

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

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The point fastening kits for roof panels (in the following referred to as "point fastening kits") consist of the following components:

- Fasteners[1] made of stainless steel according to EN 1993-1-4, Annex A, Tables A.3 and A.4 (optional),
- A mounting plate made of steel, with minimum 5 µm zinc coating, with a round tube on top (lower part) - connected to the substrate by screws or fasteners depending on the substrate (corrugated metal sheets, timber or concrete),
- Disc with thread to connect the thermoelement with the lower part through screws,
- Foil sealing (optional), temperature resistant sealing rubber (thermoelement and thermoelement disc),
- Sealing rubber disk, stainless steel plate and brackets that are mounted to the top module (roof top support),
- Screw that connects the stainless-steel plate and the mounting plate made of steel (lower part).

See Figure 1.1.1 for detailed description of the kit.

The aluminium pipe mounted to the top module is not part of the kit.

This EAD applies only to uncoated steel components and to coated steel components which contain less than 1% of organic material by volume or mass whichever is more onerous.

Note: The point fastening kit may be sensitive to the applied torque while setting. Therefore, it is assumed that the manufacturer specifies a maximum installation torque. If this information is not provided, the installation tools or equipment used in the tests apply and shall be given in the ETA as the conditions for which the performance has been established.

1 Depending on the substrate (metal, timber or concrete) also screws might be used for fixing the kit onto the substrate. However, in order to avoid misunderstandings with regard to the term "screws" as used in this document according to figure 1.1.1, the term "fastener" is used throughout the document.

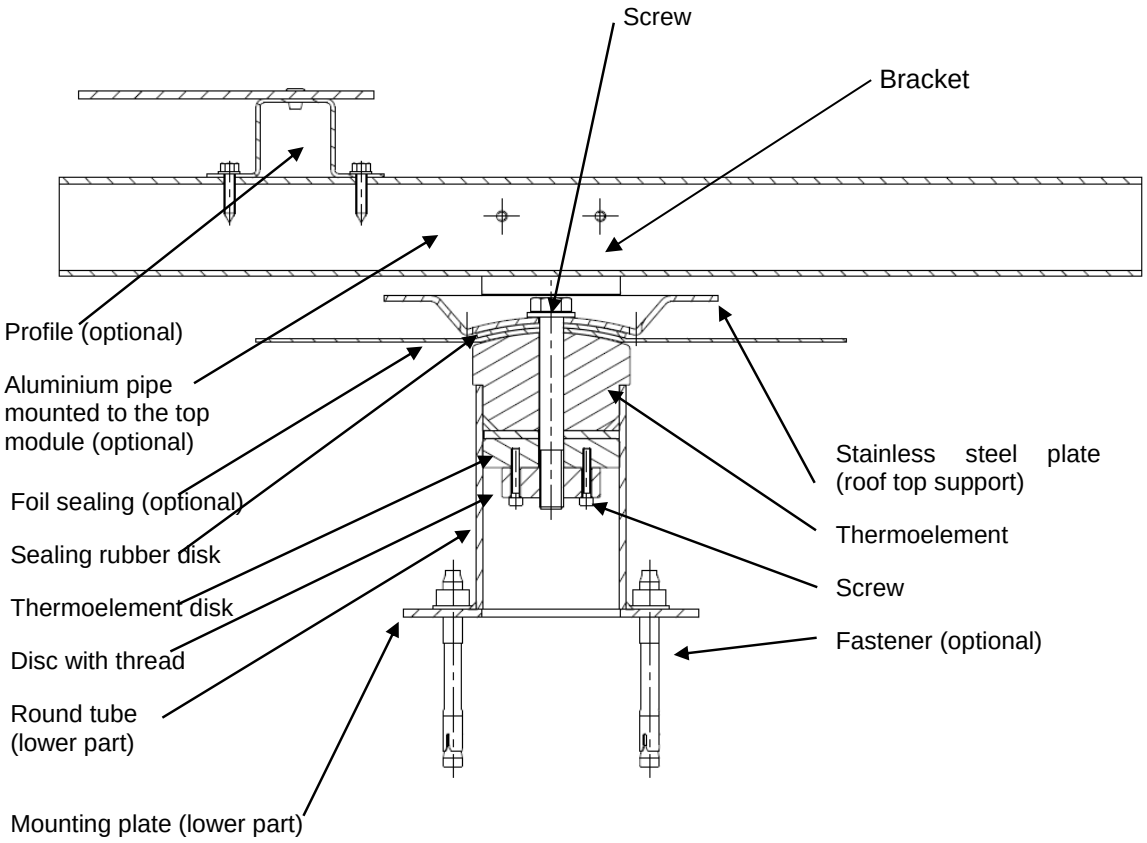

Figure 1.1.1: Description of the kit

Assessment of the fasteners for fixing the point fastening kit to the metal, timber or concrete substrate is not covered by the EAD.

The product is not covered by a harmonised technical specification.

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 point fastening kits are intended to be used in roofs for fixing decorative façade panels or constructions for foot grids, air-conditioning systems etc. to a metal, timber or concrete substructure through the weather screed without compromising the watertightness of the substructure.

The point fastening kit is intended to be exposed to static, quasi-static and repeated loads in tension, shear and combined tension and shear and bending due to the fact that the roofs in which the point fastening kits are intended to be used are not only flat roofs, but also sloped roofs with inclination up to 70°, that constitute the transition to the façade.

Note. The limitation to 70° roof slope is based on the available experience and knowledge for this product and its intended use as well as with regard to the assessment methods given in this EAD.

The panels which the point fastening kit is intended for, are mainly for decorative purposes and they do not contribute to the weather screen of the building.

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 point fastening kits for the intended use of 50 years when installed in the works (provided that the point fastening kits 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.

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

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 point fastening kits are established in relation to the essential characteristics.

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

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class
Basic Works Requirement 3: Hygiene, health and environment			
2	Watertightness	2.2.2	Description
Basic Works Requirement 4: Safety in use			
3	Characteristic resistance to failure under tension loads	2.2.3	Level
4	Characteristic resistance to failure under shear loads	2.2.4	Level
5	Characteristic resistance to failure under combined tension and shear loads for sloped roof applications*	2.2.5	Level
6	Displacements under short-term and long-term loading	2.2.6	Level
7	Characteristic resistance to repeated loads	2.2.7	Level
Aspects of durability			
8	Durability	2.2.8	Level

* This characteristic is applicable only in case the fasteners are intended to be subjected to combined shear and tension loads, e.g., when used for sloped roof applications from 1° to 70°.

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

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer, and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant essential characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

Tests shall be carried out using measuring equipment having a documented calibration according to international standards. The load application equipment shall be designed to avoid sudden increase in load especially at the beginning of the test. The measurement bias of the measuring chain of the load shall not exceed 2% of the measured quantity value.

Displacements shall be recorded continuously for example with electrical displacement transducers with a measuring bias not greater than 0,02 mm or 2,0% for displacements > 1 mm.

The point fastening kit may be sensitive to the applied torque while setting. Therefore, it is assumed that the manufacturer specifies a maximum installation torque. If this information is not provided, the installation tools or equipment used in the tests apply and shall be given in the ETA as the conditions for which the performance has been established.

2.2.1 Reaction to fire

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

Therefore, when the conditions referred to above are fulfilled, the performance of those components is class A1.

Due to the limited dimensions of the foil sealing and the temperature resistant rubber those components are considered to satisfy the requirements for small components in accordance with the following provisions.

- not made from class A1/A2 material,
- a mass ≤ 50 g,
- a size of ≤ 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).

In this case those components can be considered as small components and their reaction to fire performance can be neglected and does not need to be tested and classified separately.

The ETA shall state those components being considered as small components.

In case the conditions for small components as given above are not met, the foil sealing and the temperature resistant sealing rubber shall be tested, using the test method(s) relevant for the corresponding reaction to fire class according to EN 13501-1. The foil sealing and the temperature resistant sealing rubber shall be tested in accordance with clause 5.2.5.2 of EN 13956 and classified according to the Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

The reaction to fire classification of the components shall be given in the ETA.

Thus, the reaction-to-fire performance of the product is class A1 if the conditions for small components for the foil sealing and the temperature resistant rubber are fulfilled. If those conditions are not fulfilled, the

worst performance of the foil sealing and the temperature resistant rubber as assessed by testing represent the performance of the product which shall be given in the ETA.

2.2.2 Watertightness

The tests shall be performed according to Annex A, Table A.1, line W1 to W3 until failure.

The point fastening kit shall be installed with a bituminous sheet or roofing foil, and the watertightness of the assembly shall be tested in accordance with EN 1928.

The water shall be coloured through 0,05% Eosin ± 0,01% and a layer of filter paper shall be set beneath the sheeting.

The watertightness shall be tested on three specimens:

- One specimen is subject to 200 mm ± 2 mm water column for 34 days with no loading.
- One specimen is subject to 200 mm ± 2 mm water column and a permanent shear load of 8,9 kN. ± 0,1 kN.
- One specimen is subject to 200 mm water column and a permanent axial load of 14,9 kN± 0,1 kN .

The torque moment specified by the manufacturer shall be used for the test, if available (see 2.2).

Examples of a test setup for test without loading and with tension load are shown in Figure 2.2.3.1 and Figure 2.2.2.2.

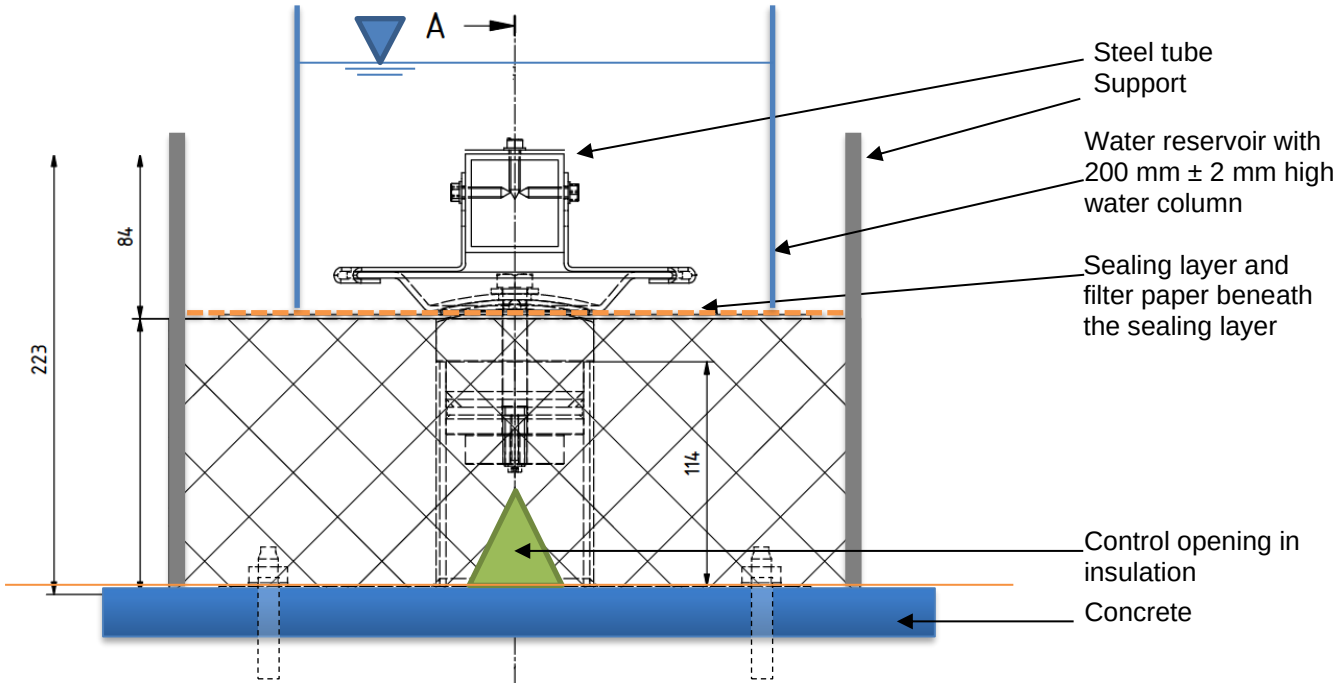

Figure 2.2.2.1: Example for test setup without loading

The test setup for tension load is shown in Figure 2.2.2.2 with examples of dimensions. The specimen shall be loaded unrestricted through support until failure occurs.

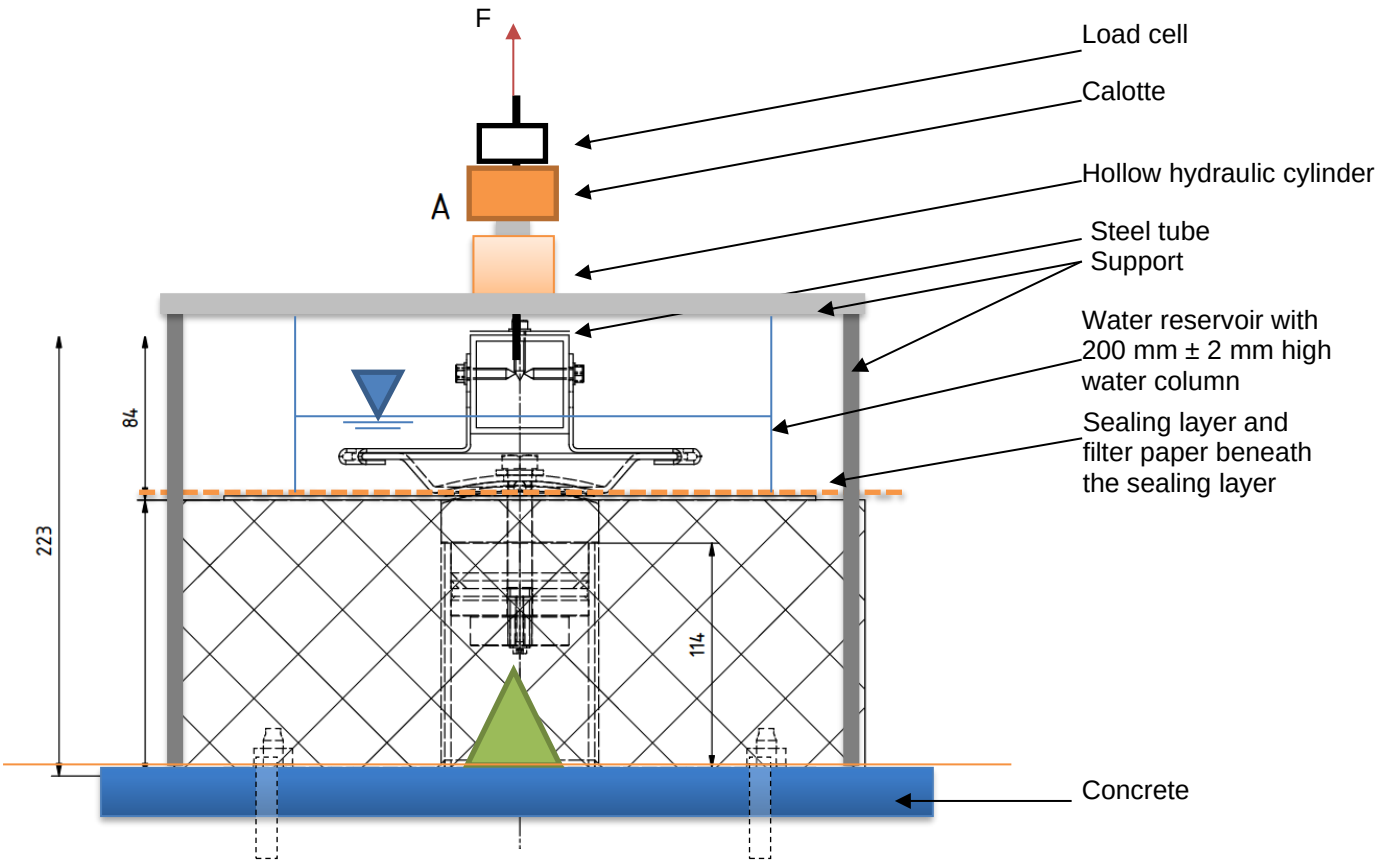

Figure 2.2.2.2: Example for test setup with tension loading

The tests for watertightness under shear load shall be performed in accordance with the tension loading test, with shear loading. An example for a shear loading test setup without subject to 200 mm ± 2 mm water column is given in Figure 2.2.4.1.

It is stated in the ETA if the point fastening kit is watertight after the above exposure or not.

2.2.3 Characteristic resistance to failure under tension loads

The tests are performed to determine the characteristic resistance to material failure of a point fastening kit under tension load.

The tests shall be performed according to Annex A, Table A.1, line A1, until failure.

Test conditions: The tests shall be carried out on the point fastening kit set on a rigid surface with the load applied through the fixing on the steel tube that connects the façade panel with the point fastening kit (see Figure 2.2.3.1). The torque moment specified by the manufacturer, if available (see 2.2), shall be set. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

Both ends (the stainless-steel plates and the brackets (upper part) and the mounting plate (lower part) of the point fastening kit shall be supported sufficiently to cause failure of a part of the point fastening kit.

An example of a testing rig is shown in Figure 2.2.3.1.

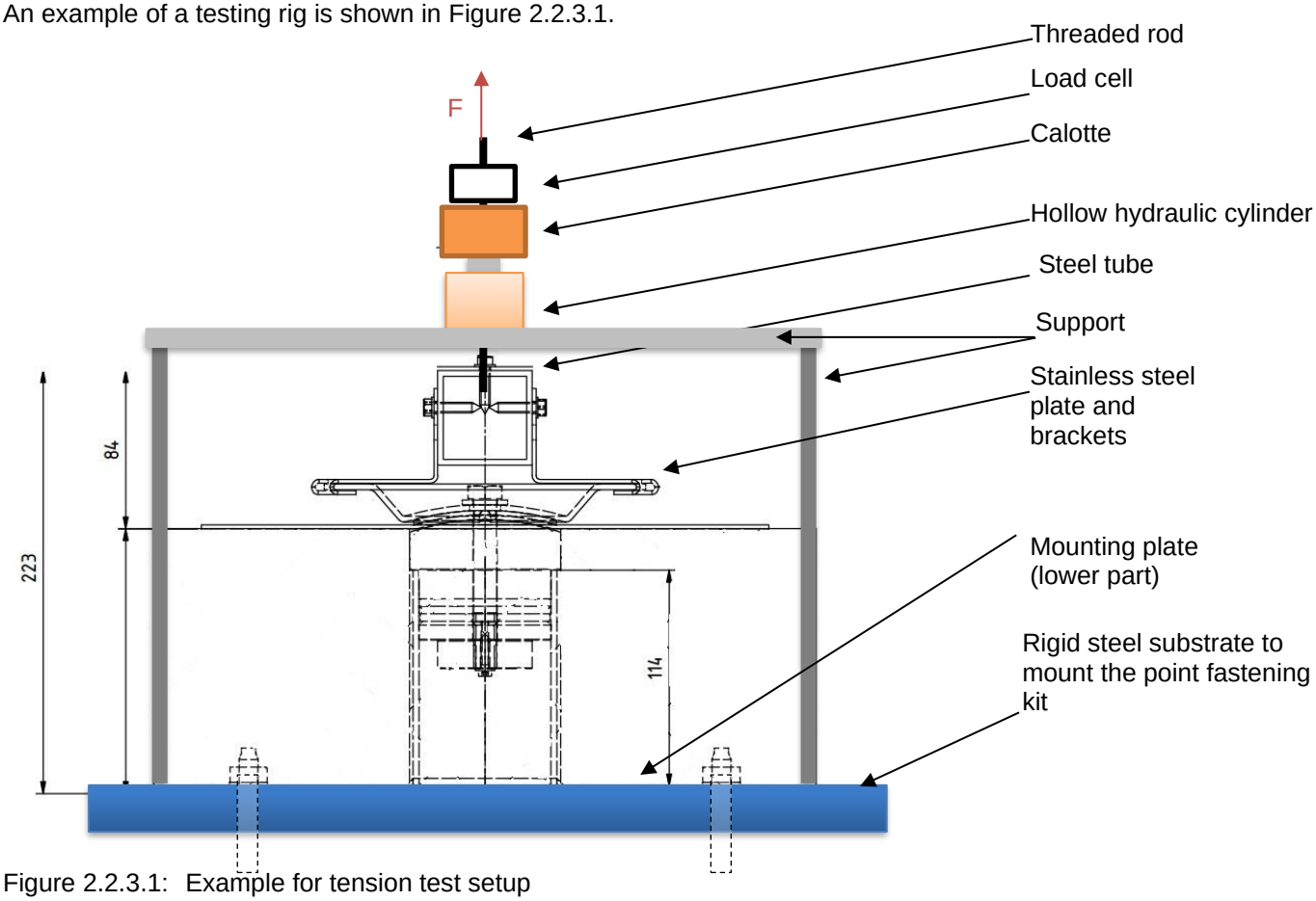

Figure 2.2.3.1: Example for tension test setup

The assessment of failure loads and displacements and determination of the characteristic resistance shall be done according to Equation 2.2.3.1. The characteristic resistance shall be rounded down to 0,1 kN steps. This value shall be normalized to account for over-strength of tested specimens according to equation A.2.1.1 or A.2.1.2 in Annex A and stated in the ETA.

$$N_{Rk} = F_{5\%}\,(A1) \quad [kN] \qquad (2.2.3.1)$$

with: $F_{5\%}$ (A1) = 5%-fractile of the failure loads of test series A1

The 5%-fractile $F_{5\%}$ [kN] shall be given in the ETA.

2.2.4 Characteristic resistance to failure under shear loads

The tests are performed to determine the characteristic resistance to material failure of a point fastening kit under shear load.

The tests shall be performed according to Annex A, Table A.1, line A2, until failure.

Test conditions: The tests shall be carried out on point fastening kit set on a rigid surface with the load applied through the fixing on the steel tube and fixing of the sealing plate (see Figure 2.2.4.1). The torque moment specified by the manufacturer, if available (see 2.2), shall be set. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

Both ends of the point fastening kit shall be supported sufficiently to cause failure of a part of the point fastening kit.

An example of a testing rig is shown in Figure 2.2.4. 1.

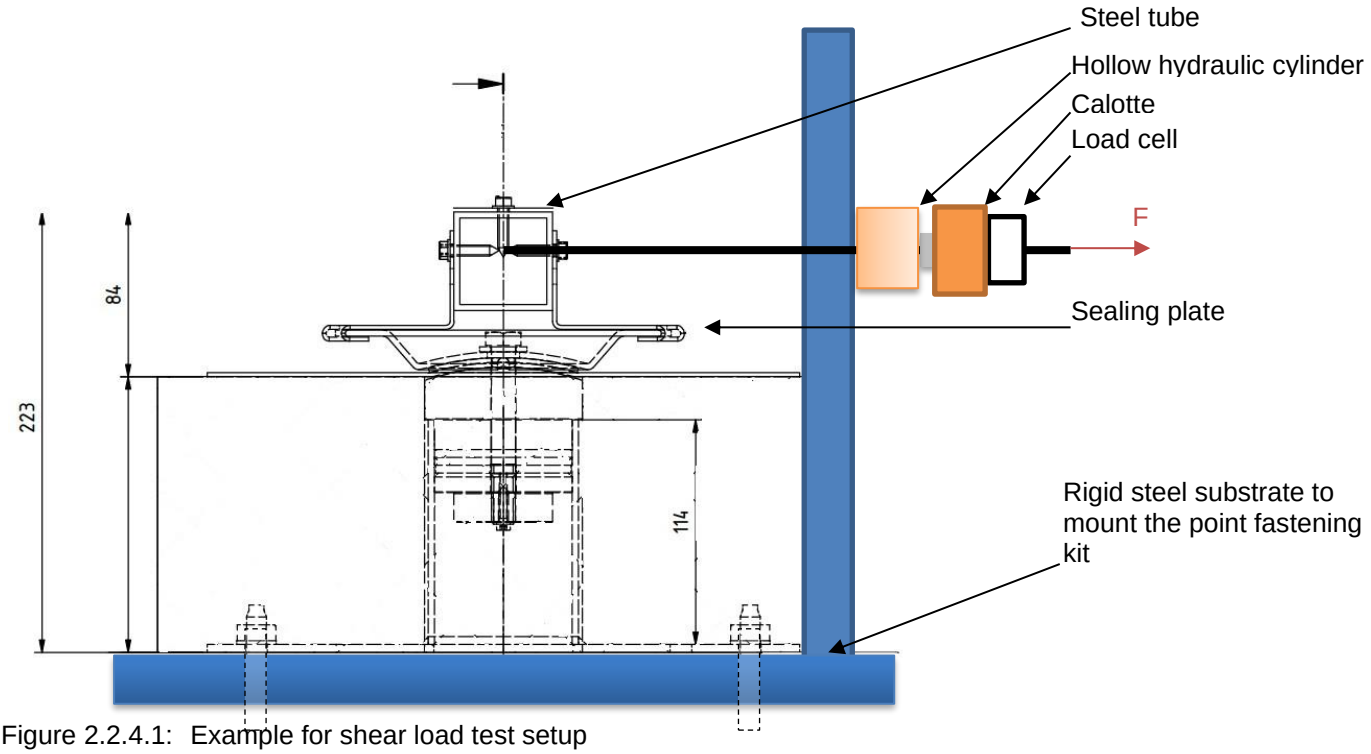

Figure 2.2.4.1: Example for shear load test setup

The assessment of failure loads and displacements and determination of the characteristic resistance shall be done according to Equation 2.2.4.1. The characteristic resistance shall be rounded down to 0,1 kN steps. This value shall be normalized to account for over-strength of tested specimens according to equation A.2.1.1 or A.2.1.2 according to Annex A and stated in the ETA.

$$V_{Rk} = V_{5\%}\,(A2) \qquad (2.2.4.1)$$

with: $V_{5\%}$ (A2) = 5%-fractile of the failure loads of test series A2

The 5%-fractile $V_{5\%}$ [kN] shall be given in the ETA.

2.2.5 Characteristic resistance to failure under combined tension and shear loads

The characteristic is applicable only in case the fasteners are intended to be subjected to combined shear and tension loads, e.g., when used for sloped roof applications from 1° to 70°.

The tests are performed to determine the characteristic resistance to material failure of a point fastening kit under combined tension and shear load.

The tests shall be performed according to Annex A, Table A.1, line A3, until failure.

Test conditions: The tests shall be carried out on point fastening kit set on a rigid surface with the load applied through the fixing on the steel tube that connects the façade panel with the point fastening kit (see Figure 2.2.5. 1). No thermal insulation shall be used; the torque moment specified by the manufacturer, if available (see 2.2), shall be set. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

Both ends of the point fastening kit shall be supported sufficiently to cause failure of a part of the point fastening kit.

An example of a testing rig is shown in Figure 2.2.5.1.

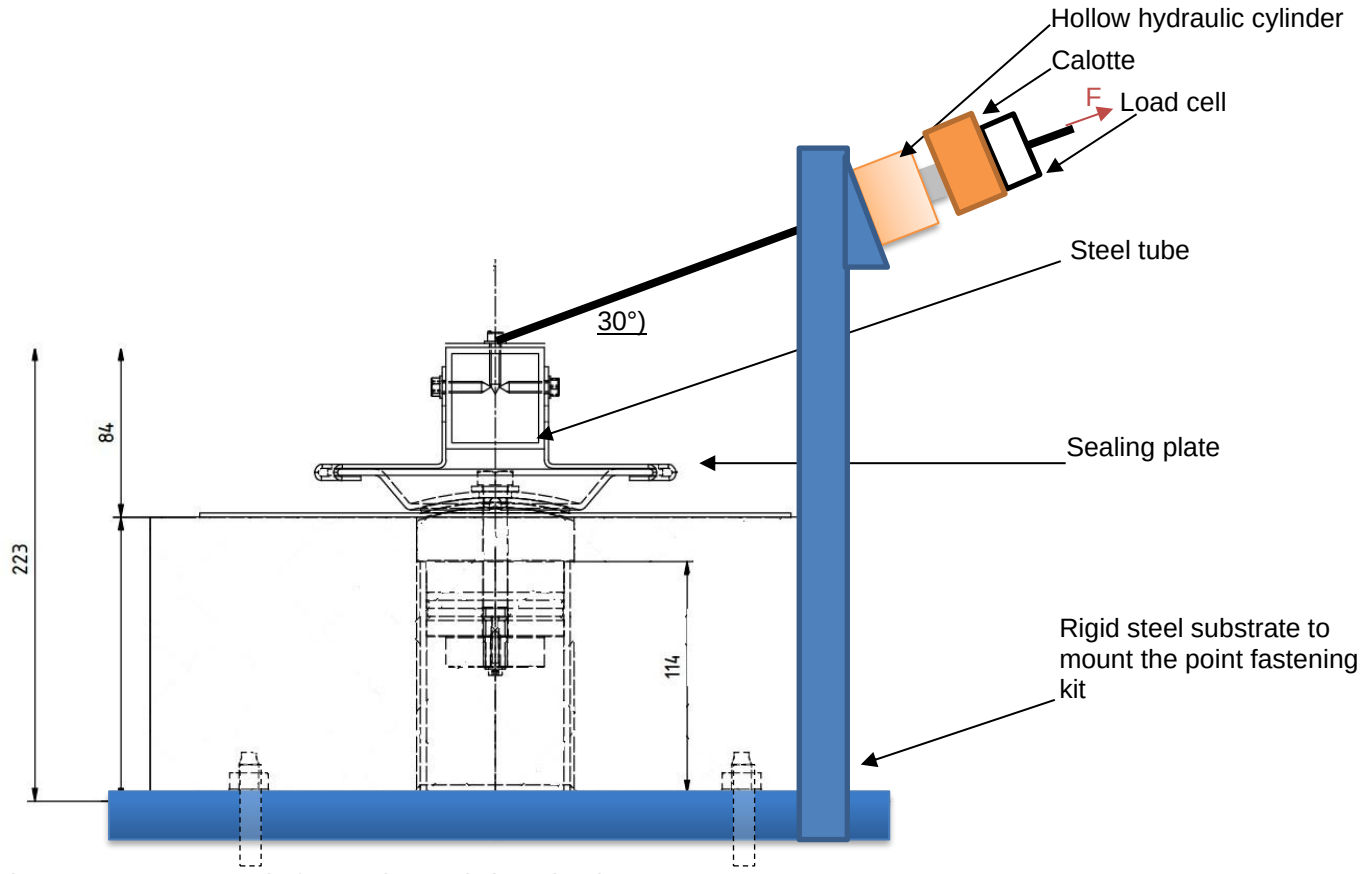

Figure 2.2.5.1: Example for tension and shear load test setup

The test shall be performed at an angle of 30°. Together with the result of the tests performed according to 2.2.3 and 2.2.5 (angles at 90° and 0°), and the linear relationship between angle and resistance shall be calculated to cover all other slope angles.

The assessment of failure loads and displacements and determination of the characteristic resistance shall be done according to Equation 2.2.5.1. The characteristic resistance shall be rounded down to 0,1 kN steps. This value shall be normalized to account for over-strength of tested specimens according to equation A.2.1.1 or A.2.1.2 according to Annex A and stated in the ETA.

$$S_{Rk} = S_{5\%}\,(A3) \qquad (2.2.5.1)$$

with: $S_{5\%}$ (A3) = 5%-fractile of the failure loads of test series A3

The 5%-fractile $S_{5\%}$ [kN] shall be given in the ETA.

2.2.6 Displacements under short-term and long-term loading

The tests are performed to determine the displacement (change of the length) of the thermoelement after applying the torque moment that is specified by the manufacturer, if available (see 2.2).

The tests shall be performed according to Annex A, Table A.1, lines A4 and A5.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment is applied with a calibrated torque wrench and the tension force in the fixing shall be measured depending on the applied torque moment. No thermal insulation shall be used; the torque moment specified by the manufacturer, if available (see 2.2), shall be set. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

2.2.6.1 Displacements under short-term loading

The tests are performed to determine the displacement (change of the length) of the thermoelement (see Annex A) after applying the torque moment that is specified by the manufacturer for short-term of 24 h. If no torque moment is specified by the manufacturer, torque moment shall be applied so that the mean pre-stressing force shall be smaller than the characteristic failure load in section 2.2.3.

The tests shall be performed according to Annex A, Table A.1, line A4.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment shall be applied with a calibrated torque wrench and the tension force in the fixing shall be measured depending on the applied torque moment. The length change ΔL [mm] of the thermoelement shall be measured after applying the torque moment and after 24 h and stated in the ETA.

It is sufficient to give one value which represents the most unfavourable condition.

No thermal insulation shall be used. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

2.2.6.2 Displacements under long-term loading

These tests are performed to determine the displacement (change of the length) of the thermoelement after applying the torque moment that is specified by the manufacturer for long-term of 2500 h.

The tests shall be performed according to Table A.1, line A5.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment shall be applied with a calibrated torque wrench and the tension force in the fixing shall be measured depending on the applied torque moment. The length change ΔL [mm] of the thermoelement (see Annex A) shall be measured after applying the torque moment and after every 24 h until 3000 h; the length change after 3000 h shall be stated in the ETA.

It is sufficient to give one value which represents the most unfavourable condition. The ratio of the displacements between long-term to short-term shall be calculated.

No thermal insulation shall be used. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

2.2.7 Characteristic resistance to repeated loads

The tests are performed to determine the performance of the point fastening kit under repeated loads without any damage of a part of the kit.

The tests shall be performed according to Annex A, Table A.1, line A6.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment shall be applied with a calibrated torque wrench.

Perform pull-out tests with 22100 cycles and repeated tension load. The tension load alternates between $N_o = 0{,}6 \cdot N_{Rk}$ ± 0,1 kN as upper limit and 0 kN as lower limit. No thermal insulation shall be used. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

During the repeated load portion of the test no failure shall occur. After the repeated load portion, tension test shall be performed according to section 2.2.3. If the performance levels $N_o = 0{,}6 \cdot N_{Rk}$ ± 0,1 kN are not met and failure occurs, repeat the test with load values determined based on a reduced value until the performance levels are met.

The assessment of failure loads according to section 2.2.3 and determination of the characteristic resistance to repeated loads shall be done according to Equation 2.2.7.1. The characteristic resistance shall be rounded down to 0,1 kN steps. This value shall be normalized to account for over-strength of tested specimens according to equation A.2.1.1 or A.2.1.2 according to Annex A and stated in the ETA.

$$N_{Rk,red} = F_{5\%}\,(A6) \qquad (2.2.7.1)$$

with: $F_{5\%}$ (A6) = 5%-fractile of the failure loads of test series A6

2.2.8 Durability

2.2.8.1 Corrosion

The point fastening kit characteristics shall not change during the working life; therefore, the mechanical properties on which the functioning and bearing behaviour of the point fastening kit depends (e.g., material, coating) shall not be adversely affected by ambient physico-chemical effects such as corrosion and degradation caused by environmental conditions (e.g., alkalinity, moisture, pollution). Furthermore, those parts of point fastening kit that are according to the manufacturers product installation instructions (MPII) intended to move against each other during installation (e.g., nut on thread or cone in sleeve) or in use (e.g., cone in sleeve) shall not be subject to jamming so that the behaviour is not impaired when the fastener is loaded to failure. In the context of the assessment of durability of the construction product the following shall be considered:

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

1. Steel components intended for use in structures subject to dry, internal conditions:

No special corrosion protection is necessary for steel parts as coatings provided for preventing corrosion during storage prior to use and for ensuring proper functioning is considered sufficient.

2. The point fastening kit screws for use according EN 1993-1-4, Annex A:

Screws for the kit made of stainless steel according EN 1993-1-4, Annex A, Table A.3, are considered to have sufficient durability for the corresponding Corrosion Resistance Class (CRC).

2.2.8.2 Durability of the thermoelement membrane

The tests are performed to determine the displacement (change of the length) of the thermoelement after applying the torque moment that is specified by the manufacturer and after heat ageing.

The tests shall be performed according to Annex A, Table A.1, lines A4 and A5.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment shall be applied with a calibrated torque wrench and the tension force in the fixing shall be measured depending on the applied torque moment. No thermal insulation shall be used; torque moment specified by the manufacturer, if available (see 2.2), shall be set. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

2.2.8.2.1 Displacements under short-term loading and heat ageing with 60°C

The tests are performed to determine the displacement (change of the length) of the thermoelement after applying the torque moment that is specified by the manufacturer for short-term of 24 h and after heat ageing.

The tests shall be performed according to Annex A, Table A.1, line A7.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment shall be applied with a calibrated torque wrench and the tension force in the fixing shall be measured depending on the applied torque moment. The length change ΔL [mm] of the thermoelement shall be measured after applying the torque moment and after 24 h and stated in the ETA.

It is sufficient to give one value which represents the most unfavourable condition.

No thermal insulation is used. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

2.2.8.2.2 Displacements under long-term loading and heat ageing with 60°C

The tests are performed to determine the displacement (change of the length) of the thermoelement after applying the torque moment that is specified by the manufacturer for long-term of 24 h and after heat ageing.

The tests shall be performed according to Annex A, Table A.1, line A8.

Test conditions: The tests shall be carried out on point fastening kit with the torque applied through the fixing that connects the sealing plate and the lower part. The torque moment shall be applied with a calibrated torque wrench and the tension force in the fixing shall be measured depending on the applied torque moment. The length change ΔL [mm] of the thermoelement shall be measured after applying the torque moment and after every 24 h until 3000 h and stated in the ETA.

It is sufficient to give one value which represents the most unfavourable condition. The ratio of the displacements between long-term to short-term shall be calculated and stated in the ETA.

No thermal insulation is used in the test set-up. The point fastening kit of the weakest material combination shall be tested (the mechanically weakest case).

The evaluation method to determine a regression analysis described in EN ISO 10928 provides - despite the testing temperature of 60°C - a long-term resistance for 40°C and 50 years for glass-reinforced thermosetting plastics (GRP) and heat-resistant materials and is used in this EAD. The constant temperature of 60°C is seen as representative concerning the durability for 50 years of service life in all European regions.

To limit the practical testing time and to ensure the resistance in the range of the practical maximum temperature, the tests shall be made at 60°C with a shorter duration. The time/temperature shifting factor of 100 for shifting from 40 °C to 60°C is safe for a wide range of Glass Fibre Reinforced Polymer (GFRP) or heat-resistant materials.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

For the products covered by this EAD the applicable European legal act is Decision 97/161/EC.

The applicable AVCP system is 2+.

3.2 Tasks of the manufacturer

The corner stones of the actions to be undertaken by the manufacturer of the point fastening kit for roof panels 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; corner stones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC)					
1	Dimensions	Measurement	According to control plan	According to control plan	Every delivery
2	Density	Component specific method	According to control plan	According to control plan	Every batch
3	Reaction to fire	2.2.1	According to control plan	According to control plan	Once per 2 years*)

*) indirect testing in accordance to the manufacturer's methods

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 point fastening kit for roof panels are laid down in Table 3.3.1. The tasks of the notified body are referred to assessment and verification of constancy of performance on the level of the manufacturer as detailed on the table thereafter.

Table 3.3.1 Control plan for the notified body; cornerstones

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

4 REFERENCE DOCUMENTS

EN 1928:2000	Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of watertightness
EN 1993-1-4:2025	Eurocode 3 - Design of steel structures – Part 1-4: Stainless steel structures
EN 13501-1:2018	Fire classification of construction products and building elements - Part 1: Classification using data from fire reaction to fire tests
EN ISO 10928:2025	Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes and fittings - Methods for regression analysis and their use (ISO 10928:2024)
EN 13956:2013	Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics

ANNEX A TEST PROGRAMME AND GENERAL ASPECTS OF ASSESSMENT

A.1 Test program

Table A.1. Test program

N°	Tests according to the following sections	Concrete	Number of tests	Remarks
BWR 3 Watertightness				
W1	- Watertightness without load	C20/25	≥ 5	According to EN 1928
W2	- Watertightness with axial load		≥ 5	
W3	- Watertightness with shear load		≥ 5	
BWR 4 mechanical resistance				
A1	Tension load	-	≥ 5	2.2.3
A2	Shear load	-	≥ 5	2.2.4
A3	Combined tension and shear loading	-	≥ 5	2.2.5
A4	Displacements under short-term and long-term loading	-	≥ 5	2.2.6
A5			≥ 5	
A6	Repeated loads	-	≥ 5	2.2.7
Durability				
A7	Displacements under short-term and long-term loading with 60°C		≥ 5	2.2.8.3
A8			≥ 5	2.2.8.4

A.2 GENERAL ASSESSMENT METHODS

A.2.1 CONVERSION OF FAILURE LOADS TO NOMINAL STRENGTH

The conversion of failure loads shall be done according to Equations (A.2.1.1) to (A.2.1.2) depending on the failure mode.

Steel failure $$F_{u,s} = F_{u,5\%} \frac{f_u}{f_{u,t}}$$ **(A.2.1.1)**

Failure of the rubber $$F_{u,r} = F_{u,5\%} \frac{f_{ur}}{f_{ur,t}}$$ **(A.2.1.2)**

$F_{u,s}$ = converted 5%-fractile of the ultimate loads measured in a test series with steel failure

$F_{u,r}$ = converted 5%-fractile of the ultimate loads measured in a test series with failure of the rubber

f_u = nominal characteristic steel/rubber ultimate strength

$f_{u,t}$ = steel/rubber ultimate strength in the test

A.2.2 ESTABLISHING 5%-FRACTILE

The 5%-fractile of the ultimate loads measured in a test series shall be calculated according to statistical procedures for a confidence level of 90%. If a precise verification is not possible, a normal distribution and an unknown standard deviation of the population shall be assumed.

$$\boldsymbol{F_{u,5\%} = F_{u,m}(1 - k_s \cdot CV_F)} \quad \textbf{(A.2.2.1)}$$

$$\boldsymbol{F_{u,95\%} = F_{u,m}(1 + k_s \cdot CV_F)} \quad \textbf{(A.2.2.2)}$$

e.g.: n = 5 tests: k_s = 3,40

n = 10 test: k_s = 2,57