EUROPEAN ASSESSMENT DOCUMENT

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STAINLESS STEEL POINT FASTENER FOR GLASS CLADDINGS

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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) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 DESCRIPTION OF THE CONSTRUCTION PRODUCT

This EAD applies to the construction product – stainless steel point fastener for glass claddings (point fastener). Point fastener is manufactured in different types (e.g. rigid or hinged) and system sizes (e.g. diameter and/or length of rod). The point fastener is made of stainless steel according to EN 10088-3[1].

It consists of the bottom part (the part between substructure and cladding) and a top part that holds glass cladding on the opposite side of the cladding. The top part is a clamping plate or a sunk sleeve which will be fastened through the cladding to the bottom part by a special bolt.

The fastening of the point fastener to the load-bearing substructure can be direct or via a sleeve with internal thread which is welded to the substructure. In this case the minimum screw-in length has to be observed. Typically, additional components such as EPDM components, silicone sealing rings and plastic distance sleeves are parts of the point fastener as well.

Examples of different types of point fasteners are given in Annex A.

The bolts which are used for the fastening of the top parts can be secured against unscrewing by means of a special adhesive. Glass cladding and special adhesive are not covered by the EAD.

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

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

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual good 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 point fastener is intended to be used for accessible pinned suspensions of claddings with different thicknesses in structures with predominantly static loads.

This EAD covers the intended use which is comprising the pinned fastening of suspended claddings. An example of the possible arrangement of the point fastener is given in Annex A. The point fastener is intended to be used in position perpendicular to surface of cladding glass sheet.

Typical applications comprise roof or wall claddings made of glass. The substructure is normally internal but can be also external.

Examples for the intended use and types of point fasteners are given in Annex A.

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 fastener for the intended use

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

of 50 years when installed in the works. 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

For the purposes of this document, the terms and definitions given in ISO 6707-1 apply.

1.3.1 Design value of resistance

The design value of resistance is to be calculated according to EN 1990, Clause 6.3.5, Par. (3). Partial safety factor γ_M can be taken into account by value 1.4 for tensile, compression, shear and/or bending calculation, if there is no value given in national regulations.

1.3.2 Rigid fastener

The bottom part of point fastener consists of a circular clamping plate (another term is bearing disk) and a threaded bar for direct fastening to the substructure.

1.3.3 Hinged fastener

Bottom part of point fastener consists of a circular clamping plate and a threaded bar which is finalised with a ball and socket joint.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject and the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that there are 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 1 shows how the performance of the point fastener for glass claddings is assessed in relation to the essential characteristics.

Table 1 Essential characteristics of the point fastener for glass claddings and assessment methods and criteria for 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 4: Safety and accessibility in use			
2	Tensile resistance	2.2.2	Level
3	Compression resistance	2.2.3	Level
4	Shear / bending resistance	2.2.4	Level
5	Resistance to repeated tensile load	2.2.5	Description, Level
6	Dimensions	2.2.6	Level
Aspects of durability linked with the Basic Works Requirements			
7	Durability	2.2.7	Description

2.2 METHODS AND CRITERIA FOR ASSESSING THE PERFORMANCE OF THE POINT FASTENER 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.

Testing will be limited only to the essential characteristics which the manufacturer intends to declare. If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

2.2.1 Reaction to fire

The point fastener shall be tested according to the test method(s) referred to in EN 13501-1 and relevant for the corresponding reaction to fire class. The product shall be classified according to the Commission Delegated Regulation (EU) No 2016/364. The reaction to fire of the point fastener made of materials according to EC decision 96/603/EC as amended may be classified without testing.

The class of reaction to fire of the product is given in the ETA.

2.2.2 Tensile resistance

The test of tensile resistance is to be performed on three test specimens at least for each type and system size of point fastener according to the Annex B.

The tensile resistance R_t of tested specimen is given as maximal load at failure in test. Average value $R_{t,av}$ of tensile resistance and estimation of standard deviation σ_n are calculated for each type and system size of point fastener separately.

Characteristic value of tensile resistance $R_{t,k}$, given as 95 % quartile on confidence level 95 % for V_x as unknown, with normal distribution of the population assumed, according to EN 1990, Annex D, Clause 7.2 is to be evaluated for each type and system size of point fastener separately according to equation:

$$R_{t,k} = (R_{t,av} - \sigma_n \times k_n) \times \eta \quad (1)$$

where: $R_{t,k}$ characteristic value of tensile resistance of point fastener [kN]

$R_{t,av}$ average value of tensile resistance of point fastener [kN]

σ_n estimation of standard deviation [kN]

k_n coefficient of estimation of fractile [-] according to EN 1990, Annex D, Clause 7.2 and Table D.1

η coefficient of conversion [-] according to EN 1990, Clause 6.3.3, calculated as:

$$\eta = \frac{f_{y,nom}}{f_{y,test,av}} \quad (2)$$

where: $f_{y,nom}$ minimal standardized nominal value of yield tensile strength of material used for rod according to EN 10088-3 [MPa]

$f_{y,test,av}$ average value of yield tensile strength of material used for rod in tests [MPa]

For determination of the coefficient of conversion η test of yield strength of five test rods (according to the Figure 1, item 7) used for point fastener is to be performed according to EN ISO 6892-1. The coefficient η is identical for tensile resistance and shear / bending resistance calculations.

Furthermore average value $R_{t,1,av}$ of tensile resistance corresponding to a deformation of 1 mm and estimation of standard deviation σ_n are calculated for each type and system size of point fastener separately.

Characteristic value of tensile resistance $R_{t,1,k}$ given as 95 % quartile on confidence level 95 % for V_x as unknown, with normal distribution of the population assumed, according to EN 1990, Annex D, Clause 7.2 [3] is to be evaluated for each type and system size of point fastener separately according to equations above mentioned in this article.

Following characteristics are given in the ETA for each type and system size of point fastener:

- characteristic value of tensile resistance $R_{t,k}$ [kN] rounded to three significant digits
- characteristic value of tensile resistance corresponding to a deformation of 1 mm $R_{t,1,k}$ [kN] rounded to three significant digits
- working diagrams of each individual test - load / deformation curves, merged in a single graph.

2.2.3 Compression resistance

The test of compression resistance is to be performed on three test specimens at least for each type and system size of point fastener according to the Annex C.

[3] Detailed information on values of coefficients k_n, not mentioned in EN 1990, is given in ISO 16269-6, Annex C, Table C.4.

The compression resistance R_c of tested specimens is given as maximal load at failure in test. Average value $R_{c,av}$ of compression resistance and estimation of standard deviation σ_n for each type and system size of point fastener are calculated separately.

Characteristic value of compression resistance $R_{c,k}$, given as 95 % quartile on confidence level 95 % for V_x as unknown, with normal distribution of the population assumed, according to EN 1990, Annex D, Clause 7.2 is to be evaluated for each type and system size of point fastener separately according to equation:

$$R_{c,k} = R_{c,av} - \sigma_n \times k_n \times \eta \quad (3)$$

where: $R_{c,k}$ characteristic value of compression resistance of point fastener [kN]

$R_{c,av}$ average value of compression resistance of point fastener [kN]

σ_n estimation of standard deviation [kN]

k_n coefficient of estimation of fractile [-] according to EN 1990, Annex D, Clause 7.2 and Table D.1

η coefficient of conversion [-] according to EN 1990, Clause 6.3.3, determined in 2.2.2, (2)

Following characteristics are given in the ETA for each type and system size of point fastener:

- characteristic value of compression resistance $R_{c,k}$ [kN] rounded to three significant digits
- working diagram of each individual test - load / deformation curves, merged in a single graph.

2.2.4 Shear / bending resistance

The test of shear / bending resistance is to be performed on three test specimens at least for each type and system size of point fastener according to the Annex D.

The shear resistance R_s of tested specimens is given as maximal load R_{max} at failure in test. The bending resistance M_b of tested specimen is given as product of maximal load R_{max} at failure and nominal value of lever arm in test l_{nom} according to Fig. D.1.

Average values $R_{s,av}$ and $M_{b,av}$ of shear / bending resistance and relevant estimation of standard deviation σ_n are calculated for each type and system size of point fastener separately.

Characteristic value of shear / bending resistance $R_{s,k}$ and/or $M_{b,k}$ given as 95 % quartile on confidence level 95 % for V_x as unknown, with normal distribution of the population assumed, according to EN 1990, Annex D, Clause 7.2 are to be evaluated for each type and system size of point fastener separately according to equations:

$$R_{s,k} = (R_{s,av} - \sigma_n \times k_n) \times \eta \quad (4)$$

$$M_{b,k} = (M_{b,av} - \sigma_n \times k_n) \times \eta \quad (5)$$

where: $R_{s,k}$ characteristic value of shear resistance of point fastener [kN]

$R_{s,av}$ average value of shear resistance of point fastener [kN]

$M_{b,k}$ characteristic value of bending resistance of point fastener [kN.m]

$M_{b,av}$ average value of bending resistance of point fastener [kN.m]

σ_n estimation of standard deviation [kN]

k_n coefficient of estimation of fractile [-] according to EN 1990, Annex D, Clause 7.2 and Table D.1

η coefficient of conversion [-] according to EN 1990, Clause 6.3.3, determined in 2.2.2, (2)

Furthermore, average value $M_{b,1,av}$ of bending resistance corresponding to a deformation of 1 mm and estimation of standard deviation σ_n are calculated for each type and system size of point fastener separately.

Characteristic value of bending resistance $M_{b,1,k}$ given as 95 % quartile on confidence level 95 % for V_x as unknown, with normal distribution of the population assumed, according to EN 1990, Annex D, Clause 7.2 is to be calculated for each type and system size of point fastener separately according to equation (5) .

Following characteristics are given in the ETA for each system size of point fastener:

- characteristic value of shear resistance $R_{s,k}$ [kN] rounded to three significant digits
- characteristic value of bending resistance $M_{b,k}$ [kN.m] rounded to three significant digits
- characteristic value of bending resistance corresponding to a deformation of 1 mm $M_{b,1,k}$ [kN.m] rounded to three significant digits
- working diagram of each individual test - load / deformation curves, merged in a single graph.

2.2.5 Resistance to repeated tensile load

Point fasteners, in the long term, shall continue to function effectively when their service load is subject to variation. The test of resistance to repeated tensile load is to be performed on one test specimen at least for each type and system size of point fastener according to the Annex B.

The point fastener is to be subjected to $5x10^4$ tensile load cycles with a frequency of 2 Hz up to 5 Hz. During each cycle the load is to be changed as a sine curve between $R_{t,max}$ and $R_{t,min}$ given according to equations:

$$R_{t,max} = \frac{2}{3} \times R_{t,k} \times \frac{1}{\eta} \quad (6)$$

$$R_{t,min} = \frac{1}{20} \times R_{t,k} \times \frac{1}{\eta} \quad (7)$$

where: $R_{t,max}$ upper value of test tensile load [kN]

$R_{t,min}$ bottom value of test tensile load [kN] or 5 kN, higher value of both is to be used

$R_{t,k}$ characteristic value of tensile resistance of point fastener [kN]

η coefficient of conversion [-] according to EN 1990, Clause 6.3.3, determined in 2.2.2, (2)

After completion of repeated tensile load the point fastener is to be unloaded and a single tension test $R_{t,k,rep}$ up to the failure performed according to 2.2.2. Furthermore value $R_{t,1,rep}$ of tensile resistance corresponding to a deformation of 1 mm is determined.

Following characteristics are given in the ETA for each tested specimen, each type and system size of point fastener separately:

- interval of applied tensile load $R_{t,min}$ – $R_{t,max}$ [kN]
- single value of tensile resistance after repeated load $R_{t,rep}$ [kN] rounded to three significant digits
- single value of tensile resistance after repeated load corresponding to deformation of 1 mm $R_{t,1,rep}$ [kN] rounded to three significant digits
- working diagram of test - load / deformation curve in a graph

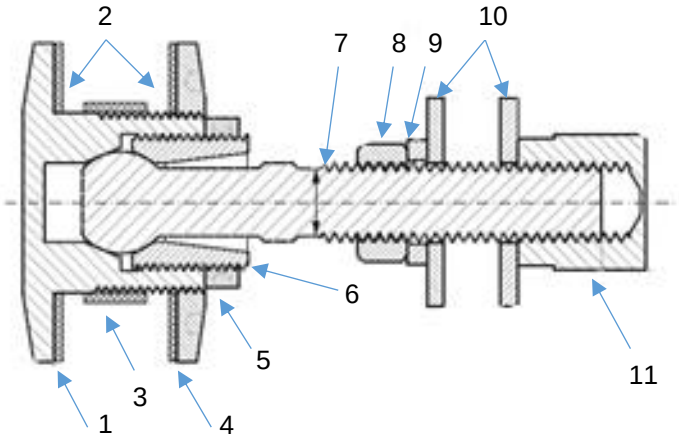
2.2.6 Dimensions

Following critical dimensions of the point fastener are to be measured.

The test is to be performed on three test specimens at least for each type and system size of point fastener. Each dimension is to be measured three times in position on tested specimen rotated for 120°. Measured values are recorded.

The test is to be performed at the critical parts regarding point fastener's function as evident on the Figure 2, such as:

- total length of rod l_t [mm]
- minimum diameter of rod d_{min} in thinnest cross section point [mm]
- external diameter of head rotuel d_1 [mm]
- thickness of head rotuel t_1 [mm]
- external diameter of body of head rotuel d_2 [mm]
- total length of head rotuel h_1 [mm]
- height of external thread of head rotuel h_2 [mm]
- external diameter of clamp plate d_3 [mm]
- thickness of clamp plate t_2 [mm]



1 head rotuel, 2 nylon round gasket, 3 cylindrical gasket, 4 clamp plate, 5 lock nut, 6 adjustment sleeve, 7 rod, 8 hex nut, 9 spring washer, 10 slot washer, 11 end nut

Figure 1: Example of the point fastener

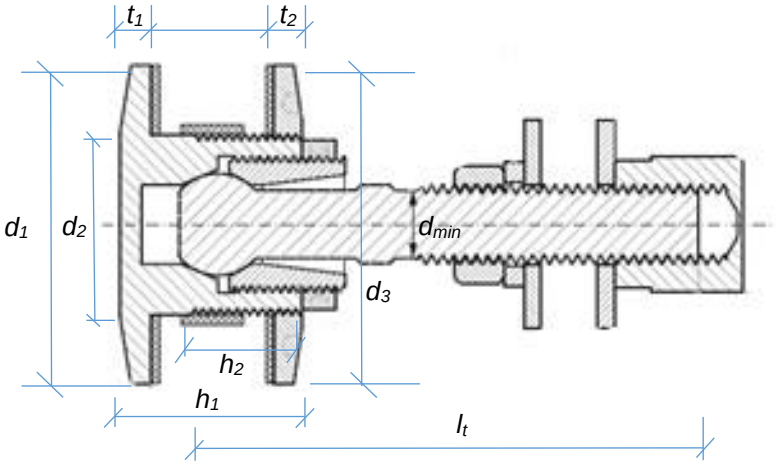


Figure 2: Example of the point fastener and critical dimensions

The median (ISO 3534-1, Clause 1.13) and estimation of standard deviation σ_n of all measurements on all tested specimens of each specified point fastener component are evaluated. The two-sided confidence interval of critical dimensions at the confidence level 95 % according to ISO 2602, Clause 6.2 is to be calculated with accuracy 0,01 mm.

The median and two-sided confidence interval of dimensions [mm] and relevant scheme of point fastener are given in the ETA.

2.2.7 Durability

The corrosion protection of stainless steel components is to be described according to the appropriate EN standard (e.g. EN ISO 3506-1, EN 1670, etc.)

The choice of stainless steel grade is to be described according to the appropriate EN standards (e.g. EN 10088-1, EN 10088-3, EN 10088-4, EN 10088-5 for stainless steels, etc.).

The corrosivity of atmospheres specified in EN standards (e.g. EN ISO 9223) are to be described in function of the field of application (e.g. marine atmosphere, industrial atmosphere, etc.).

The specification of stainless steel according to EN standards (e.g. EN 10088-1, EN 10088-3, EN 10088-4, EN 10088-5 for stainless steels, etc.) is given in the ETA.[4]

[4] The durability characteristics of plastic or POM distance sleeves, silicone sealing rings and EPDM washers and seals are not relevant to the performance characteristics of the point fastener itself. The durability characteristics of the EPDM components might be relevant for the performance characteristics of assembled cladding systems. Due to the fact that only the rim of the EPDM component might be exposed to ageing media, the EPDM component ensures adequate durability for the intended use and working life.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 SYSTEM(S) OF ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE TO BE APPLIED

For the products covered by this EAD the applicable European legal act is: Decision 98/214/EC as amended by Commission Decision 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 2.

Table 2 Control plan for the manufacturer; cornerstones.

No	Subject/type of control	Test or control method (*)	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) including testing of samples taken at the factory in accordance with a prescribed test plan					
1	Dimensions and tolerances	Comparison with the details given in the drawings 2.2.5	As defined in Control Plan	10	Every production unit
2	Characteristic values of: - tensile - compression - shear / bending Tensile resistance value after subjected to repeated tensile load	2.2.2 2.2.3 2.2.4 2.2.5	As defined in Control Plan	3 3 3 1	When starting the production or a new production line
3	Stainless steel components: check of material properties and chemical composition according to EN 10088-3	Inspection documents 3.1 according to EN 10204	As defined in Control Plan	1	Every production unit
4	EPDM components and silicone sealing ring: check of material properties and chemical composition according to EN 868	Inspection documents 3.1 according to EN 10204	As defined in Control Plan	1	Every production unit
(*) In all cases, the TAB and the manufacturer may agree to alternative tests or control methods or, where none exist, these parties may agree on the method.					

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 product are laid down in Table 3.

Table 3 Control plan for the notified body under AVCP system 2+; cornerstones

No.	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer considering the constancy of performances of components defined in the Control Plan (except reaction to fire).	As defined in Control Plan	As defined in Control Plan	Laid down in Table 2	When starting the production or a new production line
Continuous surveillance, assessment and evaluation of factory production control					
2	Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer considering the constancy of performances of kit components defined in the Control Plan (except reaction to fire).	As defined in Control Plan	As defined in Control Plan	Laid down in Table 2	1/year

4 REFERENCE DOCUMENTS

EN 1670:2007 Building hardware - Corrosion resistance - Requirements and test methods

EN 1990:2002/A1:2005 Eurocode: Basis of structural design

EN 1993-1-1:2005/A1:2014: Eurocode 3: Design of steel structures – Part 1.1: General rules and rules for buildings

EN 1993-1-4:2006/A1:2015 Eurocode 3: Design of steel structures – Part 1.4: Supplementary rules for stainless steels

EN 10088-1:2014 Stainless steels - Part 1: List of stainless steels

EN 10088-3:2014 Stainless steels – Part 3: Technical delivery conditions for semi-finished products, bars, rods and sections for general purposes

EN 10088-4:2009 Stainless steels - Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes

EN 10088-5:2009 Stainless steels - Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes

EN 10204:2004 Metallic products – Types of inspection documents

EN 13501-1:2007+A1:2009 Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests

EN ISO 868:2003 Plastics and ebonite: Determination of indentation hardness by means of a durometer (Shore hardness)

EN ISO 3506-1:2009 Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs

EN ISO 6892-1:2016 Metallic materials - Tensile testing - Part 1: Method of test at room temperature

EN ISO 7500-1:2018 Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system

EN ISO 9223:2012 Corrosion of metals and alloys - Corrosivity of atmospheres - Classification, determination and estimation

ISO 2602:1980 Statistical interpretation of test results. Estimation of the mean. Confidence interval

ISO 3534-1:2006 Statistics - Vocabulary and symbols - Part 1: General statistical terms and terms used in probability

ISO 6707-1:2017 Buildings and civil engineering works – Vocabulary – Part 1: General terms

ISO 16269-6 Statistical interpretation of data – Part 6: Determination of statistical tolerance intervals

ANNEX A EXAMPLES OF POINT FASTENERS

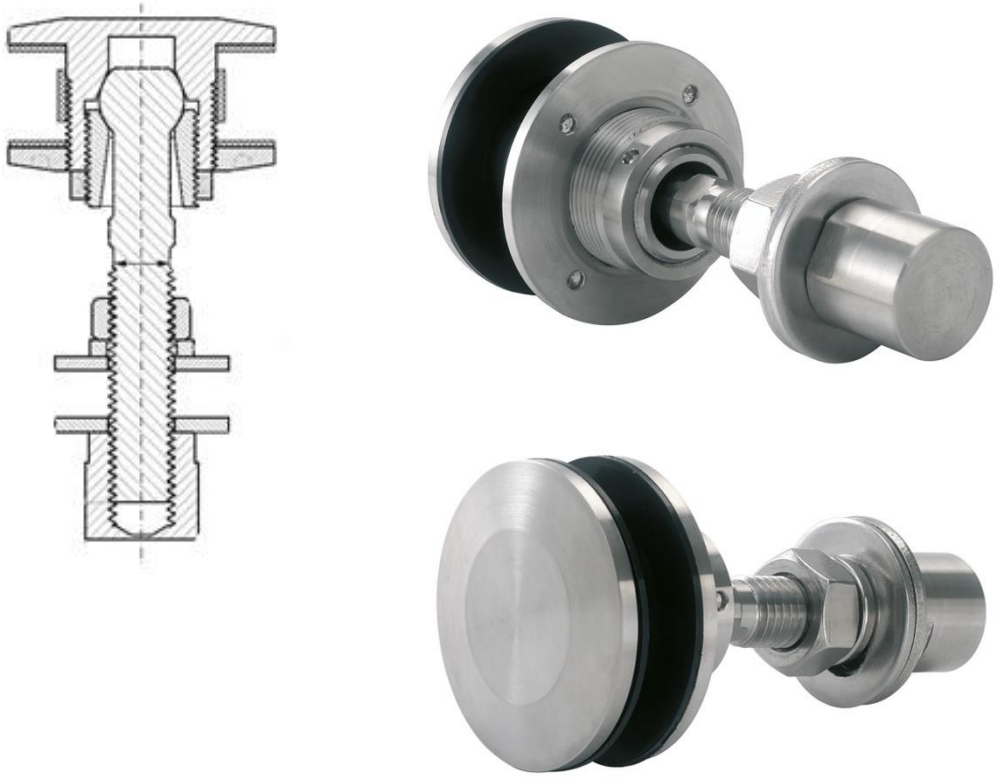


Figure A.1 – Example of hinged point fastener with ball and socket joint

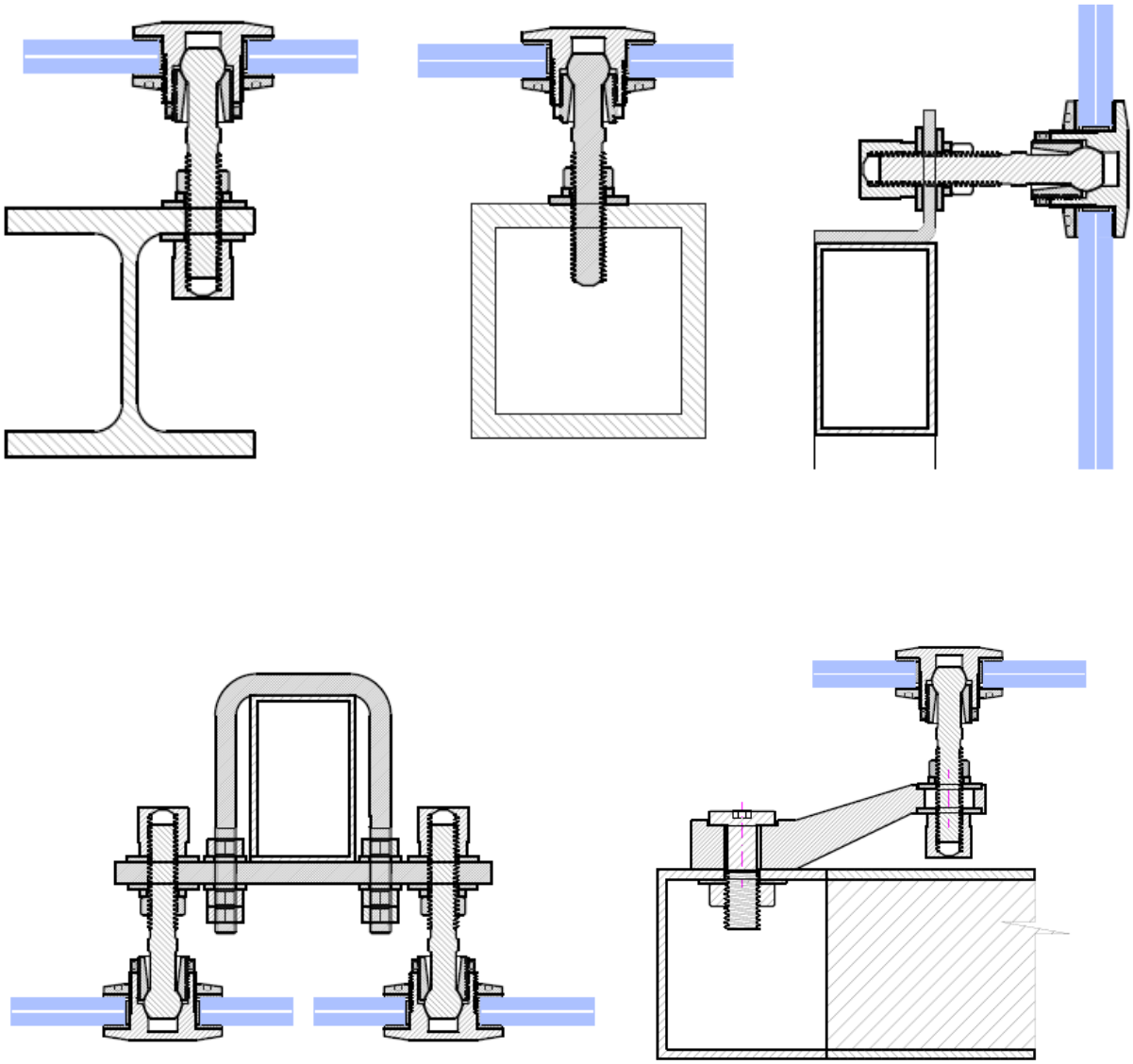


Figure A.2 – Examples of point fasteners

ANNEX B TEST SET UP FOR TENSILE TEST

The test load is to be increased under deformation control mode until failure of the point fasteners. The load deformation curve and the respective failure mode of the point fasteners used for the test is to be documented in the test report. The failure loads as well as the loads corresponding to a maximum deformation of 1 mm are to be given in the test report.

The material properties (yield strength, tensile strength and elongation) of the point fasteners used for the tests is to be documented in the test report.

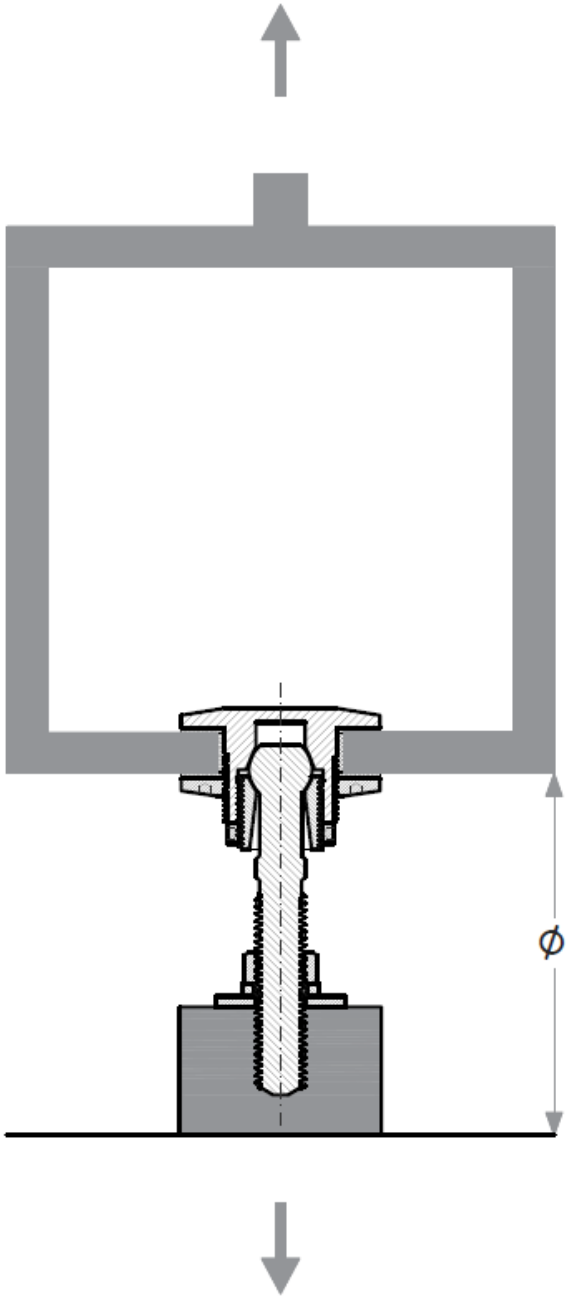


Figure B.1 – Test set up for tensile test

ANNEX C TEST SET UP FOR COMPRESSION TEST

The test load is to be increased under deformation control mode until failure of the point fasteners. The load deformation curve and the respective failure mode of the point fasteners used for the test is to be documented in the test report. The failure loads as well as the loads corresponding to a maximum deformation of 1 mm are to be given in the test report.

The material properties (yield strength, tensile strength and elongation) of the point fasteners used for the tests is to be documented in the test report.

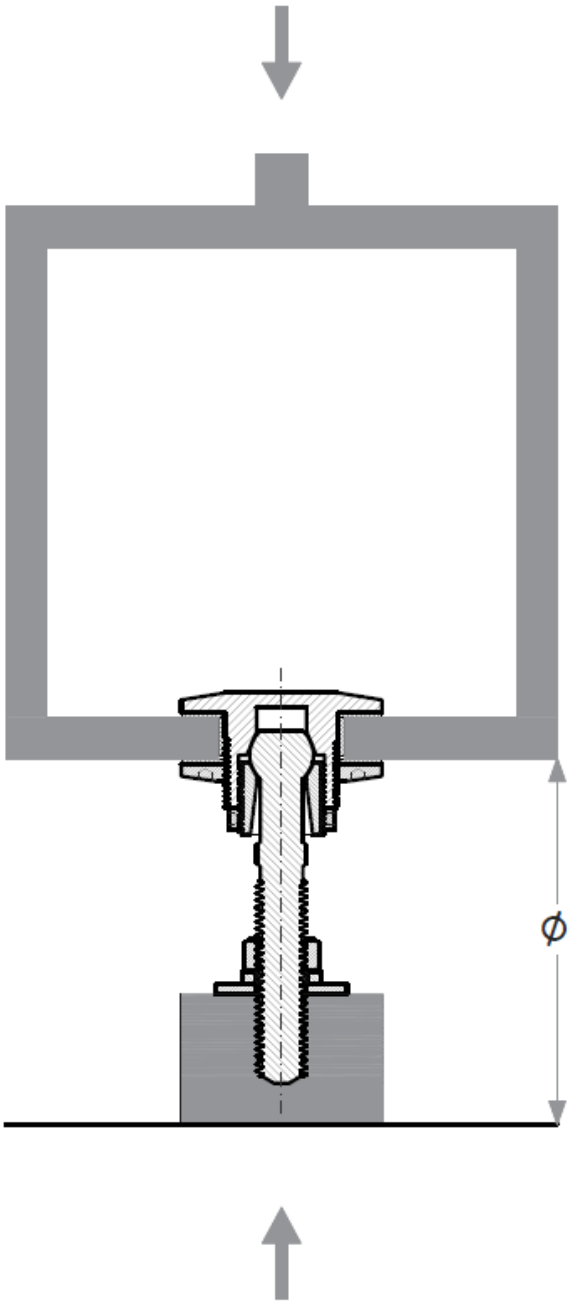


Figure C.1 – Test set up for compression test

ANNEX D TEST SET UP FOR SHEAR / BENDING TEST

The test load is to be increased under deformation control mode until failure of the point fasteners. The load deformation curve and the respective failure mode of the point fasteners used for the test is to be documented in the test report. The failure loads as well as the loads corresponding to a maximum deformation of 1 mm are to be given in the test report.

The material properties (yield strength, tensile strength and elongation) of the point fasteners used for the tests is to be documented in the test report.

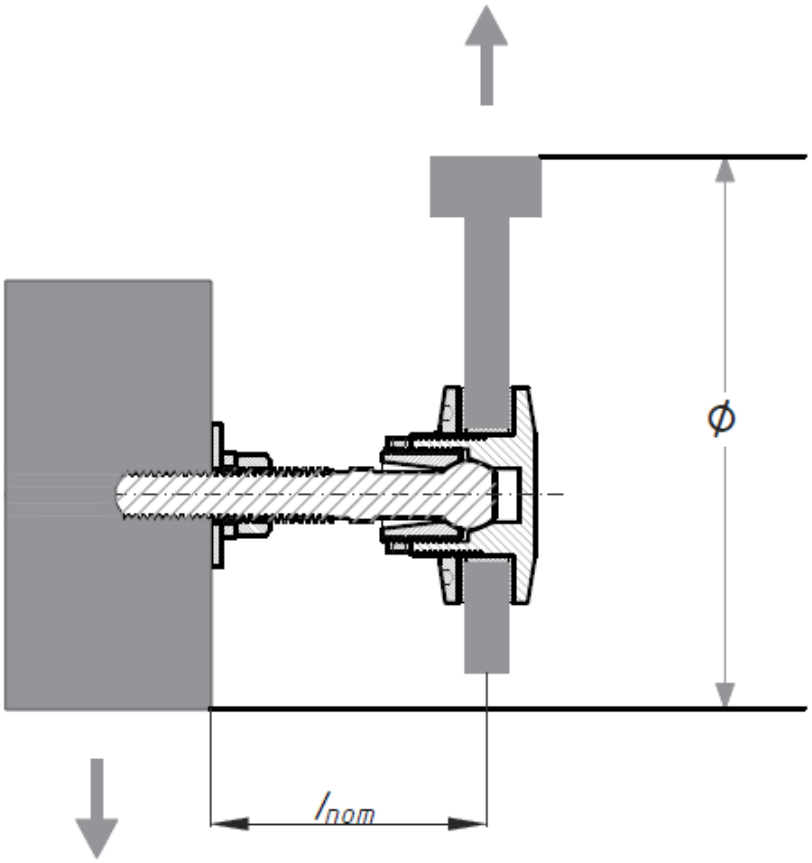


Figure D.1 – Test set up for shear / bending test